Strategic positioning of MOOS in the retail technology ecosystem

An ecosystem-based diagnosis of actionable shelf insight and its role between shelf reality and store action

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Preface

This thesis marks the final step of my MSc Strategic Product Design at Delft University of Technology. The project was carried out in collaboration with the company MOOS and focused on the strategic positioning of shelf-sensing technology in the retail technology ecosystem.

The project started from a practical question: how can a small shelf-level sensing tech start-up become relevant in a highly competitive and crowded landscape? During the research, this question developed into a broader ecosystem problem. Shelf insight only becomes valuable when it can be trusted, routed, owned, and acted on by the right actors. This made the project both analytical and strategic. It required moving between store-level and expert perspectives, academics, and design reasoning.

I would like to thank my graduation committee for their guidance throughout the project. Dr. Shahrokh Nikou and Nikolaos Kyriakopoulos helped me keep the academic contribution clear and grounded, while also supporting me through the process. I am also grateful to Dr. Marc Reunis and the rest of the MOOS team for their good atmosphere, openness, feedback, and access to their strategic discussions during the project.

I also want to thank the store respondents, expert interview participants, and co-creation/validation participants who contributed their time and perspectives. Their input made it possible to move beyond a technology-centred view and understand how shelf sensing is evaluated in practice.

Finally, I want to thank my close relatives and friends. Their encouragement helped me complete a process that was at times demanding, but also highly valuable as a learning experience.

Gijs de Meester

Delft, May 2026

Abstract

This thesis examines how MOOS, a shelf-sensing component provider, can position itself in the retail technology ecosystem around actionable shelf insight. The study starts from the observation that shelf-level problems such as out-of-stocks and theft are not only visibility problems. Shelf information becomes valuable only when it is reliable, timely, connected to a workflow, owned by a decision-maker, and able to trigger store action.

The research uses ecosystem-as-structure as the main theoretical lens. This lens helps analyse the activities, actors, positions, links, and alignment conditions required to turn shelf-condition information into action. Co-innovation risk, adoption-chain risk, and internal readiness are used as supporting concepts.

The empirical research combines 41 store visits with a ranking exercise and eight semi-structured expert interviews. The findings show that store teams mainly need reliable signals, timely actionability, and low additional workload. At ecosystem level, shelf sensing depends on fragile links between store teams, IT, loss prevention, point-of-sale systems, workflow systems, partners, and ownership structures. Theft-related use cases are mainly shaped by urgency and response risk, while on-shelf availability use cases depend more strongly on integration and backend closure.

The design phase translates this diagnosis into a positioning direction and roadmap. The thesis concludes that MOOS can most credibly position itself as a bounded, partner-ready shelf intelligence and trigger layer between shelf reality and store action. The revised roadmap should be used as a strategic decision-support tool, not as a fixed rollout plan or proof of market success.

List of abbreviations

AI
Artificial intelligence

CCTV
Closed-circuit television

DEPEST
Demographic, Economic, Political, Ecological, Social, and Technological analysis

ERP
Enterprise resource planning

ESL
Electronic shelf label

IT
Information technology

LP
Loss prevention

OOS
Out-of-stock

OSA
On-shelf availability

POS
Point of sale

RFID
Radio-frequency identification

RQ
Research Question

SQ
Subquestion

Executive summary

Retailers increasingly need better information about what happens at the shelf. Out-of-stocks, theft, shrinkage, and store execution problems show that the physical shelf remains a weak point in retail operations. Many systems know what should be in store, but not always what is actually happening at the shelf. MOOS addresses this gap with shelf-sensing technology that can detect shelf events and turn them into usable signals.

The central problem in this thesis is that shelf visibility does not automatically create value. A shelf signal only becomes useful when it can be trusted, routed to the right actor or system, connected to a workflow, owned by a decision-maker, and followed by store action. This makes MOOS's positioning problem broader than a product or competitor question. MOOS must position itself in an ecosystem of retailers, store teams, IT departments, loss-prevention teams, point-of-sale systems, workflow tools, enterprise systems, and technology partners.

The main research question is:

How can MOOS, as a shelf-sensing component provider, position itself in the retail-technology ecosystem around actionable shelf insight?

The thesis uses ecosystem-as-structure as the main theoretical lens. This lens defines an ecosystem around a focal value proposition and examines the activities, actors, positions, links, and alignment conditions needed to realise that proposition. In this thesis, the focal value proposition is actionable shelf insight. Co-innovation risk, adoption-chain risk, and internal readiness are used as supporting concepts to assess where value creation may break down and what MOOS must be able to execute internally.

The empirical research consists of two parts. Part 1 includes 41 store visits with a structured ranking exercise and short contextual conversations. This part identifies store-level adoption thresholds. Part 2 consists of eight semi-structured expert interviews with actors across the retail and retail technology ecosystem. This part examines ecosystem-level dependencies, ownership issues, integration conditions, and adoption risks. The two parts were analysed separately first and then synthesised through the conceptual framework.

The store-level findings show that store teams mainly care about three conditions: reliable signals, fast enough actionability, and low additional workload. Respondents did not evaluate shelf sensing as an abstract technology. They evaluated it through daily store work. A system that produces many false alerts, arrives too late, or adds another app or process is unlikely to be accepted, even if the sensing technology itself is promising.

The ecosystem-level findings show that the path from shelf signal to store action is fragile. Several actors may control different parts of the action chain. Store teams may feel the operational pain, but IT, loss prevention, operations, data teams, or external vendors may control the systems needed to act on the signal. This means that responsibility is spread across several actors. The main challenge is not only whether MOOS can detect shelf events, but whether those events can be connected to the right routines, systems, and decision owners.

The synthesis shows an important difference between theft-related use cases and on-shelf availability use cases. Theft-related use cases are mainly shaped by urgency, routing, response risk, and safe escalation. They may create value when a trusted shelf event can trigger a timely and targeted response. On-shelf availability use cases depend more strongly on integration with replenishment, stock data, task ownership, and backend correction. This makes availability more dependent on wider system alignment.

The design phase translates these findings into positioning options and roadmap logic. The preferred positioning direction is that MOOS should become a bounded, partner-ready shelf intelligence and trigger layer between shelf reality and store action. Bounded means that MOOS should not try to become the full retail operating system. Partner-ready means that MOOS should be able to connect selectively to adjacent systems and partners. Shelf intelligence and trigger layer means that MOOS should focus on reliable shelf events, interpretation, and action routing.

The initial roadmap was developed as a pre-validation design output. It was then validated for clarity, relevance, credibility, and usefulness. The validation did not prove market success, technical performance, commercial viability, partner willingness, or long-term operational effectiveness. It tested whether the roadmap logic was understandable and useful as a strategic decision-support tool.

The validation led to a clearer revised roadmap. The main shift was from a time- and segment-led expansion path toward a maturity-based decision logic. MOOS should start from its current proof point, understand which conditions make it work, define repeatable traction patterns, and then move toward adjacent propositions only when similar conditions are present. Deeper ecosystem embedding should come later and selectively, when proof, readiness, and dependency load justify it.

The practical implication is that MOOS should not expand broadly across retail segments too quickly. It should use the roadmap as a decision filter. New opportunities should be assessed through lookalike conditions, use-case fit, integration burden, partner dependency, internal readiness, and evidence strength. Theft and on-shelf availability should remain on different scaling paths because they depend on different action chains. Partners should be assessed not only by commercial access, but also by the dependency load they create.

The thesis concludes that MOOS's strongest position is not as a stand-alone sensor provider and not as a full store operating system. Its most credible role is between those extremes: a bounded shelf intelligence and trigger layer that makes shelf reality usable for store action. This position is promising, but it requires disciplined choices about proof, repeatability, partnerships, integration, and internal readiness.

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Chapter 1

Introduction

1.1 Background and motivation
1.2 Problem definition and research gap
1.3 Research objective and research questions
1.4 Scope and boundaries
1.5 Theoretical lens and research approach
1.6 Expected outputs
1.7 Thesis structure

This chapter introduces the positioning problem addressed in this thesis. It explains why shelf-level information matters for retail execution, but also why visibility alone is not sufficient. Shelf information only becomes valuable when it is reliable, timely, connected to a workflow, owned by a decision-maker, and able to trigger accountable store action. The chapter then positions MOOS as the focal case for studying this problem, defines the research gap and research questions, and outlines the scope, theoretical orientation, expected outputs, and structure of the thesis.

1.1 Background and motivation

Retail and wholesale are undergoing structural change driven by digitalisation, sustainability requirements, and increasing pressure on labour and margins (McKinsey & EuroCommerce, 2022). As retailers integrate online and offline channels, in-store execution becomes more important because pricing, replenishment, fulfilment, and availability depend on timely and usable information from the shop floor (Deloitte, 2025).

Two persistent operational problems illustrate why store-level information remains economically material. First, out-of-stock (OOS) situations continue to cause lost sales and customer dissatisfaction despite decades of process optimisation and information system investment (ECR Europe, 2012). Inventory inaccuracy is a structural driver of OOS situations because system records frequently diverge from physical shelf reality, which makes execution decisions less reliable at store-level (Rekik et al., 2019). Second, shrinkage imposes high financial and organisational costs on retailers and also affects employee safety and daily store operations (National Retail Federation, 2023).

Both issues are linked to gaps between what systems assume and what actually occurs at the shelf in stores. Greater visibility into shelf conditions can therefore support better execution and decision-making, but only when that visibility can be translated into timely and accountable store action (ECR Europe, 2012).

Within this context, the case company, MOOS, develops shelf-sensing technology that produces real-time insights into shelf conditions using AI-based sensors (MOOS, 2025). The company frames its value proposition around making shelf events visible and actionable for store operations, with the aim of supporting OOS execution and reducing theft-related losses (MOOS, 2025).

However, the value of shelf-sensing does not emerge from the component alone. A shelf event must be reliable enough to trust, timely enough to matter, routed into a workflow, connected to a decision owner, and followed by accountable store action. Impact at scale therefore depends on integration with enterprise systems, alignment with store processes, and coordination with partners across the retail technology landscape (EY, 2023). This creates a strategic positioning challenge that goes beyond product performance.

MOOS therefore functions as the focal case through which this thesis examines how a shelf-sensing component provider can seek a viable position when value creation depends on actors, interfaces, and routines beyond its direct control.

1.2 Problem definition and research gap

Although retailers deploy a growing number of in-store technologies, these initiatives are often implemented as isolated solutions rather than as integrated system changes, which can create silos across data, processes, and organisational ownership (Verhoef et al., 2021). This can lead to fragmented technology landscapes in which interoperability and data integration remain difficult to achieve across channels and store systems (Mirzabeiki & Saghiri, 2020). This fragmentation matters because shelf-level problems such as OOS and shrinkage are not solved by visibility alone. Shelf information becomes valuable only when it can move across systems, roles, and routines in a way that supports store action.

In such settings, control over interfaces, data access, and decision rights can become contested because value creation and value capture depend on how governance is organised across interdependent actors (Jacobides et al., 2018). For a shelf-sensing component provider such as MOOS, this creates a specific positioning problem. The component may detect shelf events, but the value of those events depends on whether other actors can integrate, interpret, route, and act on the signal. Strategic positioning therefore cannot be assessed only by asking whether the technology works. It must also be assessed by asking which actors, links, and routines are needed to turn shelf information into accountable execution.

Research on innovation increasingly emphasises that outcomes depend not only on technological capabilities, but also on how firms align their roles and activities within ecosystems (Adner, 2017). An

ecosystem-as-structure perspective is useful here because it defines an ecosystem around a focal value proposition and examines the activities, actor positions, and dependency links required to realise that proposition (Adner, 2017). However, existing retail technology and operations literature does not fully explain how cross-actor dependencies, ecosystem coordination, and link-level alignment shape the feasibility of actionable shelf insight in store execution settings.

Research on inventory accuracy and on-shelf availability (OSA) often examines specific mechanisms or single technologies, such as inventory record inaccuracy in analytical supply chain models (Fleisch & Tellkamp, 2005) or the effects of RFID-enabled visibility on OOS events (Hardgrave et al., 2013). Retail technology research also often frames the issue as an adoption or acceptance decision, for example through organisational acceptance constructs (Venkatesh et al., 2003) or retailer adoption conditions shaped by shopper attitudes and privacy concerns (Inman & Nikolova, 2017). Studies of omnichannel execution explain process realignment within the retailer and its supply chain (Ishfaq et al., 2022), while digital transformation scholarship explains constraints related to legacy systems and organisational change (Vial, 2019). Together, these streams explain important parts of the problem, but their dominant units of analysis are different from the problem addressed in this thesis: the inventory record, the technology, the adopter, the retailer process, or the transformation programme. They do not sufficiently explain how shelf insight becomes feasible when value depends on links between multiple actors that control different systems, interfaces, routines, and decision rights. This leaves a gap in explaining why a technically promising shelf-sensing solution may still fail to create value when it cannot be aligned across the ecosystem required for store execution.

This thesis contributes by operationalising ecosystem-as-structure for a component provider in a retail execution setting. The contribution is not a new ecosystem theory, and it is not limited to MOOS as a single case. It lies in using ecosystem-as-structure as a diagnostic approach that makes activities, actor positions, dependency links, alignment conditions, and risks observable around a focal value proposition. This allows the feasibility of actionable shelf insight to be assessed before it is translated into positioning options and roadmap logic.

In this thesis, actionable shelf insight means shelf-condition information that can trigger a relevant store decision or action. It is actionable when the signal can be trusted, arrives in time, fits a workflow, reaches a clear decision owner, and does not create unacceptable extra workload. This definition keeps the analysis focused on operational value rather than on sensing outputs in isolation. It is motivated by evidence that gaps between system records and physical shelf reality create real execution losses and require better detection and response mechanisms (Rekik et al., 2019)

1.3 Research objective and research questions

The objective of this project is to diagnose the ecosystem conditions that shape how a shelf-sensing component provider can position itself around actionable shelf insight, and to translate that diagnosis into positioning and roadmap logic for MOOS.

In this thesis, actionable shelf insight is examined across two related use-case variants that MOOS aims to support. The first variant concerns availability execution and OOS reduction. The second variant concerns the execution of loss prevention (LP) and the detection of theft-related events. The ecosystem configuration and feasible positioning options may differ across these variants because data access, governance constraints, and operational ownership can vary by use case.

Therefore, the central research question is*:*

'How can MOOS, as a shelf-sensing component provider, position itself in the retail-technology ecosystem around actionable shelf insight?'

This question is addressed through four thematic subquestions that move from ecosystem structure, to dependencies and alignment, to risk and feasibility, and finally to leverage and readiness.

SQ1. **Structure and actionability** - *What activity structure, actor clusters, and actionability conditions are required to turn shelf-condition information into store action?*

SQ2. **Dependencies and alignment** - *Where do key dependencies, bottlenecks, and misalignments occur across ecosystem positions and links?*

SQ3. **Risks and feasibility** - *How do co-innovation risk and adoption-chain risk affect the feasibility of*

different positioning options for a shelf-sensing component provider?

SQ4. **Leverage and readiness** - *Which leverage points and internal readiness conditions should guide MOOS in selecting and sustaining a viable ecosystem position?*

1.4 Scope and boundaries

The focal value proposition of this study is actionable shelf insight, defined as shelf-condition information that can trigger relevant store decisions or actions through reliable, timely, integrated, and accountable execution. This scope keeps the analysis centred on the ecosystem required to realise this value proposition, rather than on the full retail-technology market or on MOOS as a firm in isolation.

The unit of analysis is the ecosystem-alignment structure around this value proposition, rather than a single firm or a single technology in isolation. This means that the analysis focuses on the conditions under which actionable shelf insight can be realised across actors, systems, and routines, rather than on evaluating MOOS' product performance in isolation. Adoption is included only insofar as it manifests as staged, multi-gate adoption-chain risk within the ecosystem-alignment structure, and not as a stand-alone consumer or user-adoption problem.

The empirical setting focuses on the retail-technology context described in the context chapter, with emphasis on enterprise retailers and their partner landscapes in Europe. The thesis does not aim to provide a complete go-to-market strategy, pricing model, or customer-adoption plan, except where such elements are necessary to analyse incentives, governance, and alignment. Observations from retail-technology trade fairs are used solely as contextual input to support understanding of actor categories and recurring problem framings and are not treated as formal empirical data because of the absence of systematic data collection.

1.5 Theoretical lens and research approach

The core theoretical lens of this study is ecosystem-as-structure. It is used to examine how activities, actors, positions, and links must fit together around a focal value proposition (Adner, 2017). In this thesis, that value proposition is actionable shelf insight. The lens is used to study why shelf sensing may fail to create value when the links between actors, systems, and routines are not aligned.

Two supporting lenses are used in a limited way. Co-innovation risk and adoption-chain risk help identify where the path from pilot to wider use may break when several actors must act together (Adner & Kapoor, 2010). Dynamic capabilities are used as an internal readiness layer to assess whether MOOS can execute and adapt a chosen position as conditions change (Teece, 2007). In short, ecosystem-as-structure maps the external alignment problem, risk concepts show where delivery may break down, and internal readiness assesses whether a position is feasible for MOOS.

The research approach starts with a focused literature review, which is used to develop the conceptual framework in Chapter 3. That framework informed the interview protocol and analytical coding scheme

Empirical data were collected through semi-structured expert interviews with selected actors across relevant ecosystem clusters. These interviews were used to examine links, alignment failures, governance mechanisms, bottlenecks, and adoption gates. The diagnosis then became the basis for positioning options and roadmap logic.

Figure 1.1 provides a simplified preview of the research logic. It shows that actionable shelf insight defines the ecosystem boundary, while ecosystem structure and dependency diagnosis make the positioning problem visible. Positioning is treated as an output of ecosystem diagnosis, not as a starting assumption.

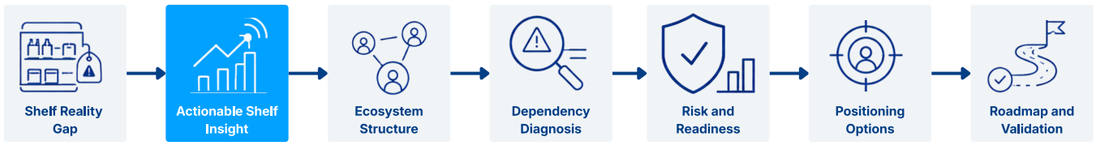


 Figure 1.1. Research logic.

The figure shows how the thesis moves from actionable shelf insight to ecosystem structure, dependency diagnosis, risk and readiness assessment, positioning options, roadmap logic, and validation. It does not show the full conceptual framework, which is developed in Chapter 3.

1.6 Expected outputs

The expected output of this thesis is a strategic design synthesis rather than a product design, technical specification, or go-to-market plan.

The academic output is an operationalisation of ecosystem-as-structure for diagnosing how a component provider can position itself around a focal value proposition in a retail execution setting. This operationalisation connects ecosystem structure, dependency links, alignment conditions, risk diagnosis, and internal readiness in one diagnostic logic.

The empirical output is a structured diagnosis of the actionable shelf insight ecosystem. It identifies bottlenecks, alignment failures, risk patterns, governance issues, and differences between availability and loss-prevention use cases.

The design output translates this diagnosis into positioning options and roadmap logic for MOOS as the case company.

The validation output assesses the clarity, relevance, credibility, and usefulness of the roadmap and supports a final revision of the strategic direction. The roadmap is not presented as a rollout plan or as evidence of market success. It is a decision-support tool for strategic positioning.

1.7 Thesis structure

The remainder of the thesis follows the logic from problem framing to context, framework, method, results, design, validation and roadmap revision, discussion, and final conclusion.

Figure 1.2 summarises the chapter flow. Chapter 2 grounds the positioning problem in MOOS and the retail-technology environment. Chapter 3 develops the analytical lens, Chapter 4 explains the method, Chapter 5 presents the empirical diagnosis, Chapter 6 translates that diagnosis into a pre-validation roadmap, and Chapter 7 validates and revises the roadmap. Chapter 8 discusses the meaning and limits of the work, and Chapter 9 gives the final answer to the research question.

The figure shows how the report moves from problem framing and context to framework, method, empirical diagnosis, design translation, conducted validation and roadmap revision, discussion, and final conclusion. The thesis proceeds as follows:

Chapter 1 introduces the research context, research problem, research questions, scope, theoretical orientation, expected outputs, and thesis structure.

Chapter 2 presents the ecosystem context analysis. It introduces MOOS as the focal case and explains the retail technology setting, store technology trajectories, actor categories, alternatives, and competitors around shelf level visibility.

Chapter 3 reviews the academic literature and develops the conceptual framework. It explains ecosystem as structure as the core lens and shows how risk diagnosis and internal readiness support the empirical analysis.

Chapter 4 outlines the research methodology. It explains the case context, use case focus, store visits, expert interviews, ethics, data preparation, and analytical procedure.

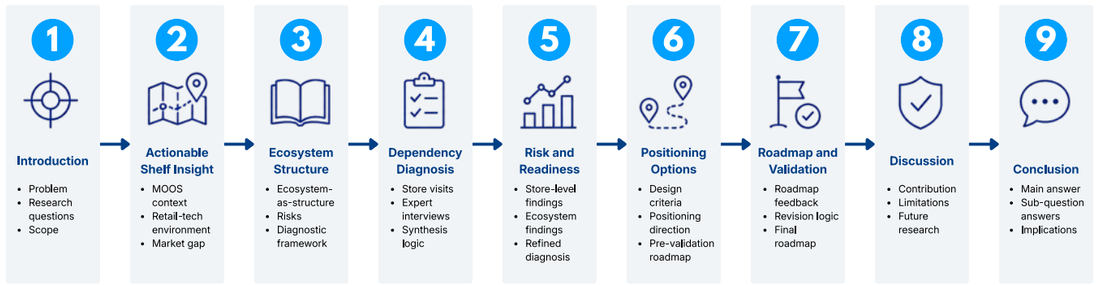


Figure 1.2. Report structure.

Chapter 5 presents the empirical results in the same order as the research design. It reports the store level findings, then the ecosystem level findings, and finally synthesises both datasets into a diagnosis of dependencies, alignment failures, risk patterns, governance gaps, and framework refinements.

Chapter 6 develops the design phase. It translates the empirical diagnosis and co creation input into design criteria, a preferred positioning direction, and a pre validation strategic and tactical roadmap for MOOS.

Chapter 7 presents the conducted validation and roadmap revision. It assesses whether the pre validation roadmap is understandable, relevant, credible, and useful for MOOS and relevant stakeholders, and explains how validation findings informed the final revised roadmap.

Chapter 8 discusses the meaning of the findings. It reflects on the conceptual contribution, methodological and design contribution, practical implications for MOOS, limitations, and future research.

Chapter 9 concludes the thesis. It answers the main research question and subquestions, then closes with the final positioning answer and the main implication for MOOS and for ecosystem based positioning in retail execution.

Chapter 2

Ecosystem Context Analysis

2.1 Internal context: MOOS as the focal case
2.2 Retail and retail technology environment
2.3 Store technology trajectories and scaling constraints
2.4 Retail technology actor categories and control points
2.5 Alternatives and competitors around shelf-level visibility

This chapter establishes the market and ecosystem context for examining how MOOS can position itself within retail technology systems. The chapter does not yet present the formal theoretical framework. Instead, it explains why MOOS' positioning problem cannot be understood as a single product, buyer, or competitor problem.

Retail and wholesale are undergoing structural change driven by digitalisation, sustainability pressure, and skills constraints, which reshape how stores are designed, operated, and managed within omnichannel systems (McKinsey & EuroCommerce, 2022). Consumer expectations also push retailers to treat technology as part of the core store experience rather than as a set of supporting tools (Dhingra et al., 2023). These changes matter for MOOS because shelf sensing only becomes valuable when it connects shelf reality to system data, workflows, decision ownership, and accountable follow-up action.

The analysis is based on desk research using published sector reports, industry material, and organisational documents. It moves from MOOS as the focal case to the wider retail technology environment, store technology trajectories, actor control points, and alternative routes to shelf-level visibility. Across these sections, one central point is developed: MOOS operates in a retail technology ecosystem in which shelf reality, store systems, actor control points, and workflow ownership do not automatically align. This creates the need for the ecosystem lens developed in Chapter 3.

2.1 Internal context: MOOS as the focal case

MOOS is used in this thesis as the focal case of a company developing shelf-level sensing for physical retail environments. Its relevance does not lie only in the sensing technology itself, but in the fact that it addresses operational problems that remain structurally difficult to solve in stores, namely OSA, shrink, and execution workload (MOOS, 2025). In that sense, MOOS is relevant not simply as a technology supplier, but as a case through which the relation between shelf events, store action, and ecosystem dependencies can be examined.

This distinction is important because the same sensing capability may enter different operational chains depending on the use case. Prevention-oriented applications require fast signals, clear response routines, and ownership over immediate action. Diagnosis-oriented applications require evidence quality, comparison with other data sources, and integration with review or investigation routines. The use-case split therefore already points to a positioning problem rather than a single product logic.

MOOS is positioned around persistent shelf-level problems, such as OOS events, theft-related losses, and inefficient execution on the shop floor (MOOS, 2025). Rather than presenting value through one single performance indicator, the offering is framed as a set of operational improvements that depend on making shelf events visible, interpretable, and actionable within existing store routines and decision moments.

The internal framing of use cases suggests that MOOS aims to support both prevention and diagnosis. For prevention, it describes alerts when high-risk shelf transactions or irregular shelf movements occur, so staff can respond while the event still matters operationally. For diagnosis, it proposes comparing shelf transactions with point-of-sale (POS) data to identify incidents, narrow down time and location, and reduce the effort of reviewing camera footage by making it more targeted. This implies that the product is designed to complement existing security and operational systems rather than replace them, because it explicitly references enrichment of camera-based approaches and alignment with POS records. As a result, the offering is best understood as a contributing layer within broader operational and security configurations, not as a stand-alone end system with full ownership over the workflow.

Two characteristics follow from this internal problem framing. First, the product sits at the boundary between hardware deployment in stores and software integration with operational and analytic systems, which makes scaling dependent on partners, retailer IT maturity, and process change. This dependence is consistent with broader sector observations that retailers need to overhaul architecture and operating models to exploit technology investments fully (Bick et al., 2022). Second, the primary user group is not only the shopper, but also store operations teams, loss-prevention teams, and retail IT. This means that the value of shelf sensing is shaped by cross-functional incentives and by the ability to integrate new data streams into existing decision routines (Dhingra et al., 2023). For MOOS, the strategic question is therefore not only whether it can generate accurate shelf signals. The question is where those signals should connect, who should act on them, and which partners or systems are needed to make the signal operationally useful at scale.

Figure 2.1 shows the path from a physical shelf event to interpretation, routing, and store action. It highlights that MOOS' value does not depend only on sensing accuracy, but also on the systems and routines that receive, interpret, and act on the signal.

2.2 Retail and retail technology environment

Retail and wholesale in Europe face transformation pressures that combine digitalisation, sustainability, and workforce constraints, which require both investments in new channels and reinvention of the physical store role (McKinsey & EuroCommerce, 2022). In this setting, technology adoption tends to create value only when it is embedded in operating models, governance arrangements, and routines that make new data usable in execution (Vial, 2019). Omnichannel operations further increase interdependence because store-level processes depend on shared data infrastructures and cross-functional coordination across fulfilment, pricing, and replenishment activities (Ishfaq et al., 2022). These pressures matter for MOOS because its product sits inside store operations, where integration quality, execution readiness, and ownership of follow-up actions influence whether shelf-level sensing can become a scalable position rather than a pilot-level technology.

This shift increases the operational demands placed on the store. Digitalisation expands the number of processes that require reliable data, such as pricing integrity, fulfilment, replenishment, and availability management, which are hard to execute when store-level information is incomplete or delayed (McKinsey & EuroCommerce, 2022). At the same time, retailers are expected to reduce friction and keep store processes consistent across channels (Dhingra et al., 2023). This makes shelf-level execution a more visible constraint. Availability, shrink, and workload are not only store problems. They are also data and coordination problems. For MOOS, this means that shelf sensing becomes strategically relevant only when the signal fits into an operational rhythm: who receives it, when it is received, which action follows, and whether that action can be repeated without adding too much workload.

Two store-level problems are particularly relevant for MOOS: OOS events and shrinkage. A sector perspective on availability notes that it is not unusual for a supermarket to miss out on around 5 percent of sales through OOS events, which frames availability as a recurring economic loss rather than a marginal operational issue (Oliver Wyman, 2012). The same source links availability performance to replenishment routines, forecasting, and in-store processes (Oliver Wyman, 2012). Better sensing is therefore not enough on its own. The shelf signal must connect to a decision point, an accountable actor, and a practical follow-up action. This fits the broader argument that retail technology creates value when it is integrated into operating model change, rather than treated as a standalone upgrade (Bick et al., 2022).

The implication for MOOS is that availability is not only a detection problem. A shelf signal only becomes valuable when it leads to replenishment ownership, task prioritisation, or another clear action. This makes OOS a difficult positioning case.

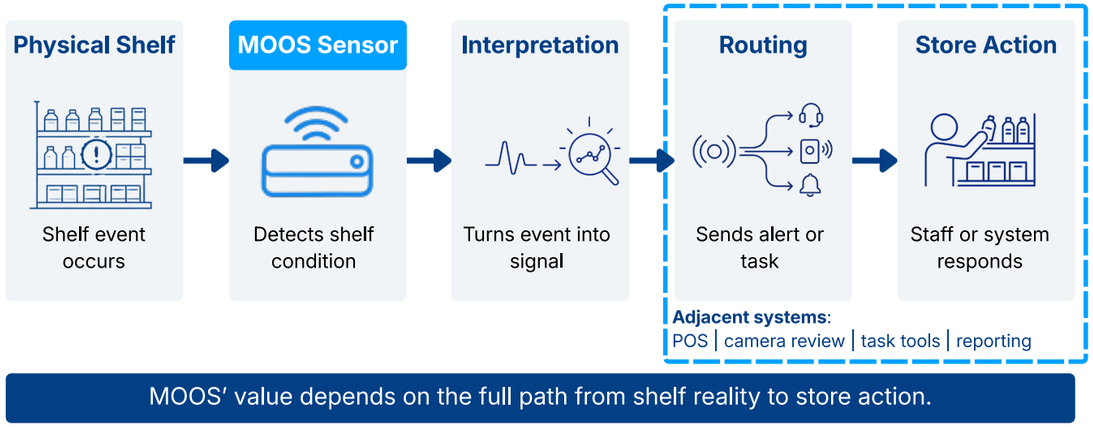


Figure 2.1. MOOS in store operations.

MOOS may win where retailers need faster shelf-level evidence, but it may struggle where the main problem sits in forecasting, replenishment logic, backend stock correction, or unclear store ownership.

Shrink is a second structural driver because it combines economic loss with safety and operational burden. The National Retail Security Survey reports that shrinkage as a percentage of sales increased from 1.4 percent to 1.6 percent, and it estimates total retail shrinkage at $112.1 billion, signalling a level of loss that is material for both margin and managerial attention (National Retail Federation, 2023). The same report highlights that organised retail crime and violence have become central concerns for retail leaders, suggesting that loss-prevention investments are shaped not only by financial calculations but also by safety and reputational considerations (National Retail Federation, 2023).

For a shelf-sensing offer, this matters because theft-reduction use cases are likely to be assessed within broader security strategies and evidence routines. MOOS company material describes links between shelf events, POS data, and video review, which suggests that the product is not positioned as a replacement for camera-based security, but as a signal that can make review and response more targeted (MOOS, 2025). This creates a different positioning logic from OOS. In LP, MOOS may be strongest where the retailer needs a timely shelf-level trigger and supporting evidence. It may be weaker where the main need is broad visual surveillance, deterrence, staff safety infrastructure, or investigation after the event.

Cost and capability constraints also shape the environment. The EU sector analysis emphasises that upgrading e-commerce, expanding supply chain networks, and digitally enabling stores require significant investment and organisational capacity, which implies that retailers will prioritise technologies that fit into coherent roadmaps rather than adding isolated tools (McKinsey & EuroCommerce, 2022). A related point in retail technology transformation work is that retailers often need to modernise their technology architecture and reorganise IT to deliver faster time-to-market and manage technological complexity (Bick et al., 2022). These constraints are consistent with a pattern in which operational technologies must show clear links to performance outcomes and be implementable within limited transformation bandwidth. For MOOS, this creates a practical constraint on positioning. A technically strong shelf-sensing proposition may still struggle if it requires too much integration effort, unclear ownership, or a business case that competes with higher-priority transformation initiatives. The positioning problem is therefore partly about reducing perceived implementation burden while making the operational value specific enough to justify attention and investment.

A DEPEST view helps to condense these pressures into a smaller set of contextual forces that shape store technology decisions. The purpose here is not to present a full trend study, but to identify which external forces increase the relevance of shelf-level visibility and which forces constrain technology adoption.

Demographic and social factors include ageing populations, smaller households, time pressure, and expectations of convenient, low-friction shopping. These forces increase pressure on stores to remain easy to operate and reliable for shoppers, while labour availability becomes more constrained (McKinsey & EuroCommerce, 2022).

Economic factors include margin pressure, cost inflation, value-seeking consumer behaviour, and the need to improve productivity. In this context, technologies are likely to be evaluated against clear operational benefits, short payback expectations, and their ability to reduce manual workload or prevent avoidable losses (Deloitte, 2025).

Political and legal factors are visible in the increased attention to retail crime, employee safety, data protection, and traceability requirements. These forces can support investment in loss-prevention and tracking technologies, but they also make privacy, evidence quality, and data governance more sensitive evaluation criteria (National Retail Federation, 2023).

Ecological factors include waste reduction, supply chain transparency, and the sustainability transition of retail operations. These forces make better inventory visibility relevant because inaccurate or delayed store information can contribute to waste, inefficient replenishment, and avoidable operational losses (McKinsey & EuroCommerce, 2022).

Technological factors include the growing maturity of AI, cloud infrastructure, edge computing, connectivity, and in-store automation. These technologies make real-time sensing and decision support more feasible, but they also increase the need for coherent data architectures, cybersecurity, and integration standards (McKinsey & Company, 2025).

Taken together, the DEPEST forces suggest that the opportunity for MOOS is created by pressure on availability, labour, shrink, waste, and data-driven execution. However, these same forces also create constraints. Retailers are unlikely to adopt another point solution unless it fits existing systems, supports clear operational ownership, and can be justified within broader transformation priorities. The implication is that MOOS should not be positioned only as a more accurate sensor. Its relevance depends on whether shelf-level data can reduce execution uncertainty in situations where existing store data, staff routines, or security systems are insufficient. The full DEPEST analysis is included in Appendix B.1.

Figure 2.2 summarises the DEPEST forces that make shelf-level visibility more relevant for retailers. The figure should be read as a context filter: it translates broad external pressures into store-level conditions that matter for shelf sensing.

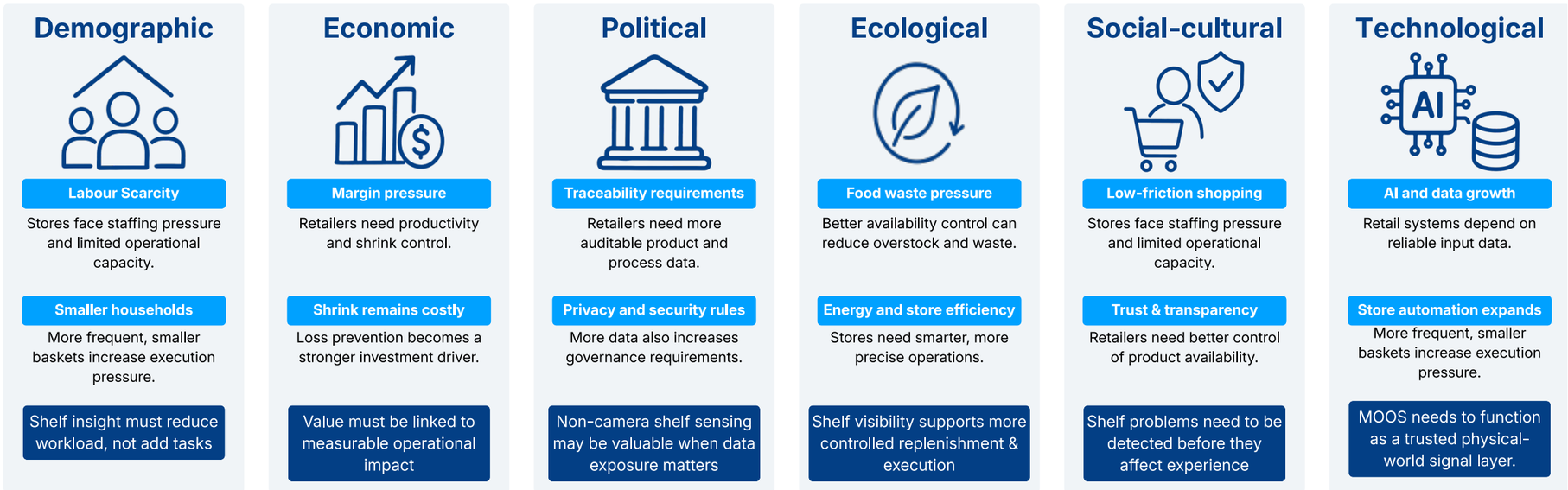


Figure 2.2. DEPEST overview.

Figure 2.3 then connects these external pressures to the operational pain points around availability, labour, cost, shrink, security, and data fragmentation. The figure shows why shelf technology becomes relevant when it reduces store burden and turns shelf events into action.

2.3 Store technology trajectories and scaling constraints

Store technologies are discussed here as contextual evidence for how in-store technologies move from pilots to scalable use, not as a separate adoption study. Retail technology in stores often develops through cycles of experimentation, infrastructure build-up, and gradual integration into broader operating models. This pattern is consistent with research on digital transformation, which suggests that technologies create value only when they are embedded in routines, governance, and architecture rather than treated as isolated upgrades (Vial, 2019). For MOOS, these trajectories are relevant because they show that technical performance is only one part of scaling. The more strategic question is whether a technology can become part of the store's existing systems, roles, and decision routines.

As a visible example, self-checkout has scaled widely over several decades, yet it continues to generate operational frictions and follow-on innovation waves such as checkout-less concepts (EY, 2023). Self-checkout illustrates that scaling a store technology can shift rather than remove operational problems. A checkout intervention may reduce labour at the transaction point, but it can also increase the need for exception handling, loss-prevention routines, and monitoring. For MOOS, this suggests that a shelf-sensing proposition should not only claim efficiency gains, but also clarify how new signals will be governed, acted upon, and connected to existing control processes.

The store technology base is also broadening beyond checkout. In the European retail context, sector evidence points to technologies such as RFID, smart carts, and traffic sensors as building blocks for more instrumented store workflows (McKinsey & EuroCommerce, 2022). These technologies do not all solve the same problem. RFID strengthens item identification and inventory visibility where tagging infrastructure is available. Smart carts and traffic sensors generate data about shopper movement, basket behaviour, and store flow. Shelf-level sensing, including the type of capability developed by MOOS, is different because it focuses on what happens at the product location itself. The relevance of this comparison is that each technology creates value from a different control point in the store.

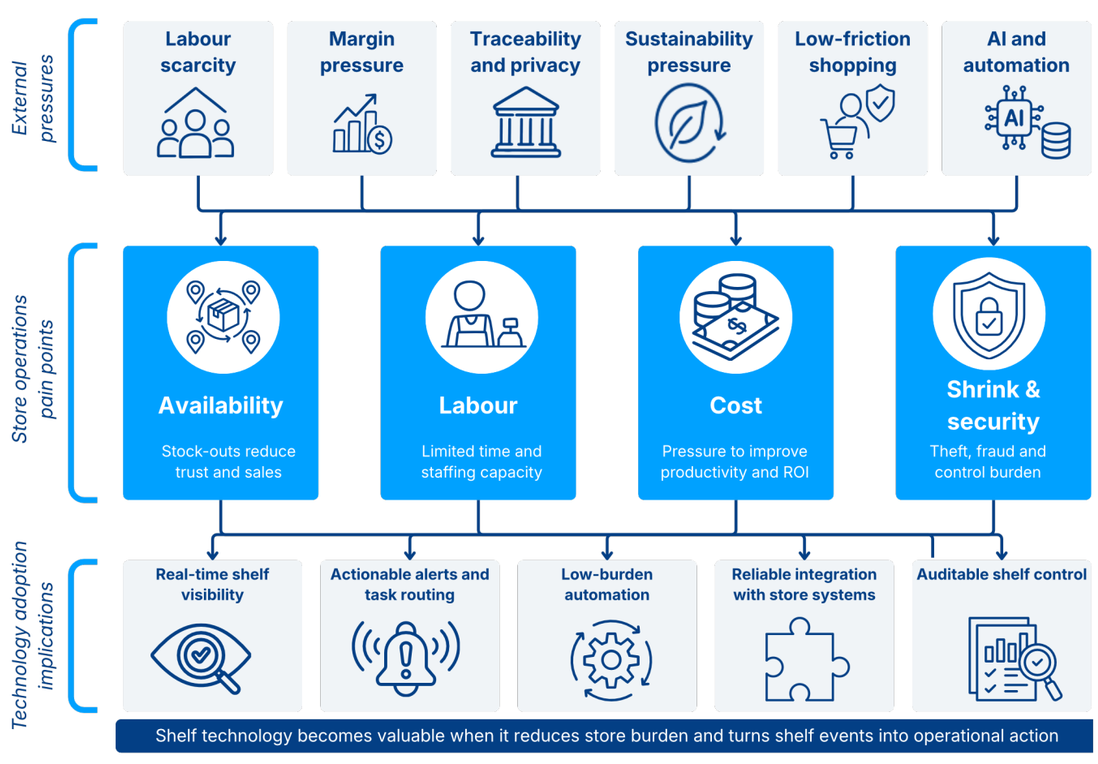


Figure 2.3. Store operations pressure map.

At the same time, general technology developments in AI, connectivity, and cloud and edge computing increase what is technically feasible in near-real-time store sensing, while also raising expectations for cybersecurity, reliability, and integration quality (McKinsey & Company, 2025). This matters because the technical feasibility of sensing is no longer the only differentiator. As AI, connectivity, and edge infrastructure become more mature, more actors can claim to generate store data. The more difficult question becomes which signals are accurate enough, timely enough, and operationally usable enough to be trusted in execution. For MOOS, this shifts the positioning problem from *"can the shelf be sensed?"* to *"which shelf signals are reliable and useful enough to become part of operational decision-making?"*

Electronic Shelf Labels (ESLs) are a relevant infrastructure class because they connect pricing and promotion execution to central systems and change the shelf from a static fixture into a managed digital surface (Deloitte, 2025). Their relevance for MOOS is not that they solve shelf sensing directly, but that they show how the shelf can become part of a broader store technology stack. ESLs infrastructures may provide physical attachment points, power, communication layers, pricing interfaces, and, in some cases, media or analytics functions. This makes ESL providers important because they can become partners, hosts, or gatekeepers for other shelf-level technologies. For MOOS, this creates a positioning tension: the company may benefit from being embedded in shelf infrastructure, but it may also become dependent on actors that control access to that infrastructure.

Across these technologies, integration and operating model readiness repeatedly appear as scaling constraints. Academic work on digital transformation highlights that legacy constraints and organisational routines can become binding, even when individual technologies perform adequately in isolation (Vial, 2019). Sector publications echo this by emphasising that retailers must modernise architecture and ways of working to scale store technologies beyond pilots (Bick et al., 2022). For MOOS, this means that technology trajectories should be read as warnings about positioning. Shelf sensing may create a valuable signal, but the signal will compete for integration capacity, workflow attention, and ownership within already crowded store technology roadmaps.

Table 2.1 summarises the selected technology trajectories as a scaling-constraint matrix. The purpose of the table is not to compare all technologies in detail, but to show how different technologies create value from different store control points and how each trajectory exposes integration, governance, or operating-model constraints that are relevant for MOOS.

Technology route	*Store fit*	*Data quality*	*Integration load*	*Ownership*	*Routine change*	*Implication*
ESL and shelf edge	High store fit	Medium data dependency	High integration load	Shared ownership	Medium routine change	MOOS should not try to own the full infrastructure here, but connect where shelf events add actionable information.
Computer vision	Variable store fit	High data dependency	High integration load	Complex ownership	High routine change	MOOS can stand out through a more focused and less privacy-sensitive sensing route than camera-based solutions.
RFID and item tagging	Physical tagging needed	High data quality need	High integration load	Supply-chain ownership	Medium routine change	RFID shows that full item-level traceability can be heavy; MOOS may be more attractive as a lighter, shelf-focused route.
POS and inventory analytics	Indirect shelf fit	Dependent on transaction data	Backend integration	Commercial or IT ownership	Low shelf visibility	MOOS can add value where backend data remains indirect and gives too little insight into physical shelf reality.
Shelf sensing	Direct shelf fit	Event-level data	Selective integration	Shared ownership	Action routine needed	This is MOOS' most logical core route, provided signals are reliable and can be connected to store action.
Workflow and task tools	Strong store fit	Depends on input signal	Medium integration load	Operations ownership	High routine dependency	MOOS should not replace these tools, but feed them with better shelf-event signals and trigger logic.

Table 2.1. Store technology trajectories and scaling constraints.

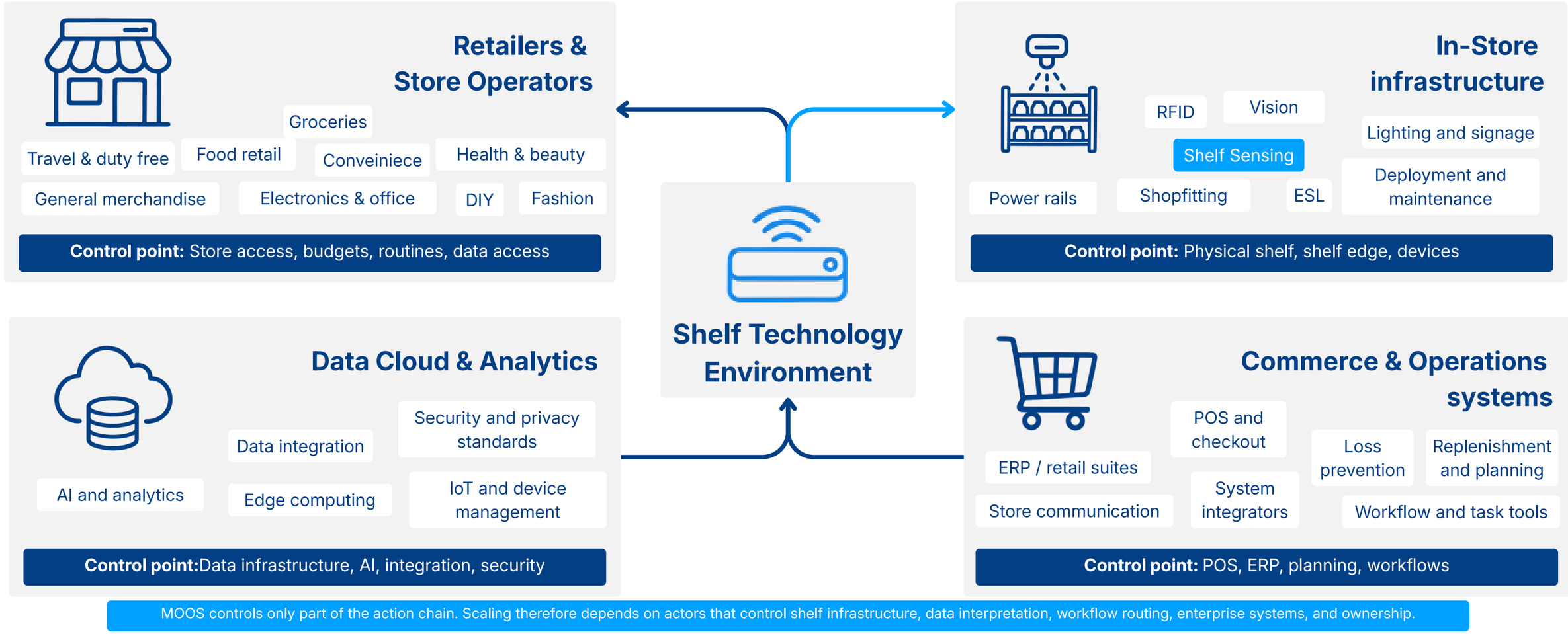


Figure 2.4. Actor categories and control points in the retail technology environment

Three implications for MOOS follow from these technology trajectories. First, store technologies tend to create value after they become part of wider store systems, not while they remain isolated tools. MOOS therefore needs to be positioned as a shelf-event signal that can be used by POS, replenishment, loss-prevention, or store execution systems. Second, competition is likely to occur around control points rather than only around direct substitutes. ESL providers, checkout systems, RFID infrastructures, camera platforms, and data platforms each control a different route to store-level insight. Third, repeatability matters. Shelf sensing is more likely to scale when installation, interpretation, and follow-up can be repeated across stores. This narrows the positioning problem: MOOS must decide where its shelf signals should attach, who should act on them, and which partners or interfaces are needed to make this realistic.

2.4 Retail technology actor categories and control points

After the technology trajectories discussed in Section 2.3, the relevant question is not only which technologies can detect, display, or process store information. For MOOS, the more strategic question is which actors control the systems that are needed to turn shelf-level information into operational action.

Retail technologies are embedded in multi-actor systems that connect retailers, vendors, integrators, infrastructure providers, and store teams through shared data flows and operational handoffs. In omnichannel retail, the store becomes part of a wider channel system in which physical and digital operations depend on shared information (Verhoef et al., 2015). This makes coordination more demanding, because replenishment, pricing, fulfilment, and customer-facing processes need consistent data across several functions and systems (Ishfaq et al., 2022). Sector evidence in the European context also frames store enablement as part of a broader transformation agenda that spans channels, logistics, and store systems (McKinsey & EuroCommerce, 2022).

To make this environment useful for MOOS, this section first separates actor categories from individual companies. The aim is not yet to compare direct competitors, but to identify which types of actors control the main interfaces around store execution. These control points include the physical shelf, the shelf edge, transaction data, enterprise systems, replenishment logic, loss-prevention workflows, data infrastructure, integration decisions, and store routines. Figure 2.4 therefore provides a category-level map before representative companies are introduced later in the section.

This figure maps the main actor categories around store technology and shows which control points they occupy. It visualises how control is distributed across the physical shelf, shelf edge, POS and checkout, enterprise systems, planning, LP, data platforms, integration partners, and store execution.

No.	Actor category	Typical example companies	Main control point	Why this matters for MOOS
1	Retailers and store operators	1	Store access, budgets, operational routines, data access	Decide whether shelf sensing addresses a priority problem and who owns the follow-up action.
2	ESL and shelf-edge platforms	2	Shelf-edge infrastructure, pricing communication, digital shelf touchpoints	Occupy a position close to the shelf and may become partners, hosts, or gatekeepers for shelf-level technologies.
3	Shelf sensing and in-store sensing actors	3	Product-location signals, shelf events, sensor data	Provide direct store-level visibility, but depend on connection to workflows and retailer systems.
4	Computer vision and autonomous store systems	4	Visual observation, behaviour detection, autonomous checkout data	Offer alternative routes to store visibility and may complement shelf data in selected use cases.
5	POS and checkout infrastructure	5	Transaction data, checkout logic, sales event records	Control the link between shelf events, sales data, basket data, and shrink logic.
6	Enterprise retail suites and ERP platforms	6	ERP, merchandising, store-system architecture, master data	Influence data architecture, integration requirements, master-data quality, and retailer IT decision-making.
7	Planning and analytics platforms	7	Forecasting, replenishment, category performance, analytics	Could use shelf signals as input, but may also absorb part of the insight layer.
8	Loss-prevention and security actors	8	Theft detection, security workflows, evidence logic, alarm systems, staff communication	Shape how shrink-related shelf signals are interpreted, escalated, and combined with existing security routines.
9	RFID and item-identification actors	9	Item-level identification, inventory visibility, tagging infrastructure	Shape expectations around automated visibility, inventory accuracy, and item-level traceability.
10	Shopfitting and shelf-fixture actors	10	Physical shelf, fixtures, displays, product presentation	Influence whether shelf-level sensing can be physically embedded, installed, maintained, and standardised at scale.
11	Systems integrators and consultants	11	Architecture choices, implementation, integration programmes, change management	Influence whether new technologies can be connected to existing retailer systems and transformation roadmaps.
12	Cloud, data, and AI infrastructure providers	12	Data infrastructure, cloud architecture, AI tooling, cybersecurity	Shape the technical environment in which shelf data is stored, processed, secured, and combined with other data streams.
13	Workforce communication and store execution tools	13	Staff communication, task routing, store-level execution	May become the output layer through which shelf events are translated into tasks, alerts, or staff action.

Table 2.2. Representative actor groups and company examples in the retail technology environment

The figure should be read as a structural overview rather than a vendor comparison. The physical shelf is shaped by shopfitting and display suppliers. The shelf edge is increasingly occupied by ESL vendors. Product identification and item visibility are supported by RFID and barcode infrastructures. Checkout and transaction data are controlled by POS, self-checkout, and payment-related systems. Replenishment and planning decisions are shaped by retail planning platforms and enterprise systems. Loss-prevention systems influence how shrink and theft signals are interpreted. Above these layers, cloud providers, data platforms, and systems integrators influence how information is connected, secured, and scaled across store networks. These control points matter because a new sensing technology does not enter an empty environment. It enters a store architecture in which other actors already control interfaces, data access, routines, and commercial relationships.

Representative companies can be placed within these actor categories because they control or influence specific parts of the store technology system. ESL vendors, for example, occupy the shelf edge. POS and checkout providers control transaction data. ERP and retail suite providers shape system architecture and master data. Shopfitting firms influence the physical shelf environment. Loss-prevention vendors shape security routines and evidence logic. Integrators influence whether new technologies can be connected to existing retailer systems. Table 2.2 translates the category-level map into representative actor groups and company examples. The table should not be read as a competitor ranking, but as a control-point overview that shows where MOOS may encounter partners, gatekeepers, infrastructure owners, or adjacent solution providers.

The table shows that the retail technology environment is organised around multiple control points rather than around one dominant technology category. For MOOS, this means that shelf sensing is not positioned in a neutral space. It must connect to actors that already control store access, shelf infrastructure, transaction data, planning systems, security routines, data platforms, and implementation decisions. The relevance of these actor categories lies not only in their individual company profiles, but in the interfaces they occupy around shelf-level information and store execution.

The implication for MOOS is that the competitive field should be read as a set of partial substitutes and possible complements. ESL systems are strong where retailers need shelf-edge infrastructure, pricing execution, and digital shelf communication. They are weaker when the problem is direct product-event detection. Camera platforms are strong where broad visual context and security monitoring matter. They may be weaker when the retailer needs a non-camera signal that points to a specific shelf event. RFID is strong where tagging infrastructure and item-level control already exist, but it is less suitable where product economics or category conditions do not support tagging. POS data is strong for transaction evidence, but weak for real-time shelf reality. Manual routines remain flexible, but they are labour-intensive and inconsistent. This creates a positioning space in which MOOS can be framed less as a stand-alone replacement and more as a specialised shelf-event layer that strengthens selected store technology routes.

The actor categories can also be grouped by their practical role in store technology decisions. Some actors organise broader systems, such as POS platforms, ERP suites, planning platforms, large ESL ecosystems, cloud infrastructures, and retailer-owned technology stacks. Other actors provide specialised components, such as sensors, RFID tags, labels, cameras, antennas, fixtures, or analytics modules. A third group focuses on integration and implementation, especially when retailers need to connect new tools to legacy systems, data platforms, security rules, and store workflows (Bick et al., 2022; Vial, 2019). These roles are not fixed. The same company may act as a component supplier in one context and as a broader system organiser in another. For MOOS, this means that actor categories cannot be assessed only as partners or competitors. Their role depends on which control point is relevant in a specific retailer setting.

For MOOS, the most important interfaces are not only physical shelf interfaces, but also informational and organisational interfaces. A shelf event creates operational value only when it can be routed to the right system or function, such as an alerting interface, a staff workflow, a POS record, a replenishment system, a loss-prevention process, or an analytics environment. In practice, these systems are often owned by different internal functions or external vendors. This makes the pathway from shelf event to store action a potential bottleneck.

Figure 2.5 compares two data flow situations around the shelf. The first flow shows the existing store technology environment without MOOS. In this situation, shelf reality is inferred through systems such as POS, inventory management, shelf media, ESL, camera vision, staff tools, team communication, and shopfitting infrastructure. These systems can each provide part of the picture, but they are not automatically connected to the same action route or decision owner. The full actor maps and stakeholder overview are provided in Appendix B.2.

The second flow shows where MOOS's shelf sensor enters this environment. MOOS adds a physical shelf-event signal between shelf reality and adjacent store systems. This creates several possible connection routes, but each route also brings dependencies around data access, interface ownership, workflow fit, and follow-up action. The figure therefore shows why MOOS's positioning problem is broader than sensor performance alone.

A signal may originate at the shelf, but its value is realised elsewhere: in a replenishment action, a security response, a POS comparison, a category-management decision, or a store task. The signal must be trusted, routed to the right system or actor, and embedded in a routine that can be repeated across stores. This is why the next chapter develops an ecosystem-as-structure lens rather than treating MOOS's position as a simple product comparison.

For MOOS, this means that technical performance is only one condition for relevance. The company also needs to determine which actors it must connect to, which interfaces it should support, and where it can create value without taking ownership of the full store technology stack. Section 2.5 therefore narrows the analysis from actor categories and control points to the alternative solutions and competitors that address shelf-level visibility, availability, and shrink.

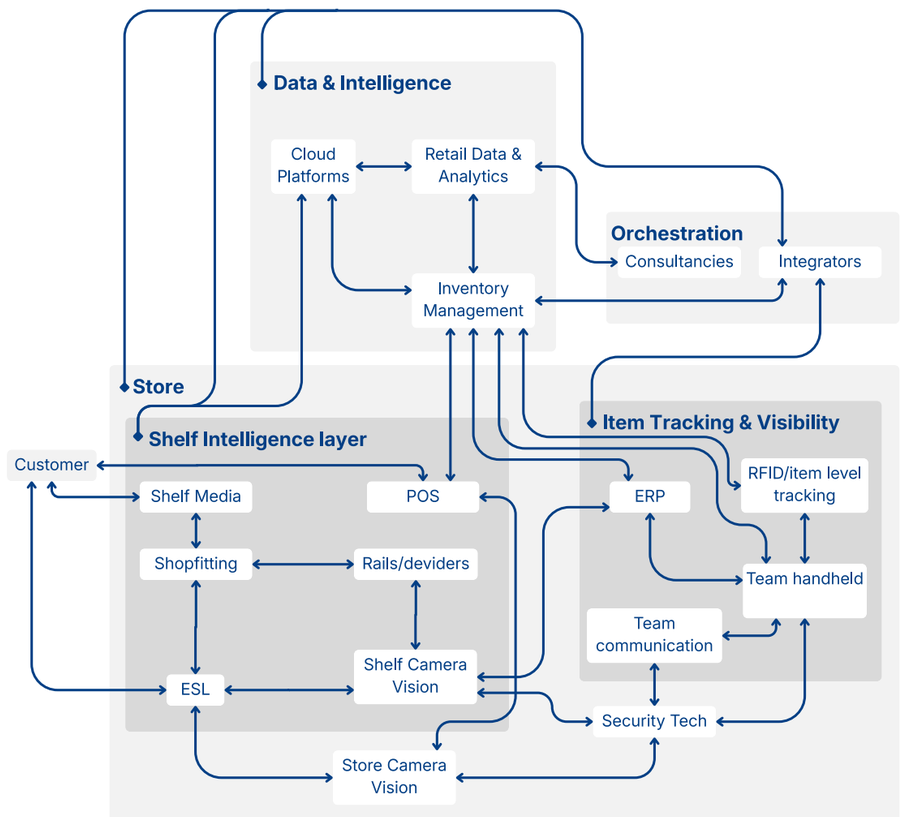


Figure 2.5. Data flow and integration bottlenecks around shelf events.

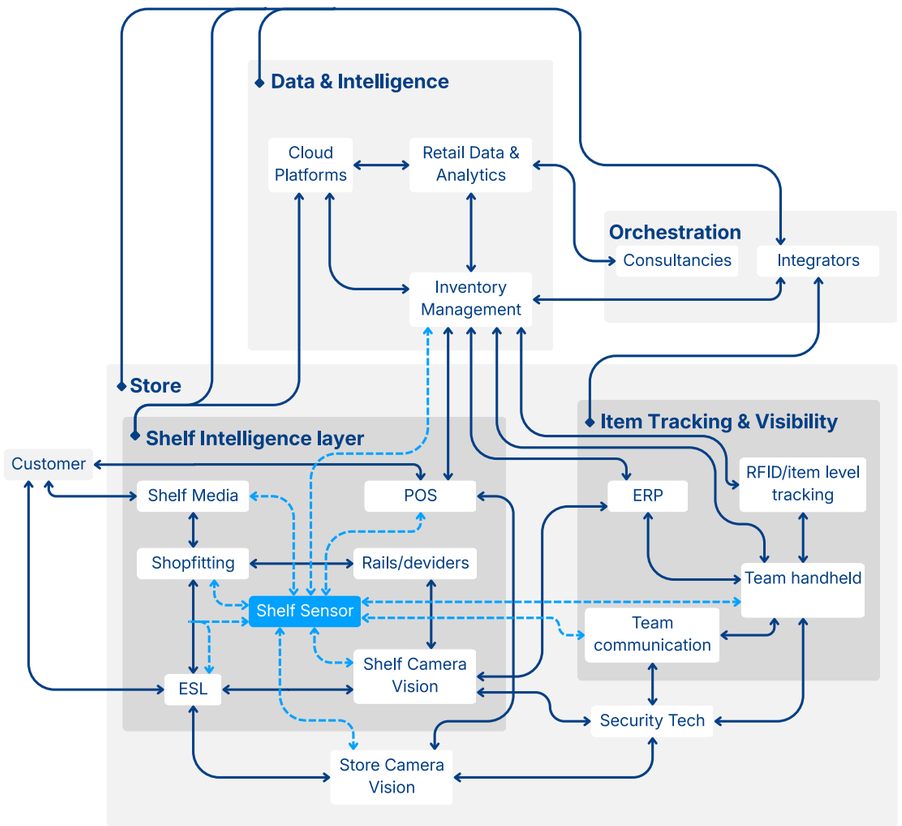


Figure 2.5. Data flow and integration bottlenecks around shelf events, including shelf sensing.

2.5 Alternatives and competitors around shelf-level visibility

This section narrows the context from actor categories to the alternative solution routes that address the same shelf-related problems as MOOS. The analysis is not meant as a full ranking of competitors. It is used to clarify where MOOS may have an advantage, where other solutions may be stronger, and which control points shape the positioning space around shelf-level visibility.

The aim is not to identify one direct substitute. Retailers already use manual routines, shelf-edge systems, cameras, RFID, checkout data, loss-prevention tools, and analytics platforms to infer what happens at the shelf. From an operational point of view, the job around the shelf includes keeping products available, maintaining pricing integrity, reducing losses, and limiting workload for store staff. These tasks become harder when assortment complexity increases, labour is constrained, and inventory records diverge from shelf reality (McKinsey & EuroCommerce, 2022; DeHoratius & Raman, 2008).

For MOOS, competition should therefore be understood functionally rather than only technologically. The relevant question is not which company uses the same sensing principle, but which solution routes retailers may use to detect, interpret, and act on shelf problems.

The full competitor and alternative solution scan is provided in Appendix B.3.

2.5.1 Solution routes around shelf-level visibility

The alternative solutions around the shelf can be grouped by the mechanism through which they create shelf-related visibility. Some solutions digitise the shelf edge, some identify items, some observe behaviour, some use transaction data, and others organise operational response. This distinction is important because these routes may aim at similar outcomes, such as better availability

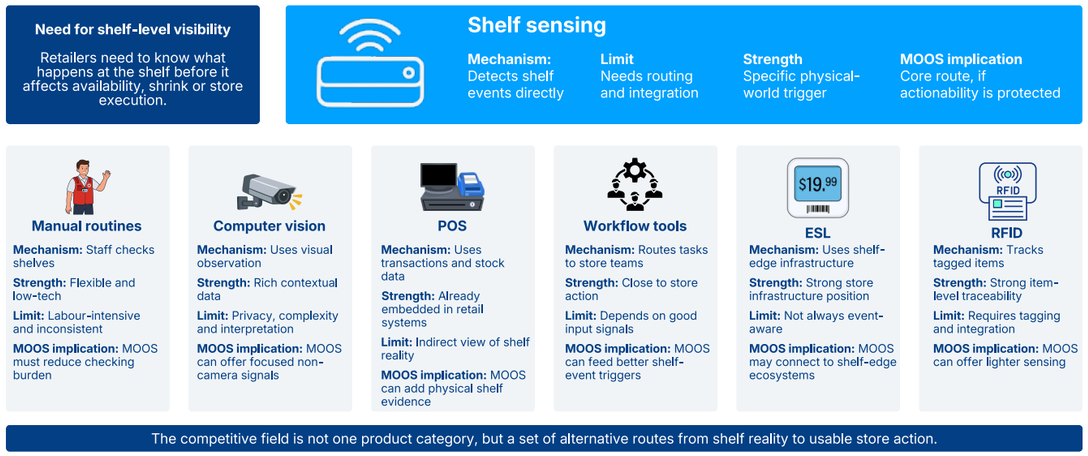


Figure 2.6: Solution routes around shelf-level visibility. Source: own analysis based on the desk-research market scan.

or lower shrink, while relying on different control points in the store technology system.

Figure 2.6 summarises the main solution routes through which retailers can create visibility around shelf-level problems. The figure is not organised by company type, but by the mechanism through which each route helps retailers detect, interpret, or act on issues such as OOS situations, shrinkage, pricing errors, and store execution problems.

The figure shows that alternatives around the shelf do not compete through one shared technical mechanism. Manual routines rely on staff observation, ESL systems digitise the shelf edge, RFID identifies tagged items, cameras observe behaviour or shelf states, checkout systems infer events from transactions, and analytics platforms organise interpretation and follow-up. Specialised shelf sensing occupies a more direct route because it aims to detect shelf events at the location where they occur. For MOOS, this means that the competitive field should be understood functionally: the relevant question is not only which technology is most similar, but which route retailers use to create usable shelf-level information.

Technology alternatives can be organised by the main mechanism through which they produce shelf-related signals. Shelf digitisation tools, such as ESLs, support pricing execution and can reduce manual work, but they do not automatically provide product-level availability or theft signals unless combined with other sensing layers (Deloitte, 2025). Checkout technologies, including self-checkout and checkout-less approaches, aim to reduce friction and may improve throughput, but they also introduce operational challenges that lead to continued iteration and complementary innovations (EY, 2023). Item identification approaches, such as RFID tags, can support automated checkout and stock management when combined with suitable infrastructure, which shows how sensing value depends on complementary components and store readiness (McKinsey & EuroCommerce, 2022). Camera-based approaches are often positioned as a way to observe behaviour and detect anomalies. MOOS frames its shelf data as a way to reduce false positives and support targeted review of camera footage, which suggests that camera-based systems can also be viewed as potential complements rather than only substitutes (MOOS, 2025).

Loss-prevention solutions form a separate but overlapping competitive field because many shelf technologies are evaluated partly through their impact on shrinkage. The scale of shrinkage and the reported rise in organised retail crime make it likely that retailers will continue to invest in tools that support prevention, investigation, and staff safety, including approaches that connect incidents to evidence and operational response routines (National Retail Federation, 2023). The National Retail Federation also shows that retailers are not only relying on traditional measures, such as CCTV, locking cases, EAS, and LP staffing, but are also researching or piloting technologies such as AI-enabled fraud detection, RFID, body-worn cameras, and facial recognition (National Retail Federation, 2023). In this context, MOOS' theft-prevention framing emphasises operational alerts

Solution route	*Company*	*Main control point*	*Shelf visibility route*	*Main strength*	*Main limitation*	*Relation to MOOS*
Specialised shelf sensing	**MOOS**	**Shelf surface / product movement**	**Direct shelf-event sensing**	**Precise, real-time, non-vision data**	**Narrow component; needs integration**	**Focal actor**
ESL & shelf digitisation	Vusion Group	Shelf edge / ESL platform	Digital shelf edge + Captana	Strong shelf presence and platform reach	Sensing depends on added modules	Mixed partner / partial substitute
ESL & shelf digitisation	Pricer	ESL and price execution	Price and workflow digitisation	Installed shelf-edge infrastructure	Limited direct movement sensing	Complement
ESL & shelf digitisation	SoluM	ESL + Newton Eye	ESL plus shelf monitoring	Combines labels with shelf visibility	Vision-based sensing remains indirect	Mixed
ESL & shelf digitisation	Hanshow	ESL and smart shelf systems	Digital shelf edge + AI modules	Broad digital shelf proposition	Less precise than direct sensing	Mixed
Shelf camera analytics	Captana	Shelf cameras	Visual shelf monitoring	Strong OSA and replenishment relevance	Vision limits: occlusion, calibration, privacy	Substitute / complement
Shelf camera analytics	Trax	Shelf image recognition	Mobile or fixed image-based shelf analytics	Strong execution and planogram analytics	Periodic or visual inference, not direct event sensing	Substitute / complement
Store camera analytics	RetailNext	Store cameras / shopper analytics	Store-level visual analytics	Strong traffic and behaviour insight	Less focused on shelf-event detection	Adjacent complement
Autonomous store / CV	AiFi	Computer vision store automation	Object and shopper tracking	Strong in frictionless store formats	High system complexity and privacy exposure	Adjacent substitute
Frictionless checkout / CV	Reckon.ai	Smart cabinets / checkout-free flow	Enclosed vision-based product tracking	Relevant for controlled shelf/cabinet formats	Less generalisable to open shelves	Niche substitute
RFID / item ID	Avery Dennison	RFID tags and digital ID	Tagged item visibility	Strong item-level identification	Requires tagging infrastructure	Complement
RFID / item ID	Nedap	RFID inventory platform	RFID-based store visibility	Strong inventory and LP relevance	Depends on RFID adoption and category fit	Platform complement
RFID / mobile devices	Zebra	Readers, scanners, mobile devices	Scanning and RFID capture	Strong operational hardware base	Often process-shelf sensing not passive	Infrastructure complement
Loss prevention (LP)	Sensormatic	EAS, RFID, shrink analytics	Deterrence, detection and evidence	Strong LP workflow relevance	Often needs separate shelf-level trigger	Partner / complement
Loss prevention (LP)	Checkpoint Systems	EAS and RFID security	Item protection and display compliance	Strong security infrastructure	Limited direct shelf-event understanding	Partner / complement
POS & checkout	NCR Voyix	POS and self-checkout	Transaction and checkout evidence	Strong checkout integration	Observes after product reaches checkout	Gateway
POS & checkout	Toshiba	POS, self-checkout, AI checkout	Checkout and store transaction flow	Strong checkout footprint	Shelf events inferred, not directly sensed	Gateway / adjacent substitute
POS & checkout	Diebold Nixdorf	POS and self-service systems	Checkout infrastructure	Strong retail system integration	Limited shelf-level visibility	Gateway
POS & checkout	Fujitsu	POS and self-checkout	Store transaction and checkout systems	Strong enterprise retail stack	Shelf visibility is indirect	Gateway
POS & grocery tech	StrongPoint	Self-checkout, grocery tech, fulfilment	Checkout, fulfilment and store tech	Practical grocery operations focus	Not primarily a shelf sensing provider	Partner / integrator
POS & grocery tech	HL Display	Shelf presentation and ESL holders	Physical shelf infrastructure	Close to shelf and ESL deployment	No sensing by itself	Physical complement
POS & grocery tech	ITAB	Shopfitting and checkout equipment	Store layout and physical retail systems	Strong physical rollout capability	Indirect visibility only	Infrastructure partner
POS & grocery tech	Wanzl	Shopfitting, carts, checkout furniture	Store equipment and customer flow	Strong physical store presence	No direct shelf-event detection	Infrastructure complement
POS & grocery tech	Kesseböhmer	Shelving and retail fixtures	Physical shelf system	Very close to shelf environment	No data capability by itself	Infrastructure complement
POS & grocery tech	POS Tuning	Shelf management and product presentation	Pushers, dividers, presentation systems	Improves facing and shelf order	No sensing by itself	Physical complement
Store infrastructure	SAP	ERP, inventory, retail systems	Enterprise data and process layer	Critical system gateway	Far from physical shelf reality	Gateway / hub
Store infrastructure	Oracle	Retail ERP, inventory, merchandising	Enterprise decision and planning layer	Strong retail system backbone	Shelf events inferred through system data	Gateway / hub
Store platform gateway	GK Software	Store platform and POS orchestration	Store process and POS integration	Important store execution gateway	Not a direct sensing provider	Gateway
Planning system	RELEX	Forecasting, replenishment, space planning	Planning and decision logic	Strong availability and replenishment relevance	Depends on reliable shelf/ input data	Decision-system complement
Consultancy / integration	Capgemini	Architecture and implementation	Integration and transformation route	Important adoption gatekeeper	No own shelf sensing capability	Integrator / gateway

Table 2.3. Reduced capability comparison of shelf-related solution categories. Analysis based on the desk-research capability scan.

and diagnostics that connect shelf events to POS data and video review workflows, which positions the product as a data source that can strengthen broader loss-prevention systems (MOOS, 2025).

The implication for MOOS is that the competitive field should be read as a set of partial substitutes and potential complements. ESL systems are close to the shelf, but they do not inherently solve shelf-level sensing. Camera platforms can observe behaviour, but they may need more precise shelf-event data to reduce interpretation errors. RFID can improve item visibility, but it depends on tagging infrastructure and category fit. Loss-prevention systems already organise evidence and response, but they may lack direct real-time shelf signals. This creates a positioning space in which MOOS can be framed less as a stand-alone replacement and more as a specialised shelf-event layer that can strengthen existing store technology routes.

2.5.2 Representative shelf-related competitors and adjacent providers

A complete retail technology market scan would include enterprise software providers, POS vendors, systems integrators, cloud platforms, workforce tools, shopfitters, ESL vendors, RFID providers, camera platforms, and loss-prevention companies. For the purpose of this section, the comparison is narrowed to companies that are directly or adjacently relevant to shelf-level visibility. This selection avoids turning the section into a general vendor overview and keeps the focus on the positioning problem of MOOS.

The selected competitors and adjacent providers can be grouped into six categories. First, ESL and shelf digitisation providers, such as Vusion, Pricer, SoluM, and Hanshow, are relevant because they already occupy the shelf edge and increasingly position the shelf as a digital interface. Second, computer-vision and shelf-analytics providers, such as Captana, Trax, RetailNext, AiFi, and Reckon.ai, are relevant because they create shelf or store insights through visual interpretation. Third, RFID and item-identification providers, such as Avery Dennison, Nedap, Zebra, and related infrastructure providers, are relevant because they offer another route to product visibility. Fourth, loss-prevention and security providers, such as Sensormatic, Checkpoint, and Nedap, are relevant because they control established theft-prevention routines and evidence systems. Fifth, POS and checkout providers, such as NCR Voyix, Toshiba, Diebold Nixdorf, Fujitsu, and StrongPoint, are relevant because transaction data remains a central source for inferring availability and shrink. Sixth, store infrastructure and shopfitting providers, such as HL Display, ITAB, Wanzl, Kesseböhmer, and POS Tuning, are relevant because shelf sensing depends on physical embedding, installation logic, and store-format fit.

MOOS occupies a different position within this field. It is not primarily a pricing system, a camera system, a checkout system, or an enterprise planning platform. Company material positions MOOS as a shelf-level sensing and insight layer that can convert shelf events into alerts, stock signals, theft diagnostics, and data integrations for store operations (MOOS, 2025). The strategic question is therefore not whether MOOS can replace all alternatives. The more relevant question is where direct shelf-event data can improve the performance of existing store technology routes.

The reduced comparison in table 2.3 shows that MOOS is not positioned against one single competitor category. The full capability comparison matrix is included in Appendix B.4. ESL providers are close to the shelf and have strong installed infrastructure, but their core function is shelf-edge digitisation rather than direct product-event sensing. Camera-based providers can create rich contextual information, but they depend on visual interpretation and may face privacy, occlusion, and false-positive challenges depending on the setting. RFID and item-identification providers can support item-level visibility, but their value depends on tagging infrastructure and category fit. POS and checkout systems provide transaction evidence, but they mainly observe what has already reached the transaction point. Loss-prevention systems organise deterrence, evidence, and response, but often need separate signals to understand what happened at the shelf. This suggests that MOOS' market gap lies in direct shelf-event detection that can complement, rather than simply replace, existing store technology routes.

2.5.3 Capability comparison and market gap for MOOS

Building on this category comparison, the market gap can be assessed through three positioning dimensions. These dimensions are not definitive market facts, but analytical comparisons based on the desk-research scan. They help clarify where direct shelf-event sensing may be stronger than indirect visibility routes, and where MOOS may remain dependent on other systems.

The first positioning comparison concerns the relation between sensing directness and operational actionability. Some routes create visibility indirectly, for example through transactions, periodic audits, staff interpretation, or aggregated analytics. Other routes are closer to the shelf event itself. This distinction matters because shelf-level problems such as OOS situations, suspicious product removal, incorrect facing, or replenishment failures lose value when they are detected too late or only inferred after the event. The more direct the signal, the more likely it is that the retailer can connect the insight to timely operational response.

Figure 2.8 suggests that MOOS is most differentiated when shelf-level visibility must be both direct and actionable. Camera analytics may provide broader contextual information, RFID may provide strong item-level identification in suitable categories, and POS data remains essential for transaction evidence. The relevant point is narrower: MOOS appears to occupy a space where shelf events can be detected at the location where they occur and then translated into store-level action signals. This is different from routes that infer shelf problems from downstream data or depend mainly on human checks.

A second comparison concerns the trade-off between proximity to shelf reality and the burden of deployment or integration. Technologies close to the shelf may create richer information about what happens in the store, but they also need to fit into physical fixtures, installation routines, maintenance processes, data architectures, and store workflows. Technologies further away from the shelf may be easier to connect at system level, but they often provide less direct information about the shelf event itself. This trade-off matters for MOOS because its sensing advantage only becomes useful when it can be deployed and connected without creating too much operational complexity.

Figure 2.9 helps to nuance the market gap. MOOS may be close to the shelf and less visually intrusive than camera-based systems, but this does not automatically make deployment simple. Its position depends on how well the sensing layer can be installed, configured, maintained, and connected to existing store systems. This interpretation is consistent with the broader observation that retail

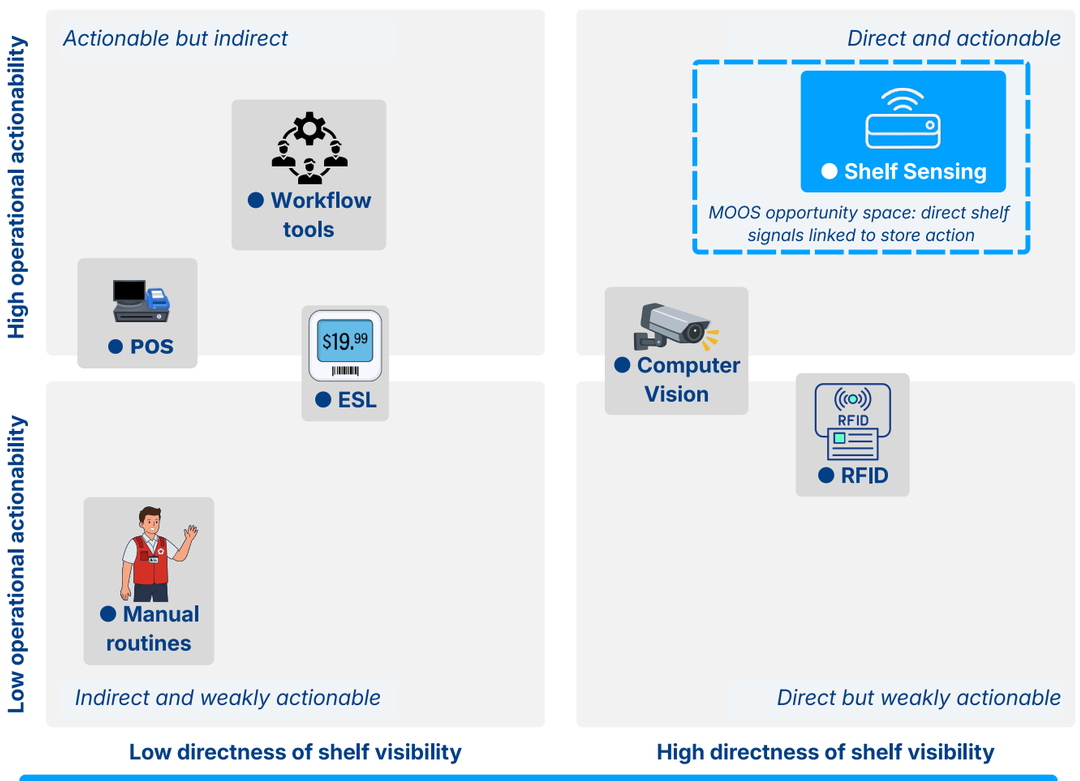


 Figure 2.8. Competitor positioning C-box 1: directness of shelf visibility and operational actionability.

technologies often create value only when architecture, operating models, and organisational routines support scaling beyond isolated pilots (Bick et al., 2022). For MOOS, the issue is therefore not only how well the sensor works, but how easily the signal can become part of the retailer's operating model.

A third comparison concerns privacy exposure and signal specificity. This is relevant because retailers increasingly need detailed operational data, while also facing concerns around visual surveillance, data ownership, security, and customer trust. Not all visibility routes create the same type of data. Camera-based systems may provide broad behavioural and contextual information, but they can also raise privacy and governance questions. POS data is less visually intrusive, but it only records what reaches the checkout. ESL systems have low privacy exposure, but their core function is not direct product-event detection. For MOOS, the relevant question is whether non-camera shelf sensing can provide specific operational signals without expanding visual observation in the store.

Figure 2.10 indicates that the market gap is not only about precision, but also about the type of data that is used to create precision. Camera-based systems can be powerful where visual context matters, but they also depend on interpretation and may face privacy, occlusion, calibration, or false-positive challenges depending on the store setting. RFID can create strong item-level visibility, but only where tagging infrastructure and product-category economics make sense. MOOS appears to occupy a different position: it aims to generate specific shelf-event signals without using visual observation. This may make the route especially relevant for use cases where retailers need operational evidence at shelf level, but do not want to expand camera-based monitoring.

Taken together, the three comparisons indicate a specific market gap for MOOS. Many existing solutions provide broad store observation, transaction evidence, shelf-edge digitisation, item-identification infrastructure, or loss-prevention response. Fewer combine direct shelf-event detection, low privacy exposure, product-level relevance, and a route into operational triggers.

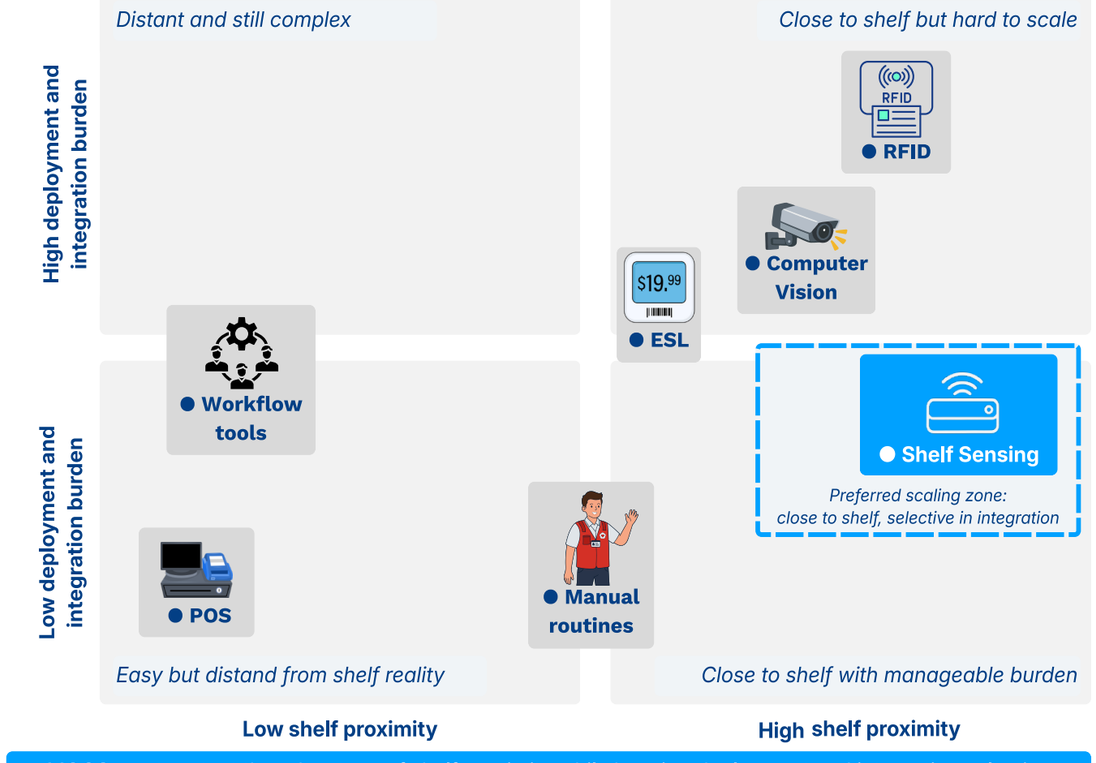


Figure 2.9. Competitor positioning C-box 2: shelf proximity and deployment or integration burden.

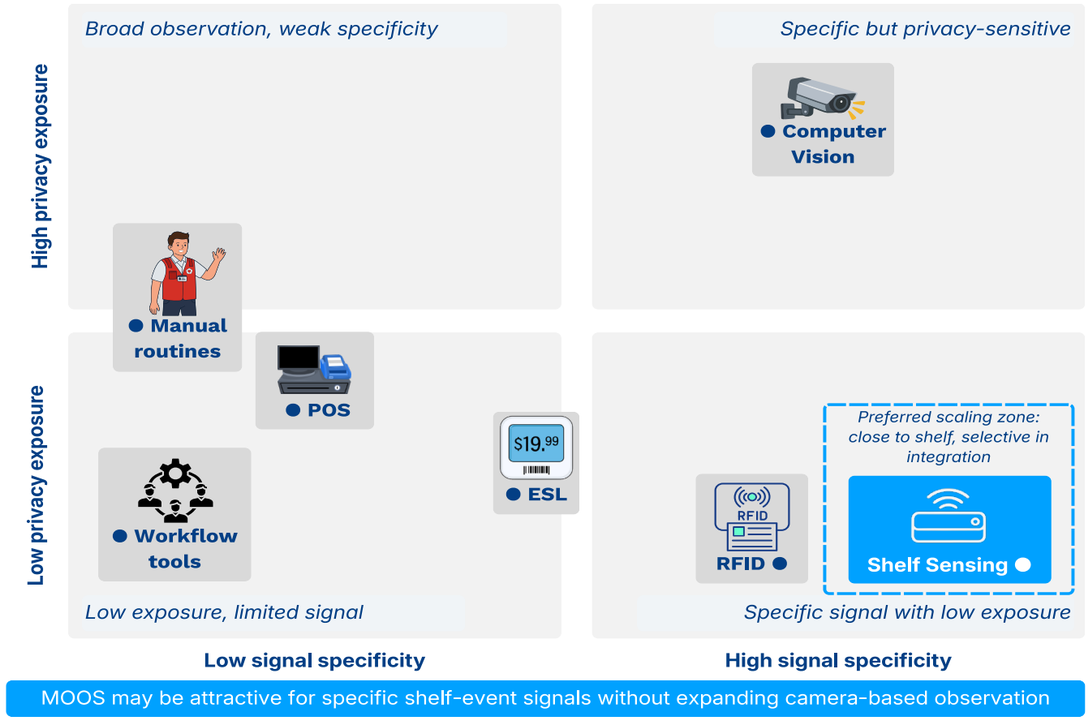


Figure 2.10. Competitor positioning C-box 3: signal specificity and privacy exposure.

MOOS therefore appears strongest when the use case depends on knowing what happened at the shelf, when it happened, and whether that event should trigger a store action. This is most relevant for high-risk removal events, targeted theft diagnostics, and availability situations where indirect data is too late or too incomplete. MOOS appears weaker when the retailer mainly needs broad store analytics, full enterprise planning, transaction reconciliation, item-level inventory control across the whole chain, or a complete workflow system. In those cases, cameras, RFID, POS systems, planning tools, or loss-prevention platforms may be stronger primary systems.

This white space should still be interpreted carefully. A strong sensing capability does not automatically create a strong market position. Retail technologies often depend on store architecture, operating models, staff routines, and integration capacity before they create value at scale (Bick et al., 2022). For MOOS, this means that shelf-event data only becomes valuable when it is connected to replenishment, shrink response, diagnostics, or decision-making. The market gap is therefore technical, but also organisational and infrastructural.

2.5.4 Positioning implications for MOOS

The competitor analysis leads to three positioning implications. First, MOOS should not be framed against one direct competitor category. Its alternatives are distributed across several solution routes, including shelf digitisation, RFID, vision, checkout, LP, workflow tools, and analytics platforms. This means that MOOS' relevance depends on the use case and on the control point that the retailer already trusts.

In theft and loss-prevention use cases, MOOS appears strongest when direct shelf-event detection can support fast response or targeted review. Its value is likely to lie in narrowing down when and where an event happened, and in connecting that event to POS data or video review workflows (MOOS, 2025). However, camera systems and established loss-prevention platforms may be stronger where the retailer needs broad visual context, deterrence, staff safety routines, or investigation after the event. For this use case, MOOS is therefore best understood as a signal layer that can strengthen existing loss-prevention systems, not as a full security system.

In OOS and availability use cases, MOOS appears strongest when the retailer needs direct evidence that a shelf condition has changed. This can be useful when system stock and shelf reality diverge, or when staff routines are too slow to detect the problem. At the same time, MOOS may struggle when the main bottleneck is not detection, but replenishment ownership, stock correction, forecasting, or integration with planning systems. In that situation, POS, ERP, replenishment platforms, or workforce tools may remain stronger control points because they already structure the process around inventory decisions.

For planogram, facing, and compliance use cases, the comparison is more mixed. Camera-based analytics may be stronger when visual layout, facing quality, promotional execution, or broader shelf appearance needs to be assessed. MOOS may be stronger when the relevant event is product removal, refill, or another shelf-level change that does not require visual interpretation. This means that MOOS should be careful not to claim the whole field of shelf analytics. Its strength is narrower: detecting specific shelf events and turning them into usable operational signals.

For general store analytics, MOOS is unlikely to be the broadest solution. Camera platforms, traffic sensors, smart carts, POS data, and analytics platforms can provide wider information about shoppers, store flow, basket behaviour, and commercial performance. MOOS can still contribute to this field, but mainly by adding a specific shelf-event data layer. Its value is likely to be highest when broad analytics need a more accurate view of what happened at the shelf.

These comparisons suggest that MOOS' strongest positioning space is between direct shelf-event sensing and operational response. Many alternatives can provide partial visibility, but fewer combine shelf proximity, real-time event detection, low privacy exposure, and a direct route to store action. This does not remove the need for integration. It means that the value proposition is strongest when MOOS can attach its shelf-event data to existing systems that already organise pricing, replenishment, LP, or staff workflows.The chapter therefore narrows the research problem. MOOS does not only need to prove that its sensing technology works. It also needs to understand where shelf-event data should connect, which actors control those connections, and which operational routines can turn signals into action.

Chapter 3

Literature Review

3.1 Theory background
3.2 Core building blocks from the “ecosystem-as-structure” and related literature
3.3 Operationalising the lens: risks, bottlenecks, and internal readiness
3.4 Integrated conceptual framework

The context analysis points to an alignment problem rather than a simple adoption problem. MOOS' positioning problem cannot be solved by comparing product features alone. It requires a lens that can analyse activities, actors, positions, links, alignment conditions, dependencies, and risks around a focal value proposition. Chapter 3 develops this ecosystem-as-structure lens.

Chapter 2 showed that actionable shelf insight depends on more than the performance of shelf-sensing technology. Shelf-condition information only becomes valuable when it can move through systems, workflows, actors, interfaces, and ownership structures in a way that supports accountable store action. This means that MOOS' positioning problem cannot be analysed as a single-firm strategy problem or as a technology adoption problem alone.

This chapter therefore develops the conceptual lens used to diagnose these dependencies. The unit of analysis is the ecosystem-alignment structure around actionable shelf insight, not MOOS as an isolated firm and not shelf sensing as an isolated technology. Ecosystem-as-structure is used as the core lens because it defines an ecosystem around a focal value proposition and then examines the activities, actors, positions, and links that must align for that value proposition to be realised (Adner, 2017).

3.1 Theory background

Several theory families can inform parts of this problem, but they do not provide the full analytical fit required here. The resource-based view (RBV) helps explain firm resources and advantage, but its main unit of analysis is the focal firm rather than cross-actor alignment in a shared activity system (Barney, 1991). Real options logic is useful for understanding staged commitments under uncertainty, for example in pilots and rollouts, but it does not map the activities and dependencies needed to realise a focal value proposition (Dixit & Pindyck, 1994). Network theory offers useful language for position and centrality, yet it does not specify which activities must align for value creation in a specific ecosystem (Freeman, 1979). Strategic foresight supports future-oriented scanning, but this chapter requires a diagnostic structure for present ecosystem dependencies rather than a broad future-scanning lens (Rohrbeck, 2010).

Ecosystem-as-structure is selected as the core theoretical lens because it fits the central problem identified in Chapter 2: actionable shelf insight depends on a value proposition that can only be realised when several activities, actors, positions, and links align (Adner, 2017). This also fits broader ecosystem literature, which emphasises that value creation and value capture depend on complementarities, governance arrangements, and the coordination of interdependent actors rather than on one firm's technology alone (Jacobides et al., 2018). The lens is therefore useful because it starts from the focal value proposition and then asks which activity structure and actor configuration are required to make that value possible.

The supporting concepts are used only to make this ecosystem lens more operational. Co-innovation risk and adoption-chain risk help explain how value realisation may break down when required complements, interfaces, or adoption stages do not mature together (Adner & Kapoor, 2010). Diffusion theory is used only as background logic for staged progression under uncertainty, not as a separate adoption framework (Rogers, 2003). The five gates used in this thesis, pilot, rollout decision, store execution and routinised use, sustained use and renewal, and scale, are therefore an operational translation for enterprise retail deployment. They are not taken directly from Rogers.

Dynamic capabilities are used as a bounded internal readiness layer. They help assess whether MOOS can execute and adapt a chosen ecosystem position when partner conditions, interfaces, and complements change (Teece, 2007). This layer remains subordinate to ecosystem-as-structure. It does not replace the external ecosystem diagnosis, but adds a feasibility check for the positioning options developed later (Warner & Wäger, 2019).

The contribution of this chapter is not a new ecosystem theory. It is a focused operationalisation of ecosystem-as-structure for a retail execution value proposition. Conceptually, it translates the ecosystem grammar of focal value proposition, activities, actors, positions, links, and alignment into a diagnostic framework for actionable shelf insight (Adner, 2017). Methodologically, it turns that grammar into categories that can guide sampling, interview questions, and coding. Practically, it prepares a way to compare positioning options for a component provider whose value depends on actors and systems beyond its direct control.

The specific contribution lies in the link-level focus. Rather than treating alignment only as a general ecosystem condition, this thesis examines whether critical links between actor positions are technically, data-wise, operationally, and institutionally workable. Co-innovation risk and adoption-chain risk are attached to those same links, so that breakdowns can be located in complements, interfaces, gate decisions, store routines, or scaling conditions. Internal readiness is added only as a bounded feasibility layer.

3.2 Core building blocks from the "ecosystem-as-structure" and related literature

3.2.1 Focal value proposition

Having selected ecosystem-as-structure as the core lens, this section defines the building blocks used throughout the framework: focal value proposition, activities, actors, positions, links, and alignment (Adner, 2017). These concepts are not used as a general vocabulary list. They are used to explain how actionable shelf insight can be analysed as a value proposition that depends on several linked activities and actor roles. The section also introduces bottlenecks, complementarities, and substitution as diagnostic concepts that help explain where the ecosystem may fail or where alternative routes to the same value outcome may exist.

In an "ecosystem-as-structure" view, an ecosystem is defined relative to a focal value proposition (Adner, 2017). The focal value proposition specifies the value that is to be realised for an end beneficiary, and it acts as the reference point for identifying which activities and actors are structurally required (Adner, 2017). This implies that the same industry can contain multiple ecosystems, because different value propositions imply different activity structures, different dependencies, and different alignment problems (Adner, 2017).

For this thesis, the focal value proposition is actionable shelf insight. This refers to shelf-condition information that can trigger relevant store decisions or actions through reliable, timely, integrated, and accountable execution. Accuracy can strengthen actionability, but value realisation depends mainly on whether the information can be used in the relevant workflow. This value proposition is grounded in a known retail execution problem: information in retail systems can diverge from physical shelf conditions, which can increase both cost and OOS levels (Fleisch & Tellkamp, 2005). Because inventory records are often inaccurate in practice, actionable shelf insight targets an execution gap where better detection and response can improve availability and performance (Rekik et al., 2019).

Because the ecosystem configuration may differ by operational objective, this thesis treats actionable shelf insight as relevant to two use-case variants: OOS reduction and loss-prevention. These variants are not separate research projects, but they serve as boundary checks for whether the same ecosystem logic holds under different store execution goals.

3.2.2 Activity structure

Activities are the tasks that must be performed to realise the focal value proposition (Adner, 2017). The key analytical move in the ecosystem-as-structure lens is to describe an ecosystem as an activity configuration that must come together, rather than as a list of firms or a focal platform with a vague periphery (Adner, 2017). The activity structure functions as a blueprint, which specifies what needs to happen, in what sequence, and with what dependencies, for the value proposition to materialise (Adner, 2017). This blueprint makes it possible to ask a concrete question in later empirical work, namely, which activity assumptions hold in practice, and where they break down (Adner, 2017).

In the actionable shelf insight setting, the activity structure runs from shelf-event detection to interpretation, routing, decision ownership, store action, and learning. Detecting a shelf event is only the first activity. The signal must also be interpreted, linked to relevant reference data, routed to the right decision owner, and translated into an executable store action. This makes the store context structurally important, because value depends on closing the gap between information and action (Bottani et al., 2017). The activity structure therefore includes both technical activities and organisational activities, which means that better sensing alone is not enough to realise the value proposition (Adner, 2017).

3.2.3 Actors and roles

Actors are the organisations that perform activities within the activity structure (Adner, 2017). Ecosystem membership is not defined by affiliation, for example being part of retail, or being part of technology, but by structural necessity

(Adner, 2017). An actor is part of the ecosystem to the extent that its contribution is required for the focal value proposition to be delivered (Adner, 2017). This framing is useful in a crowded retail technology domain, because it discourages inventorying the entire landscape and instead focuses attention on the minimal set of actors that must align.

Roles follow from what actors do in the activity structure and from the dependencies they create or control (Adner, 2017). In this thesis, actors are therefore not treated as a stakeholder list. They are analysed in terms of whether they perform, enable, block, own, or depend on activities needed for actionable shelf insight. A component provider may perform sensing or signal generation, a systems actor may enable integration into enterprise workflows, and a retailer function may own store execution and performance outcomes. These roles keep the analysis anchored in value creation rather than in vendor categories.

3.2.4 Positions and links

Positions show where actors sit in the activity structure and which activities they are responsible for (Adner, 2017). For this thesis, positions are defined at a level that is detailed enough to locate dependencies and possible failure points, but broad enough to compare alternative roles for MOOS.

Links show where positions depend on each other (Adner, 2017). These links can involve data flows, technical interfaces, approvals, commercial agreements, or operational handovers. They are central to the later analysis because actionable shelf insight can fail at these handover points, even when the sensing component works in isolation.

3.2.5 Alignment and misalignment

Alignment is the condition that the activities in the ecosystem can be performed as assumed in the blueprint, at a sufficient level of performance, and with coordinated expectations across actors (Adner, 2017).

Misalignment occurs when an assumed activity or dependency cannot be performed, or cannot be performed reliably, which prevents value realisation even if the focal technology itself is technically strong (Adner, 2017). This makes alignment a central construct for diagnosing why pilots stall, rollouts underdeliver, or solutions fail to sustain use in stores.

To support diagnosis in interviews and coding, alignment is decomposed into four related conditions that can be observed empirically. This decomposition is used as an analytic device to operationalise Adner's alignment construct in a retail technology context (Adner, 2017).

Technical alignment concerns whether systems and interfaces can connect and operate reliably across organisational boundaries.

Data alignment concerns whether data definitions, identifiers, and governance rules allow information to be interpreted and used consistently across actors.

Operational alignment concerns whether information outputs can be translated into routines, task ownership, and execution in the store context, which is often difficult when digital transformation requires changes in processes and organisational arrangements (Vial, 2019).

Incentive alignment concerns whether the actors who must invest effort or accept change also perceive value, and whether concerns such as privacy and shopper attitudes create constraints on adoption choices (Inman & Nikolova, 2017).

3.2.6 Bottlenecks, complementarities, and substitution

Bottlenecks are positions or links that constrain the ecosystem's ability to realise the focal value proposition (Adner, 2017). In this thesis, bottlenecks matter because actionable shelf insight can fail at specific handovers, for example when a signal is available but cannot be integrated, routed, owned, or acted upon. Bottlenecks therefore help identify where the action chain may break down.

Complementarities explain why MOOS may need partners. Even when the sensing component works, value may still depend on complementary systems, data access, workflow tools, store routines, or governance arrangements (Adner & Kapoor, 2010).

Substitution explains why alternative routes may solve part of the same shelf visibility problem through different activity structures, such as camera-based systems, ESLs, RFID, or POS based inference. These concepts help compare possible routes to actionable shelf insight without assuming in advance that MOOS should own the full solution.

3.3 Operationalising the lens: risks, bottlenecks, and internal readiness

Section 3.2 defined the core ecosystem grammar for this thesis. The next step is to make that grammar usable for empirical analysis. This section explains how alignment, co-innovation risk, adoption-chain risk, bottlenecks, points of influence, and internal readiness are used as diagnostic layers. These layers do not replace ecosystem-as-structure. They specify what must be examined when the framework is applied to interviews, coding, and later positioning synthesis.

3.3.1 Alignment conditions in enterprise retail settings

The focal value proposition of actionable shelf insight is operational in nature because it connects information about shelf conditions to store execution and performance outcomes. This has implications for what alignment means in practice. In enterprise retailers, technology change is often constrained by existing architectures, governance, and routines, which makes the problem less about technical feasibility in isolation and more about coordinated change across organisational units (Vial, 2019). Omnichannel settings further increase this complexity because they create dependencies between store operations, supply chain decision-making, and shared data infrastructure (Ishfaq et al., 2022).

Inventory inaccuracy and out OOS events illustrate why alignment cannot be reduced to one technical interface. In retail supply chains, discrepancies between physical inventory and system records can materially affect cost and availability, even when information systems are in place (Fleisch & Tellkamp, 2005). Evidence on inventory inaccuracy also suggests that performance losses are not explained by a single technical failure but by a wider set of process and data conditions that must hold consistently across the store system (Rekik et al., 2019). Field evidence also suggests that improving visibility through technologies such as RFID can reduce inventory record inaccuracy under certain conditions, which indicates that benefits depend on how data collection and operational routines are connected (Hardgrave et al., 2013). These findings motivate an alignment concept that spans both information flows and execution flows.

To make alignment observable in the empirical work, the four dimensions introduced in Section 3.2.5 are applied to each critical link in the ecosystem structure: **technical alignment, data alignment, operational alignment, and incentive** and **governance alignment**.

Together, these dimensions assess whether the required links can work across systems, data definitions, routines, ownership structures, and incentives. In the actionable shelf insight setting, this also includes constraints around acceptable sensing and data practices, because shopper attitudes and privacy concerns may shape what retailers are willing to deploy (Inman & Nikolova, 2017).

3.3.2 Co-innovation risk as complement maturity and integration readiness

Co-innovation risk refers to the risk that a focal offering cannot deliver value because required complements are not ready or not sufficiently integrated (Adner & Kapoor, 2010). In the context of actionable shelf insight, the focal offering is not a single product but a capability that depends on a set of complements, such as sensing hardware, connectivity, data pipelines, analytics, and the operational mechanisms that turn insights into action. The ecosystem lens implies that the focal offering can be technically sound while still failing, if the required complements lag behind or remain uncoordinated (Adner, 2017).

Two mechanisms are particularly relevant for operationalising co-innovation risk in this thesis.

Complement maturity captures whether the complementary components are stable, validated, and deployable under retailer constraints (Adner & Kapoor, 2010).

Integration readiness captures whether the interfaces and dependencies between components are sufficiently specified and supported to enable reliable end-to-end performance (Adner, 2017).

This distinction matters because a complement can be mature in isolation yet still create risk if the integration effort is underestimated, for example, due to data semantics, identity resolution, or operational edge cases that only emerge in stores (Vial, 2019).

In the empirical work, co-innovation risk will therefore be coded at the level of specific links in

the activity chain. This makes it possible to identify whether failure points are driven primarily by missing complements, immature complements, or integration challenges between otherwise mature components (Adner & Kapoor, 2010). It also supports a more concrete discussion of positioning options, because different ecosystem positions expose MOOS to different portfolios of complement dependencies (Adner, 2017).

3.3.3 Adoption-chain-risk as staged, multiple gate progression

Adoption-chain risk refers to the risk that value cannot be realised because several actors must adopt, approve, integrate, maintain, or use the solution before the focal value proposition can be delivered (Adner & Kapoor, 2010). This is not treated as a consumer diffusion problem. Diffusion theory is used only as background logic for understanding adoption as staged progression under uncertainty (Rogers, 2003). For this thesis, that logic is translated into five enterprise retail gates: pilot, rollout decision, store execution and routinised use, sustained use and renewal, and scale. These gates are an analytical device for this study, not a staging directly taken from Rogers.

In the empirical work, adoption-chain risk is analysed in relation to positions and links in the ecosystem structure. The aim is to identify where progression stalls, which actor role functions as gate owner, and which link-level misalignments explain failure to move from one gate to the next.

For operationalisation, the five gates are used to identify where progression stalls, which actor role functions as gate owner, and which link-level misalignments explain the breakdown. Adoption-chain risk is therefore analysed in relation to positions and links in the ecosystem structure. It is not treated as a separate adoption model.

3.3.4 Bottlenecks and leverage points through structure, centrality, and governance

Bottlenecks, within the ecosystem-as-structure view, are points where misalignment in activities, positions, or links prevents the ecosystem from delivering the focal value proposition (Adner, 2017). Bottlenecks are not defined only by where work happens, but by where dependencies concentrate and where failure has the largest downstream impact (Adner, 2017). This motivates the use of structural language to identify leverage points, meaning intervention points where improvements can unlock disproportionate ecosystem performance.

Centrality is a useful structural concept for this purpose, because it characterises which nodes occupy positions that connect many others and can therefore influence coordination outcomes (Freeman, 1979). In ecosystem terms, actors that are central in the relevant activity network often have the ability to set interfaces, standardise practices, or act as intermediaries between otherwise disconnected parties (Freeman, 1979). This does not imply that central actors always create value for all participants, but it does imply that their choices can affect the feasibility of alignment and scaling (Jacobides et al., 2018).

Governance complements this structural view by explaining how participation and value capture are shaped by rules, standards, and decision rights. Ecosystem strategy highlights that value creation and value capture depend on who controls critical interfaces and how complementarities are organised (Jacobides et al., 2018). Platform governance research similarly suggests that rules for access, coordination, and control can shape ecosystem outcomes by influencing partner behaviour and investment incentives (Springer et al., 2025). Together, these perspectives support a practical leverage point logic: leverage points are most credible when they sit at structurally central dependencies and when there is a plausible governance mechanism through which alignment can be enforced or incentivised (Adner, 2017).

Leverage points, for the empirical analysis, will be identified using three criteria. First, the point must be binding for actionable shelf insight, meaning that it constrains value realisation across multiple activities or links (Adner, 2017). Second, the point must have an identifiable actor or small set of actors that can influence it, which can often be approximated through structural centrality and interface ownership (Freeman, 1979). Third, the point must be actionable within realistic governance and capability constraints, which requires attention to incentives and control mechanisms (Jacobides et al., 2018).

3.3.5 Internal readiness as dynamic capabilities for ecosystem execution

Dynamic capabilities are used only as a feasibility overlay. The ecosystem lens explains the external dependencies around actionable shelf insight, while the internal readiness layer asks whether

MOOS can execute and adapt a chosen position within that structure. Dynamic capabilities theory describes this as sensing, seizing, and transforming resources and routines under changing conditions (Teece, 2007). In this thesis, these concepts are used to assess what different ecosystem positions would require from MOOS, not to explain the ecosystem as a whole.

Digital transformation research highlights that capability building is an ongoing process rather than a one-time project, especially when technologies must be integrated into existing routines and architectures (Warner & Wäger, 2019). For early-stage technology ventures, these capability demands can be amplified by resource constraints and by the need to build credibility through pilots and partner-delivered complements (Teixeira et al., 2021). The internal readiness question is therefore not whether MOOS has every capability in-house, but whether it can reliably orchestrate the capabilities required by its chosen ecosystem position (Teece, 2007).

In this thesis, dynamic capabilities are used only as an internal readiness layer. Sensing refers to MOOS' ability to identify relevant bottlenecks, gate owners, partner constraints, and possible points of influence (Teece, 2007). Seizing refers to its ability to turn this understanding into concrete choices about partnerships, integration depth, service delivery, and staged adoption paths (Teixeira et al., 2021). Transforming refers to its ability to adjust the operating model as learning accumulates, for example by standardising interfaces, improving deployment routines, or changing partner roles (Warner & Wäger, 2019). This layer does not explain the ecosystem by itself. It only assesses whether a possible position is executable for MOOS.

Together, these constructs define how the ecosystem lens will be used in the rest of the thesis. Alignment conditions specify what must hold across links. Risk concepts explain where value realisation may break down. Bottlenecks and leverage points help identify where intervention may matter most. Internal readiness specifies what MOOS must be able to execute. Section 3.4 does not introduce new theory. It integrates these elements into a version-one analytical framework for studying actionable shelf insight as an ecosystem-alignment problem.

3.4 Integrated conceptual framework

This section integrates the concepts introduced in Sections 3.1 to 3.3 into one diagnostic framework. The framework is literature-based and intentionally abstract. It does not present empirical findings, nor does it claim that specific bottlenecks, leverage points, or actor relationships have already been confirmed. Its purpose is to make ecosystem positioning conditions diagnosable by showing how actionable shelf insight depends on activity structure, actor positions, links, alignment conditions, ecosystem risks, and internal readiness (Adner, 2017).

The framework separates conceptual structure from research output. It defines how the ecosystem will be analysed, but it does not contain positioning recommendations. Positioning options are developed later from the empirical diagnosis, after activities, links, risks, ownership problems, and internal readiness constraints have been examined.

The framework has three roles in the thesis. First, it works as a diagnostic tool for mapping activities, positions, links, alignment conditions, and ecosystem risks around actionable shelf insight. Second, it provides sensitising concepts for the interview protocol and coding in Chapter 4. Third, it supports the later positioning synthesis in Chapter 6 by making alternative positions comparable in terms of dependencies, risks, leverage points, and internal readiness. Positioning options are therefore not built into the framework itself. They are derived after diagnosis, which helps avoid assuming the answer before the empirical work is conducted.

3.4.1 Framework overview and logic

Figure 3.1 summarises the full diagnostic framework used in this thesis, it should be read from left to right. It starts with the focal value proposition, which sets the ecosystem boundary. It then maps the activity structure needed to realise that value proposition, followed by the actor positions that perform, enable, own, or depend on those activities. The links between positions show where handovers, dependencies, or failure points may occur. Alignment conditions are then applied to these links to assess whether they can work in practice. Co-innovation risk and adoption-chain risk are added as overlays to identify where complements, interfaces, or deployment gates may block value realisation. The final layers identify

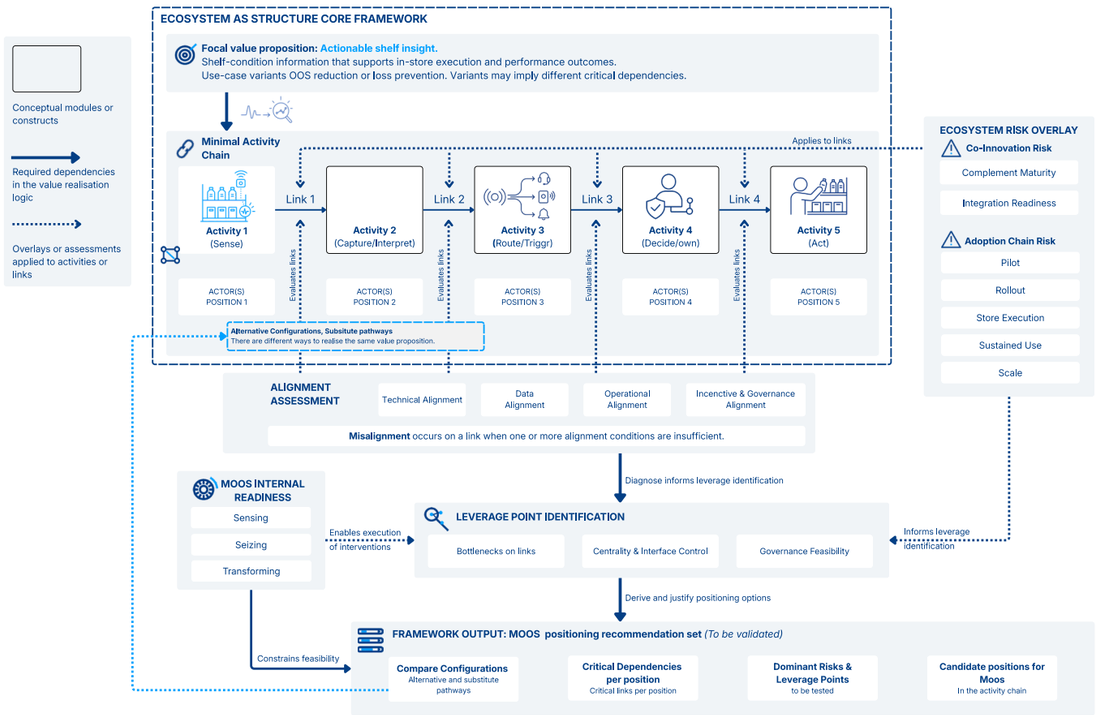


Figure 3.1. Integrated diagnostic framework for actionable shelf insight

bottlenecks, possible points of influence, and MOOS' internal readiness to act on the diagnosed ecosystem conditions.

The notation is deliberately simple. Boxes represent constructs or modules. Solid arrows represent required dependencies in the value-realisation logic. Dotted arrows represent influences or constraints rather than direct activity steps. Overlays represent evaluation lenses that are applied to activities and links. This distinction matters because the framework is not a linear process model. It is a diagnostic structure for analysing whether actionable shelf insight can be realised across actors, systems, interfaces, and routines.

3.4.2 Module 1: Focal value proposition as the boundary condition

The first module anchors the framework around actionable shelf insight: shelf-condition information that is reliable, timely, workflow-integrated, owned, accountable, and able to trigger store action. This keeps the framework focused on operational usefulness rather than sensing accuracy alone. The value proposition is applied to two use-case variants, OOS reduction and LP. These are not separate theoretical models, but boundary checks. OOS is likely to make replenishment routines, inventory data, and store task execution more important. LP is likely to make incident workflows, evidence requirements, point POS data, and video-related systems more important.

Figure 3.2 introduces the focal value proposition used in this thesis. It shows that shelf insight becomes relevant only when shelf information can support timely and accountable store action.

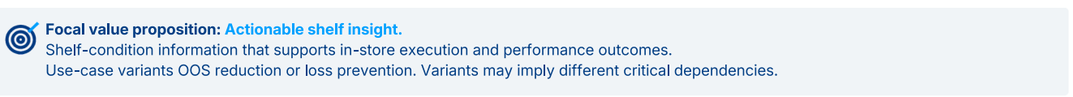


Figure 3.2. Focal value proposition for actionable shelf insight

3.4.3 Module 2: Activity structure, actors, positions, and links

The second module translates the value proposition into a minimal activity structure: sensing, signal capture, processing, decision support, and store action. The framework starts from these activities rather than from a list of companies, because the empirical analysis first needs to identify what must happen before it can assess who should occupy which position.

Generic actor positions are then mapped onto the activities. The links between these positions are the main unit of analysis. They show where one actor depends on another for data, integration, approval, operational handover, or action. This matters because actionable shelf insight may fail at the interface between actors, even when the individual sensing technology works.

Figure 3.3 translates the value proposition into a basic activity chain. It shows the minimum sequence of activities required to move from sensing to action. Added are the actor positions to the activity chain. The figure highlights that value depends not only on activities, but also on the links between the actors responsible for them.

3.4.4 Module 3: Alignment assessment across links

The third module applies alignment conditions to the links between positions. The four dimensions introduced earlier, technical alignment, data alignment, operational alignment, and incentive and governance alignment, are used as practical diagnostic categories. They ask whether systems can connect, whether information can be interpreted and shared, whether outputs fit store routines, and whether actors have the authority and motivation to make the link work. In Chapter 4, these dimensions become sensitising concepts for interview questions and coding.

Figure 3.4 shows the alignment conditions used to assess whether links between actors can work in practice. These conditions are technical, data-related, operational, and governance-related.

3.4.5 Module 4: Risk overlay with co-innovation risk and adoption-chain-risk

The fourth module adds ecosystem risk to the activity and link structure. Co-innovation risk is used to examine whether required complements are mature and sufficiently integrated for actionable shelf insight to work beyond a controlled pilot (Adner & Kapoor, 2010). Adoption-chain risk is used to examine whether progression from pilot to scale breaks down because different actors must approve, implement, use, renew, or expand the solution at different stages (Adner & Kapoor, 2010).

In this framework, both risks are treated as overlays on the same activity and link structure. They are not separate theories running beside the framework. Co-innovation risk focuses on complement maturity and integration readiness. Adoption-chain risk focuses on the five enterprise retail gates used in this thesis: pilot, rollout

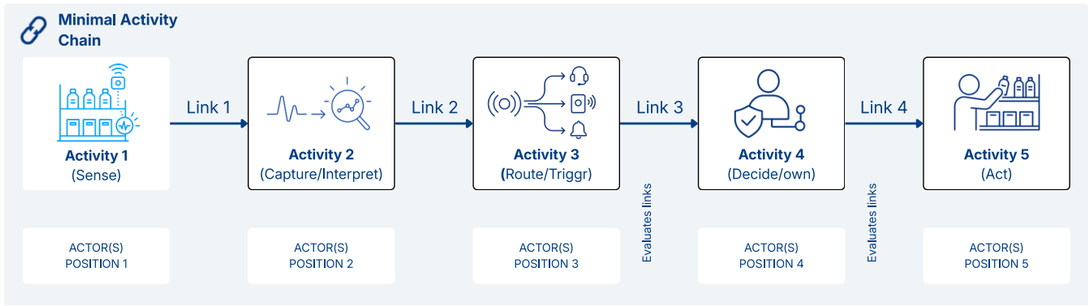


Figure 3.3. Basic activity chain from shelf sensing to store action and actor positions and dependency links in the activity chain



Figure 3.4. Alignment conditions for actionable shelf insight

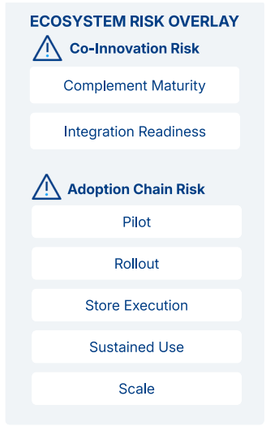


Figure 3.5. Ecosystem risks across complements and adoption gates

decision, store execution and routinised use, sustained use and renewal, and scale. This gate structure is an analytical device for this study, informed by diffusion logic, not a staging directly taken from Rogers (2003).

Figure 3.5 adds the two ecosystem risk lenses used in this thesis. Co-innovation risk concerns required complements, while adoption-chain risk concerns the actors and gates needed for use and scale.

3.4.6 Module 5: Bottlenecks and leverage points with governance feasibility

The fifth module uses the link diagnosis to identify bottlenecks and possible leverage points. A bottleneck is a position or link that constrains actionable shelf insight. A leverage point is a bottleneck or dependency where action could improve the wider ecosystem logic.

A possible leverage point is only treated as meaningful when three conditions are met. It must be binding for value realisation, it must have an identifiable actor or small group of actors that can influence it, and it must be addressable through plausible governance, partnership, or capability mechanisms. This prevents the later analysis from treating every issue as equally strategic.

Figure 3.6 shows how bottlenecks and leverage points are identified. A point of influence is only meaningful when it constrains value realisation and can plausibly be addressed by one or more actors.

The core theoretical lens of this study is ecosystem-as-structure. It is used to define the focal value proposition, map the activity structure, identify actor positions, and analyse the links that must align for actionable shelf insight to be realised (Adner, 2017). This lens provides the structural logic of the thesis. It explains where dependencies are located and why misalignment between actors can prevent value realisation, even when the sensing component performs adequately in isolation.

3.4.7 Module 6: Internal readiness through dynamic capabilities

The sixth module adds MOOS' internal readiness as a feasibility layer. This is included because ecosystem positioning is not only about where MOOS could sit in the activity structure. It is also about whether MOOS can execute and sustain that position. Dynamic capabilities are used in a limited way through sensing, seizing, and transforming (Teece, 2007).

In this framework, sensing refers to MOOS' ability to understand bottlenecks, gate owners, and partner constraints. Seizing refers to its ability to make choices about partnerships, integration depth, and adoption pathways. Transforming refers to its ability to adapt its operating model as learning accumulates. Internal readiness is therefore not a second research question. It is a feasibility constraint that becomes important in Chapter 6, where positioning options are translated into roadmap logic.

Figure 3.7 adds MOOS' internal readiness. This layer is used to assess whether MOOS can sense ecosystem conditions, make positioning choices, and adapt its capabilities over time.

Figure 3.8 summarises the diagnostic outputs that are carried forward into the design phase. These outputs include candidate positions, critical links, risks, bottlenecks, and alternative pathways

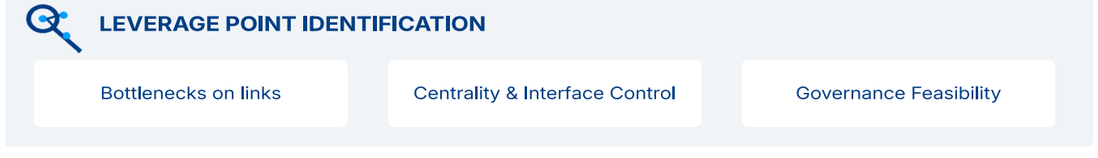


Figure 3.6. Bottlenecks and possible leverage points in the ecosystem structure



Figure 3.7. Internal readiness as a feasibility layer for MOOS

3.4.8 Using the framework for empirical work and positioning option synthesis

The framework guides the empirical work in three ways. In Chapter 4, the activity structure and actor positions inform sampling, because the interviews need to cover roles that are structurally relevant to actionable shelf insight. The alignment dimensions and risk overlays inform the interview guide and coding scheme, because each critical link can be examined in terms of technical, data, operational, incentive and governance alignment, co-innovation risk, and adoption-chain risk.

In Chapter 5, the same framework structures the empirical findings. Store-level evidence shows which actionability conditions matter in practice, while expert interviews show where link-level dependencies, bottlenecks, risk patterns, and ownership problems appear across actor positions. The framework is therefore not only a summary of Chapter 3. It is the analytical structure used to interpret the empirical material.

In Chapter 6, the framework supports positioning synthesis. It does not produce positioning options by itself. This separation matters because positioning should be an output of diagnosis, not an assumption built into the framework. Possible positions for MOOS are therefore derived after the empirical analysis by comparing roles in the activity structure, critical dependencies, alignment exposure, risk patterns, points of influence, and internal readiness. Chapter 4 explains how this framework is translated into the research design, interview protocol, and analysis approach.



Figure 3.8. Diagnostic outputs for positioning synthesis

Chapter 4

Methodology

4.1 Case context and use-case focus
4.2 Research process overview
4.3 Data collection Part 1: structured in-store visits with ranking exercise
4.4 Data collection Part 2: semi-structured expert interviews
4.5 Ethics, consent, and confidentiality
4.6 Data preparation
4.7 Data analysis
4.8 Synthesis of Part 1 and Part 2
4.9 AI-assisted analysis support
4.10 Co-creation as part of the design process
4.11 Validation logic
4.12 Methodological limitations

This chapter explains how the research was carried out. It shows how the conceptual framework from Chapter 3 was used to guide data collection, analysis, synthesis, design translation, and validation. The chapter does not present the findings themselves. These are discussed in Chapter 5.

The methodology followed a qualitative and exploratory logic. This fit the research question because MOOS's positioning problem is not only about the technical performance of shelf sensing. The value of shelf sensing depends on whether shelf events can be turned into trusted, timely, workflow-connected and accountable store action. This requires insight into store routines, actor roles, system links, partner dependencies, and adoption barriers.

The empirical work was structured in two connected parts. Part 1 focused on store-level adoption thresholds through 41 structured in-store visits with a ranking exercise and short contextual conversations. Part 2 focused on ecosystem-level conditions through eight semi-structured expert interviews. The two datasets were first analysed separately and then brought together through the conceptual framework. This sequence helped keep point-of-use requirements separate from wider ecosystem conditions before comparing them.

4.1 Case context and use-case focus

MOOS develops shelf-sensing technology that detects shelf events and converts them into signals and insights for retail operations. In this thesis, the value proposition is examined through two main use cases. The first concerns on-shelf availability and OOS situations. The second concerns theft, LP, and shrink. These use cases are related because both start from shelf-level visibility, but they do not necessarily follow the same route from signal to action.

This distinction shaped the empirical design. OOS signals usually connect to replenishment, inventory accuracy, ordering, and store execution routines. Theft-related signals often require faster response, different accountability, and a stronger link to LP or security processes. For that reason, the research did not assume that one positioning route would fit both use cases equally well. Both use cases were kept visible during data collection and analysis, so that differences in timing, ownership, integration, and partner dependency could be studied rather than hidden inside one broad shelf sensing category.

The case context also affected the level of analysis. MOOS is not treated as a retailer, a full store operating system, or a general retail platform. It is treated as a component provider that may need to connect with other actors to make its value proposition work at scale. This makes the case useful for studying positioning from the perspective of a smaller technology firm that depends on other actors for adoption and value delivery.

4.2 Research process overview

The research process combined a literature-informed framework, two empirical parts, a synthesis step, a co-creation step, design development, and conducted validation. The literature review first led to a version-one diagnostic framework. This framework was not used as a fixed model that had to be confirmed. It was used as an analytical lens for the empirical work. It helped define what needed to be examined: the focal value proposition, the activity chain, actor positions, links between actors, alignment conditions, ecosystem risks, and internal readiness.

This research design followed a qualitative and exploratory logic. This was appropriate because MOOS's positioning problem is not only a product question. It is an ecosystem question. Shelf sensing only becomes valuable when signals lead to action through store routines, systems, partners, and accountable actors. A design that only studied the sensor, or only studied store users, would have missed these dependencies. The multi-actor design made it possible to compare the point-of-use logic in stores with the wider system logic needed to make store action possible at scale.

The empirical phase started with structured in-store visits. These visits were used to identify store-level adoption requirements through a ranking exercise and short contextual conversations. After that, semi-structured expert interviews were conducted to examine ecosystem-level conditions around feasibility, integration, accountability, adoption gates, and partner routes. The two datasets were first analysed separately. They were then brought together in synthesis to identify where store-level needs and ecosystem-level conditions reinforced each other, and where tensions appeared.

This sequence was chosen deliberately. Part 1 showed what store teams appeared to require before shelf sensing becomes useful in daily work. Part 2 examined what actors, systems, governance arrangements, and integration choices are needed to deliver those requirements across stores and partners. Keeping these two levels separate at first helped avoid an early collapse of store logic into ecosystem logic. Only after this separation were the two datasets compared through the conceptual framework.

The synthesis formed the bridge to the design phase. It did not yet produce the final roadmap. Instead, it translated the empirical findings into design inputs, including adoption thresholds, activity-chain gaps, actor dependencies, and positioning tensions. After this synthesis, a co-creation session was used as a research-based design intervention. This session helped discuss the implications of the findings and explore possible positioning directions. The final roadmap was then developed and later validated. The validation was conducted after the design phase and is described in Chapter 7.

Figure 4.1 shows how the methodology moved from the conceptual framework to empirical data collection, separate analysis, synthesis, design translation, and validation. This sequence matters because the thesis first diagnoses the ecosystem problem before developing and testing the roadmap.

4.3 Data collection Part 1: structured in-store visits with ranking exercise

The first empirical part consisted of structured in-store visits with 41 store operators and store managers. The visits were conducted over approximately two weeks in the Netherlands. The geographical scope included Amsterdam and three rural villages. This created variation between urban and less urban retail settings, although the sample remained limited to stores that could be reached within the available time.

Part 1 was designed to identify store-level adoption requirements for shelf-sensing technology. The aim was practical and focused. It was not an ethnographic study and it was not a field experiment. A more accurate description is structured in-store visits with a ranking exercise and short contextual conversations. During the visits, attention was paid to visible shelf processes, store routines, and practical issues around theft, shrink, out-of-stock situations, and replenishment. These observations helped interpret the responses, but the ranking exercise was the primary structured data source.

Respondents were asked to rank eight possible adoption conditions from 1 to 8, where 1 meant most important and 8 meant least important. The eight conditions were: reliable and trustworthy signals, fast enough to act upon, no additional operational burden, works with existing store technology, low effort to keep running, fits current ways of working, clear ownership, and hardly visible in the store. Respondents did not select use cases in a formal coded task. They ranked adoption conditions and sometimes explained their choices through short examples. When theft or OOS situations were discussed, these were treated as contextual explanations rather than as closed-choice use-case data. The question list used during the store visits is provided in Appendix C.2.

The ranking exercise was recorded on prepared paper field sheets. These sheets also included space for store descriptors and short notes. The same field sheet was used across visits to keep the exercise comparable. The full instrument **will** be included in the appendix, because the exact

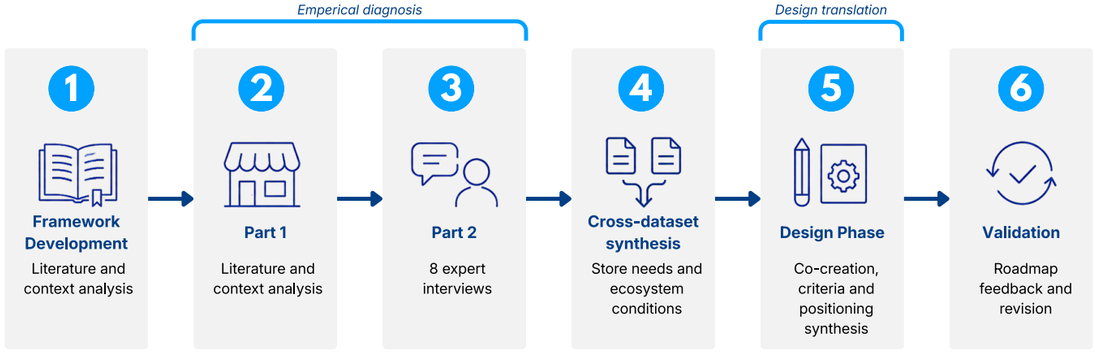


Figure 4.1. Research process overview from framework development to conducted validation.

wording of the ranking labels matters for interpreting the results. Short comments were written down when respondents explained why they ranked certain conditions high or low. These comments were not analysed as a full qualitative interview dataset. They were used as contextual support for interpreting the ranking patterns.

The sampling strategy was purposive and partly opportunistic. Stores were approached directly, and the acceptance rate was roughly one in three or one in four stores. The aim was not statistical representation. The aim was to create useful variation across relevant store contexts and to identify practical thresholds for store-level adoption. The sample included supermarkets, drugstores, and health and beauty stores. It also included variation between branch-managed and franchise-like settings. A further distinction was made between lower-tech and higher-tech stores. This label was based on the researcher's in-store impression, the respondent's explanation, and the visible use of store technology. It should be read as an interpretive classification, not as a formal technology audit.

The value of Part 1 lies in its point-of-use perspective. The ranking exercise forced respondents to prioritise between adoption conditions instead of treating every condition as equally important. With 41 visits, the dataset was useful for exploratory store-level threshold identification. It helped show which conditions store teams appeared to treat as basic requirements, and which issues seemed less immediate in daily work. The dataset does not support statistical claims about all retail stores. It supports an exploratory diagnosis of what store teams may require before shelf sensing becomes acceptable in daily practice. The store visit protocol, question list, and full store visit result material are provided in Appendix C.

4.4 Data collection Part 2: semi-structured expert interviews

The second empirical part consisted of eight semi-structured expert interviews. These interviews were conducted over approximately one week. All interviews took place online through Microsoft Teams. The respondents were purposively selected to cover different positions in the retail and retail technology ecosystem around shelf sensing.

The sample was designed for analytical ecosystem diagnosis, not for statistical representation. Eight interviews were acceptable for this purpose because the aim was to compare role-based perspectives on the main dependencies around shelf sensing. The interviews were not used to measure how common a view is across the retail market. They were used to understand how different actors reason about feasibility, integration, accountability, adoption gates, and partner routes. For this thesis, the spread of actor perspectives was more important than the number of interviews alone.

The interview set included perspectives from retail or head office, store innovation or Group IT, consultants or system integrators, shelf or display infrastructure, and technology or platform-side actors. These clusters were relevant because each controls or influences a different part of the route from shelf signal to store action. Retail actors can explain operational priorities and internal decision-making. IT and innovation actors can explain system fit, data governance, and security constraints. Integrators can explain rollout and implementation barriers. Shelf and display infrastructure actors can explain the physical store layer. Technology and platform actors can explain how shelf signals may connect to other store systems. The interview protocol, participant overview, and consent material are provided in Appendix D.

Table 4.1 gives an anonymised overview of the actor perspectives included in the expert interviews. The table is not meant to show a representative sample of the retail market. It shows which actor positions were covered and which positions were less visible in the dataset.

The sample also had limits. Procurement, legal, privacy, large enterprise software vendors, and some logistics or supply chain roles were less visible or absent. This means the interviews give analytical insight into the main dependencies around shelf sensing, but they do not cover the full buying centre of every retailer. This limitation is returned to in the discussion chapter.

Part 2 was used to understand ecosystem-level feasibility. While Part 1 focused on what stores require, Part 2 examined what is needed to make those requirements possible across multiple stores, partners, and systems. The interviews explored shelf-related retail problems, what makes shelf information actionable, the minimum activity chain from signal to action, adoption gates, accountability, ownership, deep versus light integration, partner routes, and differences between theft and OOS use cases. The interviews also asked who controls scaling decisions in the retail ecosystem and what an early focus for MOOS could look like.

The interview guide was semi-structured. It was informed by the conceptual framework from Chapter 3, so the interviews were not fully inductive. Questions were linked to concepts such as ecosystem structure, activity alignment, adoption-chain risk, co-innovation risk, and internal readiness. At the same time, the guide left room for examples, disagreement, and unexpected patterns. This balance was important. The interviews were not meant to confirm the framework narrowly. They were meant to test, sharpen, and specify it through expert experience.

Included actor perspective	*Role in ecosystem diagnosis*	*Less visible or missing perspectives*	*Implication for limitations*
Retail or head-office perspective	Explains retail priorities, internal decision-making and adoption logic.	Store staff were covered mainly in Part 1, not in Part 2.	Part 2 gives a broader organisational view, not a second store-level dataset.
Store innovation or Group IT	Explains system fit, data governance, security and integration constraints.	Legal and privacy roles were not directly represented.	Privacy and compliance findings should be treated as expert reflections, not legal assessment.
Consultants or system integrators	Explains rollout barriers, integration work and implementation risk.	Large enterprise software vendors were less visible.	The analysis may underrepresent the logic of major platform owners.
Shelf, display or store infrastructure actors	Explains the physical store layer and deployment conditions.	Logistics and supply chain actors were less visible.	Backend replenishment and supply chain closure may need further validation.
Technology or platform-side actors	Explains possible connections between shelf signals and store systems.	Procurement roles were not directly represented.	Buying-centre logic is discussed, but not fully mapped from a procurement perspective.

Table 4.1. Actor perspectives included and less visible in the expert interview sample.

4.5 Ethics, consent, and confidentiality

Ethical care was part of both empirical parts, although the procedure differed between Part 1 and Part 2. In Part 1, a simplified form of consent was used. The store visits were short, practical, and often took place during store opening hours. For that setting, a shorter yes-or-no consent procedure was used. Respondents were informed about the purpose of the research and could refuse or stop at any moment.

Part 2 used a more extended consent form. This included consent for audio recording, transcription, anonymised analysis, and the use of anonymised quotes in the thesis. The interviews were longer and included more detailed professional reflections, so a more thorough consent procedure was appropriate.

In both parts, participation was voluntary. Names of respondents and identifying store details were not used in the analysis. Respondents were referred to through codes. The data were stored on a protected TU Delft drive, with access limited to the researcher. This was important because some interview material touched on partner relations, internal decision processes, and adoption barriers that could be sensitive in a business context.

The approved project brief and the Human Research Ethics Committee approval are included in Appendix A. The interview consent form template is included in Appendix D.3.

4.6 Data preparation

The Part 1 material was prepared as a structured ranking dataset. The paper field sheets were used to record the rankings, store descriptors, and short comments. After the visits, the data were transferred into a spreadsheet format. This made it possible to compare average ranking patterns, top-ranked conditions, bottom-ranked conditions, and segment differences. Store descriptors were used to compare patterns between, for example, supermarkets and drugstores, branch-managed and franchise-like stores, and lower-tech and higher-tech stores.

The open comments from Part 1 were handled carefully. They were not coded as a full qualitative dataset. Instead, they were used to support the interpretation of the ranking results. For example, when a respondent explained why reliable signals mattered, that comment helped clarify the meaning

behind the ranking. The comments were therefore used as contextual evidence, not as the main basis for theme development.

For Part 2, the interviews were recorded in Microsoft Teams. Transcripts were produced using a combination of Microsoft Teams transcription and Google transcription support. The transcripts were then reviewed and anonymised before analysis. They became the primary material for the expert interview analysis. Audio recordings were checked selectively when tone, hesitation, certainty, or emphasis seemed relevant. This was useful because some answers, especially around integration, ownership, or partner dependency, were not only factual. They also expressed uncertainty, caution, or strategic judgement. The data preparation process, cleaning rules, codebook, interview-code overview, and theme development material are provided in Appendix E.

4.7 Data analysis

The analysis moved from structured comparison to theme development. Part 1 and Part 2 were analysed separately first. This separation was important because the two parts answered different questions. Part 1 showed which adoption conditions store respondents prioritised and how they explained these choices in daily store terms. Part 2 showed what ecosystem actors saw as necessary for delivery, adoption, integration, and scaling.

For Part 1, the first step was descriptive analysis of the ranking data. The rankings across all 41 responses were compared to identify which adoption conditions were most and least important overall. After that, segment comparisons were made. These comparisons looked at differences between store formats and organisational types, such as supermarket versus drugstore, branch-managed versus franchise-like, and lower-tech versus higher-tech stores. The final step was interpretive. The ranking patterns were translated into store-level adoption requirements, practical thresholds, and possible rejection triggers.

The Part 1 analysis remained modest in scope. It did not claim to measure adoption statistically. The sample size and sampling method do not support that kind of claim. Instead, the ranking exercise was used to make trade-offs visible. Asking respondents to rank the conditions forced them to prioritise between requirements rather than simply agree that all conditions were important. The short comments were used to clarify the meaning behind the rankings, not to build a separate thematic model.

For Part 2, the analysis followed a step-by-step process. It started with familiarisation. The researcher read the transcripts, reviewed the interview notes, and marked recurring issues in the material. Initial codes were then created manually from the transcripts and notes. Some codes came directly from the data, such as reliability, timing, workload, ownership, integration, adoption gates, partner dependency, theft, and OOS. Other codes were informed by the framework in Chapter 3, such as activity chain, actor position, link, alignment, adoption-chain risk, co-innovation risk, and internal readiness.

The framework concepts were used as sensitising concepts. They helped direct attention to actor roles, activities, links, and dependencies, but they were not used as a fixed codebook. This was important because the interviews also needed to capture examples and tensions that were not fully expected before the analysis.

The first comparison was made question by question across all eight interviews. Answers to the same question were placed together and compared. This made it easier to see where respondents agreed, where they differed, and where differences seemed linked to their ecosystem role. After this comparison, the interviews were checked again as individual cases. This case-level check helped protect the internal logic of each respondent's explanation.

Initial codes were then grouped into broader categories, including signal reliability, workflow actionability, integration depth, accountability, adoption gates, partner routes, and use-case differences. These categories were refined into higher-level themes. Some early themes were split because they covered too many issues. Others were merged because they described the same pattern from different angles.

The final themes were checked against the original notes and transcripts before being used in Chapter 5. When a theme could not be supported clearly by the source material, it was narrowed, renamed, or removed. This helped keep the findings close to the data and reduced the risk of forcing the interviews into the framework.

4.8 Synthesis of Part 1 and Part 2

Part 1 and Part 2 were synthesised only after they had been analysed separately. This sequence was important. It prevented store-level requirements from being absorbed too quickly into ecosystem-level interpretation, and it kept point-of-use actionability analytically separate from scale feasibility. The synthesis then compared the two levels of evidence through the conceptual framework from Chapter 3.

The synthesis focused on two questions. First, where did the expert interviews help explain or support the store-level thresholds from Part 1? Second, where did the expert interviews show that a store-level requirement would be difficult to deliver across the wider ecosystem? This kept the synthesis close to the research question without turning it into a new data collection step.

The comparison was made through the conceptual framework from Chapter 3. Store-level requirements from Part 1 were compared with activity chains, actor roles, links, alignment conditions, adoption gates, and use-case differences from Part 2. This made it possible to translate point-of-use requirements into ecosystem-level conditions.

The synthesis was therefore not a simple combination of two datasets. It compared two levels of the same positioning problem. Part 1 showed what store teams appeared to require. Part 2 explained what the wider retail system would need to organise to deliver those requirements. Together, the two parts formed the empirical basis for the design phase by identifying adoption thresholds, bottlenecks, actor dependencies, and positioning tensions.

4.9 AI-assisted analysis support

NotebookLM was used as a supporting tool during the analysis. Its role was limited to organising material, summarising sources, comparing passages, and retrieving relevant excerpts. It was not used as an autonomous coder. It did not create the final code structure, define final themes, interpret the findings, select evidence, or decide design directions.

For Part 2, anonymised transcripts, the interview guide, and relevant analytical notes were uploaded to NotebookLM. The tool helped create structured summaries of each interview, including the respondent's role, main claims, examples, bottlenecks, integration logic, and references to theft or OOS. These summaries made the material easier to navigate, but they were checked against the transcripts before being used.

NotebookLM was also used to support cross-interview comparison. For each interview question, it helped retrieve relevant answers across respondents and place related passages next to each other. The researcher then compared these passages manually to identify patterns, differences, and role-based explanations. After that, the interviews were checked again as whole cases to avoid losing the internal logic of each respondent.

During theme development, NotebookLM helped retrieve supporting excerpts around topics such as shelf visibility, store execution, buying centre fragmentation, integration choices, and partner routes. These excerpts were not accepted automatically. They were checked against the transcripts and notes before being used. During synthesis, NotebookLM helped organise material related to Part 1 store priorities and Part 2 ecosystem conditions, but the synthesis choices were made by the researcher.

The researcher remained responsible for the analysis. The researcher created and refined the codes, grouped them into categories, named the themes, interpreted contradictions, selected evidence, and decided how the findings were synthesised. Outputs from NotebookLM were only used after checking them against the original notes and transcripts. This check was needed because AI-generated summaries can overstate patterns, miss context, or simplify disagreement. NotebookLM therefore supported organisation and retrieval, but the analysis itself remained researcher-led.

4.10 Co-creation as part of the design process

After the empirical synthesis, the project moved into a participatory design step. A small co-creation session was included before the final roadmap was developed. This step was used to discuss the implications of the findings with relevant stakeholders and to explore possible positioning directions for MOOS.

Co-creation was treated as part of the design process, not as a third empirical evidence layer. Its

purpose was to work with the findings, not to replace them. The session helped surface strategic trade-offs, possible route choices, and criteria for the roadmap. The final roadmap should therefore not be read as the direct outcome of the co-creation session alone. It was developed from the conceptual framework, Part 1, Part 2, the synthesis, co-creation input, and further design reasoning. The co-creation slide materials are provided in Appendix F.

4.11 Validation logic

Validation was conducted after the design phase. It was not used as a substitute for co-creation. Co-creation helped discuss and shape possible positioning directions before the roadmap was finalised. Validation was later used to assess the roadmap's clarity, relevance, credibility, and usefulness for the intended context.

This sequence fits the logic of the thesis. The empirical parts first generated evidence. The synthesis translated this evidence into design inputs. Co-creation helped discuss these inputs and sharpen the design direction. The design phase then developed the roadmap. After that, validation tested the roadmap logic and informed revisions.

The validation method and findings are described in Chapter 7. In this methodology chapter, the main point is that validation had a different role from the empirical research and co-creation. It did not generate the main diagnosis. It assessed the designed roadmap after it had been developed. The validation slides, validation matrix, and roadmap revision log are provided in Appendix H.

4.12 Methodological limitations

The empirical material should be read as exploratory and analytical rather than statistically representative. The 41 in-store visits helped identify store-level priorities and thresholds, but they do not represent all retail formats. The eight expert interviews gave insight into the main actor dependencies around shelf sensing, but they did not include every actor in the retail buying centre. Some perspectives, such as procurement, legal, privacy, large enterprise software vendors, and logistics, were less visible. These limits do not invalidate the findings, but they define how they should be used. The results are suitable for diagnosing patterns, tensions, and design requirements. They are not suitable for measuring how common these patterns are across the whole retail market. A fuller reflection on these limitations is provided in Chapter 8.6, where the empirical scope, design process, and validation approach are discussed in relation to the overall thesis contribution.

Chapter 5

Results

5.1 Store level findings
5.2 Ecosystem-level findings
5.3 Cross-dataset synthesis
5.4 Framework refinement

5. Results

This chapter presents the empirical results of the study. It first reports the store level findings from the 41 store visits. It then reports the ecosystem level findings from the eight expert interviews. The final sections compare both datasets and use them to refine the diagnostic framework from Chapter 3. The chapter therefore stays close to the evidence. It does not yet choose a final positioning direction for MOOS. The store visit protocol is included in Appendix C.1.

Figure 5.1 shows how the chapter moves from store-level evidence to ecosystem-level evidence, and then to synthesis and framework refinement. The figure is relevant because both datasets are used to build one empirical diagnosis of the positioning problem.

5.1 Store level findings

Before presenting the store-level findings, it is useful to clarify the empirical setting of Part 1. As can be seen in Table 5.1, the store visits covered 41 retail locations in the Netherlands, mainly in Amsterdam and in three smaller villages. The sample included supermarkets, drugstores, and health and beauty stores. It also included variation between branch-managed stores and more franchise-like settings, as well as stores with different levels of visible technology use. This variation was not meant to create a statistically representative sample. Instead, it was used to capture different store contexts in which shelf sensing could become relevant.

Table 5.1 shows the composition of the store visit sample. It is included to clarify the type of store-level evidence behind the ranking results and open responses.

The store visits focused on how store teams understood the possible value of shelf sensing in daily practice. Respondents were asked to rank eight adoption conditions and explain which store problem they most strongly associated with the technology. These rankings and open explanations were then read together. Together, the rankings and open explanations show which conditions store teams treated as most important for daily use.

The findings are presented in five steps. First, the ranking data are used to identify the strongest store-level conditions. Second, reliability, speed, and workload protection are discussed as the main requirements for practical use. Third, the open responses clarify which use cases were most urgent at store level. Fourth, segment differences are reviewed cautiously. Finally, the lower-ranked conditions are considered as possible implementation blind spots.

Table 5.2 shows the average ranking of the eight adoption attributes. Lower average ranks indicate higher priority. The table is used to identify which attributes store respondents treated as the most important conditions for daily use, not to make statistically generalisable claims.

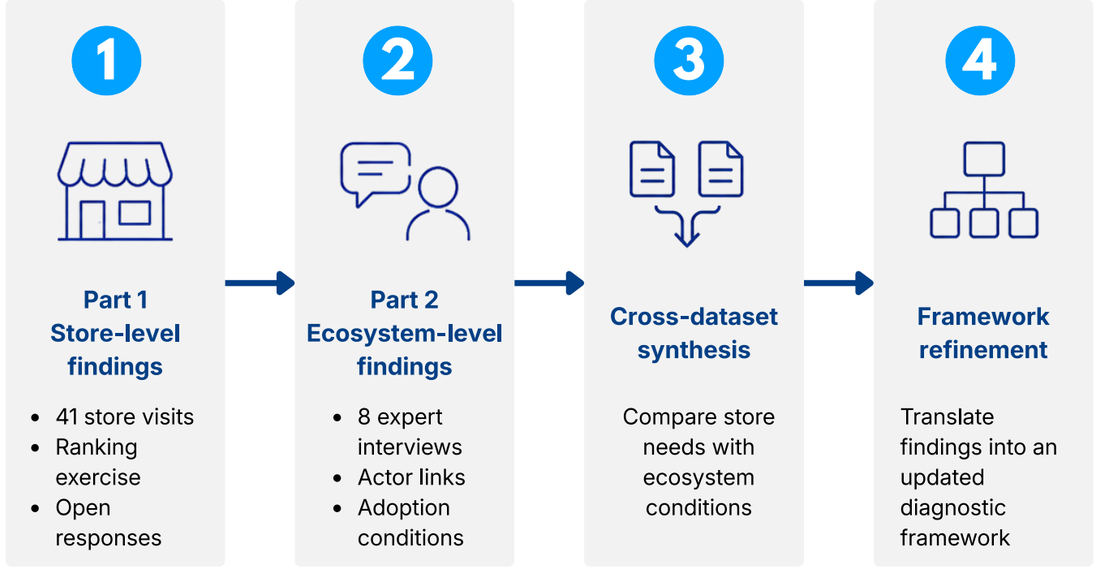


Figure 5.1, Flow diagram: Part 1 store visits → Part 2 expert interviews → cross dataset synthesis → framework refinement.

ID	Store type	Size	Governance	Location	Specialty	Tech level
1	Supermarket	Medium	Branch	Urban	-	High
2	Supermarket	Large	Branch	Urban	Discount	Medium
3	Beauty & Health	Medium	Branch	Urban	-	Medium
4	Drugstore	Medium	Franchise	Urban	-	Medium
5	Supermarket	Medium	Branch	Urban	-	High
6	Drugstore	Medium	Branch	Urban	Discount	Medium
7	Supermarket	Large	Branch	Urban	Discount	Medium
8	Supermarket	Medium	Branch	Urban	Discount	Low
9	Supermarket	Small	Branch	Urban	Discount	Low
10	Drugstore	Small	Branch	Urban	Discount	Medium
11	Supermarket	Medium	Branch	Urban	-	High
12	Supermarket	Small	Branch	Urban	-	High
13	Drugstore	Small	Independent	Urban	-	Low
14	Supermarket	Small	Branch	Urban	To Go	High
15	Beauty & Health	Large	Franchise	Urban	Premium	Medium
16	Drugstore	Small	Franchise	Urban	-	Medium
17	Drugstore	Small	Independent	Urban	-	Low
18	Drugstore	Medium	Branch	Rural	-	Medium
19	Supermarket	Medium	Branch	Rural	-	High
20	Beauty & Health	Medium	Independent	Rural	-	Low
21	Supermarket	Large	Branch	Rural	Discount	Low
22	Supermarket	Medium	Branch	Rural	Discount	Medium
23	Supermarket	Medium	Franchise	Rural	Premium	Medium
24	Supermarket	Large	Branch	Rural	-	High
25	Supermarket	Large	Franchise	Rural	-	High
26	Drugstore	Medium	Branch	Rural	-	Medium
27	Supermarket	Small	Franchise	Urban	To Go	Medium
28	Supermarket	Medium	Branch	Urban	Premium	Medium
29	Supermarket	Small	Branch	Urban	-	High
30	Drugstore	Medium	Branch	Urban	-	Medium
31	Supermarket	Medium	Branch	Urban	Discount	Medium
32	Drugstore	Small	Independent	Urban	-	Low
33	Supermarket	Small	Franchise	Urban	-	High
34	Supermarket	Medium	Branch	Urban	Premium	Medium
35	Supermarket	Medium	Branch	Urban	-	High
36	Beauty & Health	Small	Branch	Urban	Premium	Medium
37	Supermarket	Large	Franchise	Urban	-	High
38	Beauty & Health	Large	Branch	Urban	Premium	Medium
39	Supermarket	Small	Branch	Urban	To Go	High
40	Supermarket	Small	Branch	Urban	-	High
41	Supermarket	Medium	Branch	Urban	Discount	Medium

Table 5.1: overview of the store visit sample, showing store sizes, categories, location types, sample distinctions and tech level.

Overall order	*Charactersitic*	*Avg. Rank*
1	Reliable Signals	2,73
2	Fast enough to react	3,98
3	Low effort to keep it running	4,12
4	Works together with existing store technology	4,27
5	No extra work for staff	4,32
6	Fits in the current way of working	4,73
7	Hardly visible in store	5,88
8	Clear ownership	6,00

Table 5.2 shows the average ranking of eight adoption attributes. Lower average ranks indicate higher priority.

5.1.1 Store adoption follows threshold logic rather than feature preference

As shown in Table 5.2, reliable signals ranked first overall, with an average rank of 2.73. Fast enough to act ranked second, with an average rank of 3.98. Low effort to keep it running, no extra staff work, and works with existing store technology followed after that, with average ranks close to each other. By contrast, hard to notice in store and clear ownership ranked lowest. The exact differences between the middle-ranked attributes should not be overstated. The main pattern is that store teams first prioritised trust in the signal, then timely action, and then low burden in daily work.

The open explanations make this threshold structure easier to understand. Respondents repeatedly described the desired solution in practical terms: it should be trustworthy, quick enough to trigger a useful response, and invisible in terms of extra burden. When that basic test was not met, later benefits did not seem to matter. A system that might improve performance in theory was still viewed negatively if it produced false alerts, required babysitting, or forced staff into an extra workflow.

This pattern gives the first store-level explanation for why shelf sensing may fail in use. A technically useful signal still has to be trusted, timely, and easy to work with in the store routine.

5.1.2 Reliability functions as the main gatekeeper

Reliability is the clearest threshold in the store data. It ranked highest and also shaped how the other attributes should be read. Store staff first need to trust that the signal is correct. If they do not trust the signal, speed, integration, or other benefits become less relevant.

The comments support this strongly. Respondents warned that even minor errors or early "teething problems" could be enough to make the system irrelevant on the shop floor. The issue was not that stores expected perfection in an abstract sense. Rather, they expected the signal to be dependable enough to fit into a busy retail routine without constant doubt. If staff need to second-guess whether an alert is real, the system becomes one more distraction. It no longer reduces uncertainty. It adds it.

That also helps explain why some other attributes ranked lower than might be expected. Store operators seem willing to tolerate a certain amount of visible hardware, some organisational ambiguity, and even some change in process, but only after the reliability threshold has been met. In other words, reliability is not one preference among many. It sits first in the sequence. Other concerns are often postponed until the signal itself has earned trust.

For the store respondents, reliability was therefore practical rather than abstract. The signal had to be dependable enough for staff to act without first checking whether the alert was real.

5.1.3 Speed and workload protection define practical actionability

Speed ranked second, but the comments suggest that stores did not mean generic real-time performance. What mattered was whether the signal arrived early enough for a meaningful response. In theft-related situations, that often meant while the event was still live or while there was still a realistic chance to intervene. In availability-related situations, the time logic was slightly different, but still practical. A late signal was often treated as a missed chance rather than useful information.

Workload protection formed the third part of the threshold structure. Both no extra staff work and low effort to keep it running ranked high, and the

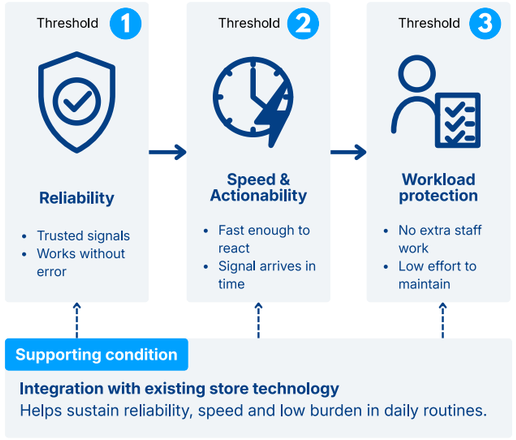


Figure 5.2: Store adoption threshold model, showing reliable signals first, fast enough to act second, and workload protection third.

comments around them were very consistent. Respondents did not want to maintain another device, manage another app, or add another task to an already crowded shift. One store comment summarised this very directly: *"another app is a no go."* That remark captures the broader pattern well. The store team did not reject technology as such. It rejected additional burden that was not clearly absorbed into existing work.

This is also where integration first appears in the store material, but only in a narrow, practical sense. Works with existing store technology was valued because it reduced friction, not because stores were thinking in architectural terms. A system that fits current routines is easier to trust and easier to keep using. A system that depends on separate maintenance, separate devices, or visible supervision quickly starts to look like extra labour.

Figure 5.2 summarises the threshold pattern from the store visits. The figure matters because it shows that store teams did not judge shelf sensing only by the alert itself. They also judged whether the alert could be used without adding work.

5.1.4 The open responses make the use case hierarchy more concrete

The ranking data becomes more meaningful when read alongside the open responses about which problem the sensor would primarily address in practice. These were not closed-choice items. Respondents stated, in their own words, the main problem they associated with the technology, and these statements were later grouped into use case categories.

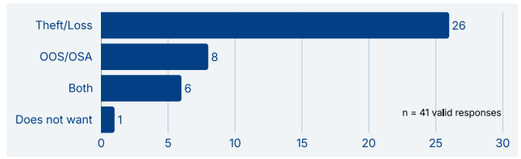


Figure 5.3, main reasons for interest in the sensor

Figure 5.3 shows how the open responses were grouped into use case categories. The figure is relevant because it shows that theft, loss, and shrink were the most visible store-level reasons for sensor interest, while OOS formed a second demand cluster.

Loss, shrink, and theft formed the strongest cluster. Out of 41 respondents, 26 stated loss or shrinkage as the primary reason for needing the sensor, and another 6 mentioned it in combination with availability. This made shrinkage or theft the most frequently stated reason in the store responses. The comments on this cluster repeatedly mentioned sweeps, particularly in categories such as cosmetics, razors, meat, and alcohol. The pain was described in two linked ways: direct financial loss and the empty shelf that remains for paying customers afterwards. In that sense, theft was not only a security problem. It also created a secondary availability problem.

Availability and OOS formed the second cluster. 8 respondents stated availability as the sole main reason for needing the sensor, and another 6 mentioned it together with shrink. Here, the pain looked different. The comments referred more often to missed sales, customer frustration, and manual checking routines. Several respondents described staff making repeated rounds to check whether shelves were still properly filled. Compared with theft, this cluster appeared less immediate in the store comments, but it still pointed to repeated operational work.

A third, smaller group of responses pointed to inventory accuracy. These responses described a mismatch between system records and shelf reality. This was less visible than theft or empty shelves, but it helps explain why the expert interviews later paid more attention to data, systems, and replenishment logic. The store responses already showed a practical difference between the two main use cases. Theft was linked to rapid response. Availability and OOS were linked more often to checking, correction, and replenishment.

5.1.5 Segment differences reveal different store logics

The store-level priorities were not identical across all settings. The sample was not designed for statistical comparison, so these differences should be read only as exploratory patterns. They are useful as context, but they should not be treated as firm segment conclusions.

As can be seen in Figure 5.4, a possible difference appeared between branch managed settings and more franchise like or independently operated stores. Branch contexts seemed to place slightly more emphasis on fit with existing systems and operational consistency. Franchise and smaller-format settings seemed somewhat more sensitive to maintenance burden and direct usability. This pattern should be read cautiously, because the subgroup sizes were limited.

A similar exploratory pattern appeared between higher-tech and lower-tech stores could be seen in Figure 5.5. Higher-tech stores seemed somewhat more open to system fit, while lower-tech stores seemed to value direct use with little dependence on surrounding infrastructure. This pattern is suggestive only.

The segment differences are therefore mainly useful as a caution. Store context may shape which condition is emphasised most, but the overall pattern remains stable: reliability, timely action, and low burden remain the strongest store-level requirements.

5.1.6 Low-ranked attributes reveal implementation blind spots

The lowest-ranked attributes are also informative. Hard to notice in the store, and clear ownership was consistently placed near the bottom. A simple reading would be that these issues do not matter much. The store comments suggest a more careful interpretation.

Visibility appears to matter less because staff care more about whether the system works than whether it is aesthetically subtle. Ownership appears to matter less because respondents often assume that budgets, responsibilities, and maintenance arrangements will be organised elsewhere. That does not mean ownership is unimportant. It may mean that ownership is less visible to the store user until the system starts failing or creating extra work.

This is where the idea of a blind spot becomes useful. The ranking suggests that stores focus on what they directly experience during daily use. Hidden coordination conditions, such as who maintains configuration quality, who has authority to correct problems, or who is responsible when the system underperforms, are often treated as background issues. They only move into view when something breaks.

Low priority at store level should therefore not be read as proof that ownership is unimportant. It may show that ownership sits outside the store's direct field of control. This issue returns in the expert interviews.

5.1.7 Conclusion

Part 1 shows that shelf sensing is judged at the store level through a narrow operational lens. Store teams do not first ask whether the proposition is strategically interesting. They first ask whether it is reliable, quick enough to matter, and easy to live with. The results also show that theft is the most visible local use case, while availability constitutes a second, still substantial, demand cluster.

At the same time, the store material leaves several conditions only partly visible. Store teams could describe what makes shelf sensing useful in daily work, but they were ss able to judge ownership, integration depth, and longer term governance arrangements. This reflects their position in the system. The next section therefore turns to the expert interviews. These interviews examine the wider conditions that must hold if the store-level requirements identified above are to work beyond a local pilot.

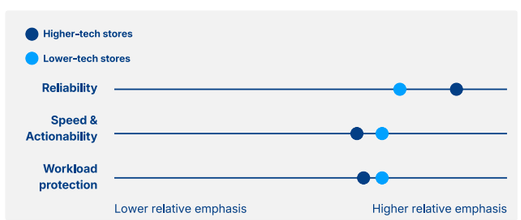


Figure 5.4: Branch-managed and franchise-like stores compared on average ranks for the main adoption attributes.

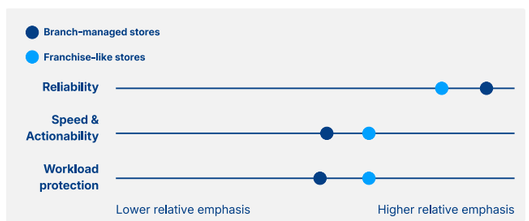


Figure 5.4: igher-tech and lower-tech stores compared on average ranks for the main adoption attributes.

5.2 Ecosystem-level findings

The expert interviews made the conditions behind the store level findings more visible. While the store visits showed what store teams require from shelf sensing in daily use, the interviews helped explain what must be organised around those requirements before they can work beyond a pilot.

Four themes stood out across the interviews. First, respondents described a form of retail blindness, where the retailer's systems and the physical shelf do not always show the same reality. Second, they pointed to a fragile link between signal and action. Third, they described a fragmented buying centre, where different actors hold different decision rights. Fourth, they showed that integration is not one technical choice, but a layered trade off between fast local action and deeper system connection.

The expert interview findings are based on the eight semi-structured interviews described in Table 4.1. In this chapter, respondent codes are used to link findings and selected quotes to broad ecosystem perspectives while preserving anonymity. The purpose is not to compare individual respondents, but to show how different actor perspectives reveal recurring dependencies around actionable shelf insight.

5.2.1 Actionable shelf insight starts with retail blindness, but OOS and theft follow different action chains

Across the interviews, the starting point was usually not the sensor itself. Respondents first described a gap between what a retailer's systems assume and what is physically happening in the store. Participant P7 described this gap directly: *"A retailer does not really know what is lying in the store. Very simply put, they only know what is paid for at the checkout"* (translated, P7). This quote shows the basic problem behind actionable shelf insight. Retailers often have sales data, but not a live view of shelf reality.

For OOS, this gap appeared most clearly as phantom inventory. In this situation, the system still assumes that stock is available, while the shelf is empty. Participant P3 explained the effect as follows: *"When the system thinks there is still stock, but there is nothing on the shelf, the store will not receive new deliveries for that item"* (translated, P3). This makes OOS more than a local shelf issue. It also becomes a backend issue, because replenishment can continue to rely on incorrect information.

The theft pathway followed a different pattern. Respondents described sweeps and other loss

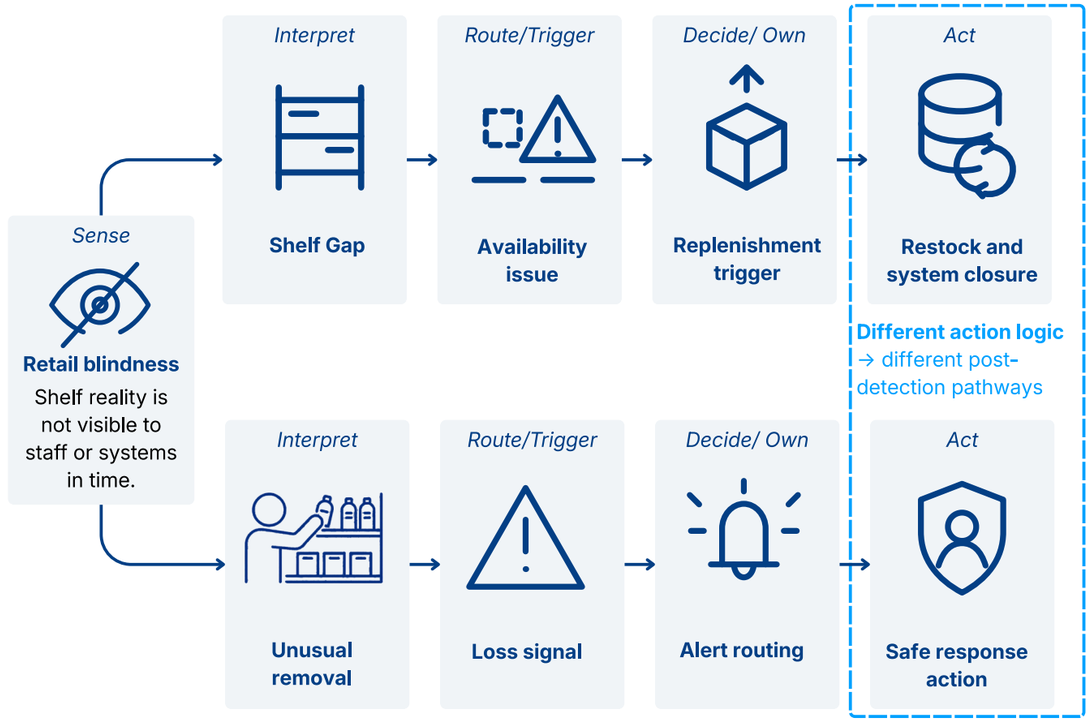


Figure 5.6. Retail blindness and the split between OOS and theft pathways.

events where products leave the shelf without passing through the checkout. Participant P5 gave the example of organised mobile groups that *"swipe the whole shelf"* and then move on to the next store (translated, P5). In this case, the issue is more immediate. The store loses products, the shelf becomes empty, and the stock record may remain wrong.

The two pathways therefore start from the same visibility problem, but they do not require the same response. Theft creates urgency and response risk. A signal only helps if it reaches the right person quickly and if the response is safe and realistic. OOS creates a different risk. Here the signal must support replenishment, ordering, or another backend routine. This distinction matters because it shows that actionable shelf insight is not one generic use case. After detection, OOS and theft require different forms of follow-up.

Figure 5.6 shows how one shared visibility problem branches into two different action chains. The figure is relevant because OOS and theft both start from poor shelf visibility, but require different forms of follow-up after detection.

5.2.2 The main operational failure point is the fragile link between shelf signal and store execution

A second pattern concerned the link between the shelf signal and the action that should follow. Respondents did not mainly question whether shelf signals could be useful. The concern was whether those signals would remain trusted and usable inside the daily rhythm of store work.

For OOS, the weak point often sat before the action. Several experts described planogram changes, shelf resets, assortment changes, and local variation as normal retail conditions. If the sensing logic does not stay aligned with those changes, the signal can lose validity. Participant P1 made this point by arguing that linked logic should refresh when shelf conditions or planograms change. This means that reliability is not only a sensor issue. It also depends on whether the shelf representation remains correct over time.

For theft, the weak point often sat after detection. The signal must be credible, routed well, and acted on by someone who can respond. Participant P7 linked this directly to trust: *"If you buy a car, you assume it is reliable. I cannot say that 10 out of 100 signals are wrong. Why would you still walk the eleventh time?"* (translated, P7). Participant P8 described the same risk in daily store language: *"In a busy store, after a week of that beep beep beeping, there is a good chance that store staff are going to ignore it or it just gets lost in the background"* (P8). These quotes show why false or poorly routed alerts can quickly become background noise.

Routing also mattered. Participant P5 described an intervention model in which *"the employee gets the call, but also immediately receives the camera images on the PDA"* (translated, P5). The example shows that the signal alone is not enough. Staff also need context for the response.

The response role was more contested. Several respondents warned against making young or low-authority staff responsible for difficult theft interventions. Participant P6 explained that the output should be usable for young employees: *"It has to be converted into data that, for example, 16 year olds can also do something with, so that they can take quick action"* (translated, P6). Participant P3 gave a sharper safety boundary: *"No one is going to say to a 16 year old girl: a customer is now committing theft, go and stop them"* (translated, P3). These comments show that actionability depends on role, authority, and safety as well as speed.

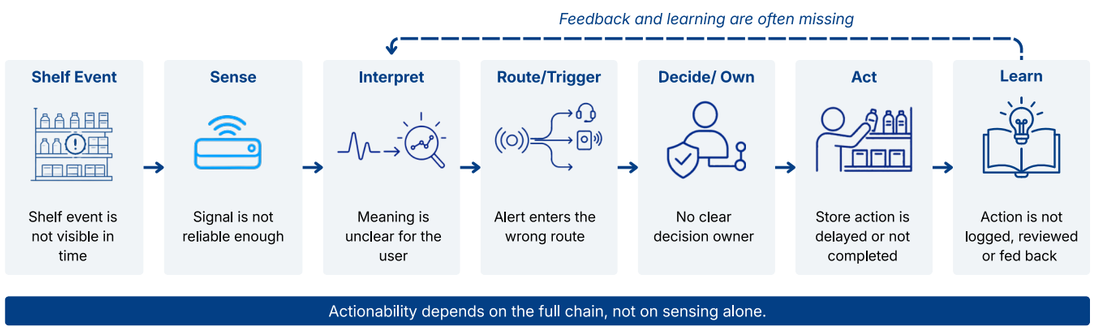


Figure 5.7. Signal-to-action failure map.

Figure 5.7 shows where the path from shelf signal to store action can break. The figure is relevant because the interviews showed that detection is only one step. The signal must also be trusted, routed, acted on, and closed. The final learn step refers to feedback from use, such as false alerts, response time, missing action data, and closure data. Without that feedback, the trigger logic cannot easily improve over time.

5.2.3 Scaling depends on a fragmented buying centre rather than on a single decision maker

A third finding is that enterprise adoption is not controlled by one clear owner. The interviews described a fragmented buying centre in which different actors control different gates. Store operations may feel the pain, information technology may control system access, data or procurement roles may affect input quality, and sales or marketing may judge the customer experience impact.

The problem owner is often not the rollout owner. Several respondents described situations in which store operations or business teams recognised the shelf problem, but still depended on other actors to move further. Participant P3 described this as a financial gate, where a clear return on investment is needed before wider adoption can be justified. This shows that the value test at headquarters is different from the usefulness test in the store.

Information technology was one of the strongest recurring gates. Respondents described central IT teams as busy, selective, and often tied to larger system programmes. Participant P6 summarised the issue as a capacity problem rather than a willingness problem. Participant P7 made a similar point when discussing enterprise proof: *"If I can show together with a partner that I trigger this, and you can see in SAP that the performance of my sensors increased my availability by 1 or 2 percent"* (translated, P7). This quote shows why the proof of value often has to appear inside the retailer's own system environment.

Master data added another layer. Participant P3 warned that incorrect input data, such as wrong product weights, can make the sensing logic fail even if the technology itself works. This matters because the actor who controls input quality is not always the actor who experiences the store-level pain.

For theft related pathways, the veto structure looked different. Participant P5 described anti theft solutions that reduce theft but can also harm customer experience. In the example of protective cabinets, the repeated beeping made people look around and created a negative store experience. The respondent noted that such measures can reduce theft, but may also create a sales drop. This shows that LP is not the only decision logic. Customer experience can also become a gate for adoption.

Support after rollout formed another gate. Participant P8 pointed to the cost of field support: *"If you have to physically send somebody there, very quickly there is the travel time. Now I have got a six hour drive to the next store"* (P8). This quote shows that the operational burden does not end after installation. A solution that works in a pilot can still become difficult to maintain across many stores.

Figure 5.8 shows the actor groups that may influence shelf sensing adoption beyond the store team. The figure is relevant because it shows why a useful store-level signal can still be blocked by IT, procurement, data ownership, finance, customer experience, or service support requirements.

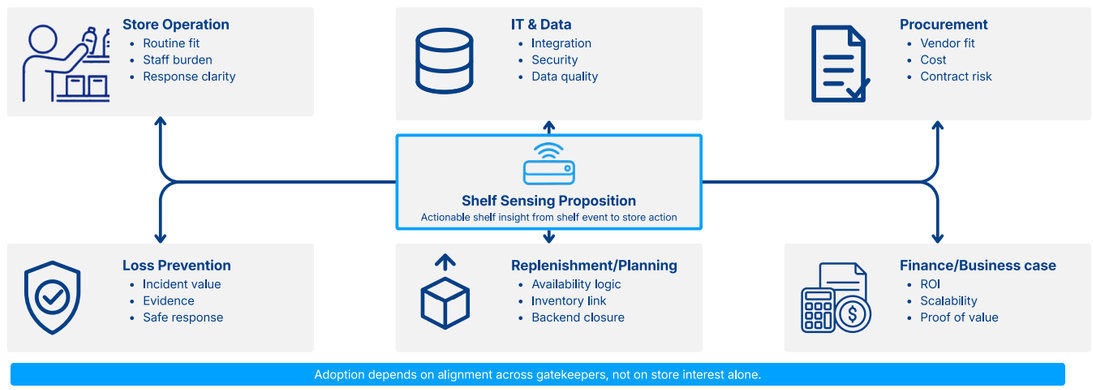


Figure 5.8. Fragmented buying centre around shelf sensing adoption

5.2.4 Integration differs by use case and route to scale

The fourth theme concerns integration and route to scale. Respondents did not describe integration as one technical choice. They described different layers, including backend connection, physical embedment, software openness, partner access, and support after rollout.

For OOS, respondents often argued that isolated alerts are not enough. To prove value, the signal must connect to replenishment, ordering, or management systems so that the correction loop can close. Participant P7 linked this to SAP proof, where improved sensor performance should become visible in availability performance. Participant P3 made a similar point by stressing that the value must be shown in the retailer's own environment. In the interview material, OOS therefore appeared more dependent on backend closure than theft.

At the same time, respondents warned against building a custom solution for every client. Participant P5 used the image of Lego blocks to explain that technologies should fit together without forcing the retailer into one fixed route. Participant P6 also pointed toward open and repeatable system logic. The practical issue is that too much custom work can make each rollout expensive and hard to repeat.

The theft pathway looked different. Several respondents suggested that a lighter route can be enough when the main value lies in timely routing and response rather than full system closure. In this route, the binding link is not always the enterprise backend. It can also be the alert channel, the responder, and the proof that the intervention model works in the store.

A useful distinction appeared between physical integration and software integration. Respondents seemed more open to physical embedment when it fitted existing shelf infrastructure, store renewal, or installed systems. Software integration was treated more carefully, because it can create lock-in or reduce flexibility later.

Partner routes were also discussed as a possible way to scale. Participants described working through installed infrastructure, planned rollouts, system integrators, ESL partners, or shelf builders as routes that may reduce disruption. Participant P4 suggested another option, where external brands help finance a rollout if the data helps their merchandisers: *"Supermarkets are very eager if they do not have to pay for it themselves. We often see that suppliers, Mars, Coca Cola, Unilever, install it for supermarkets"* (translated, P4). This was not the dominant route in the interviews, but it shows that the financing and access route may vary by actor.

Partner routes also create dependency. Participant P8 warned that a large account can consume too much of a small provider's capacity: *"If you have got 100 leads, which ones do you decide to prioritise? If you are not careful, does Tesco take up so much of the resource that these other medium fish lose momentum?"* (P8). This quote shows the tension clearly. A partner or large client can create access, but it can also create support pressure and dependence.

Figure 5.9 shows the difference between physical integration and software or data integration. The figure is relevant because theft-related action can often start from a narrow alert route, while OSA usually requires stronger backend closure through stock, replenishment, workflow, or planning systems.

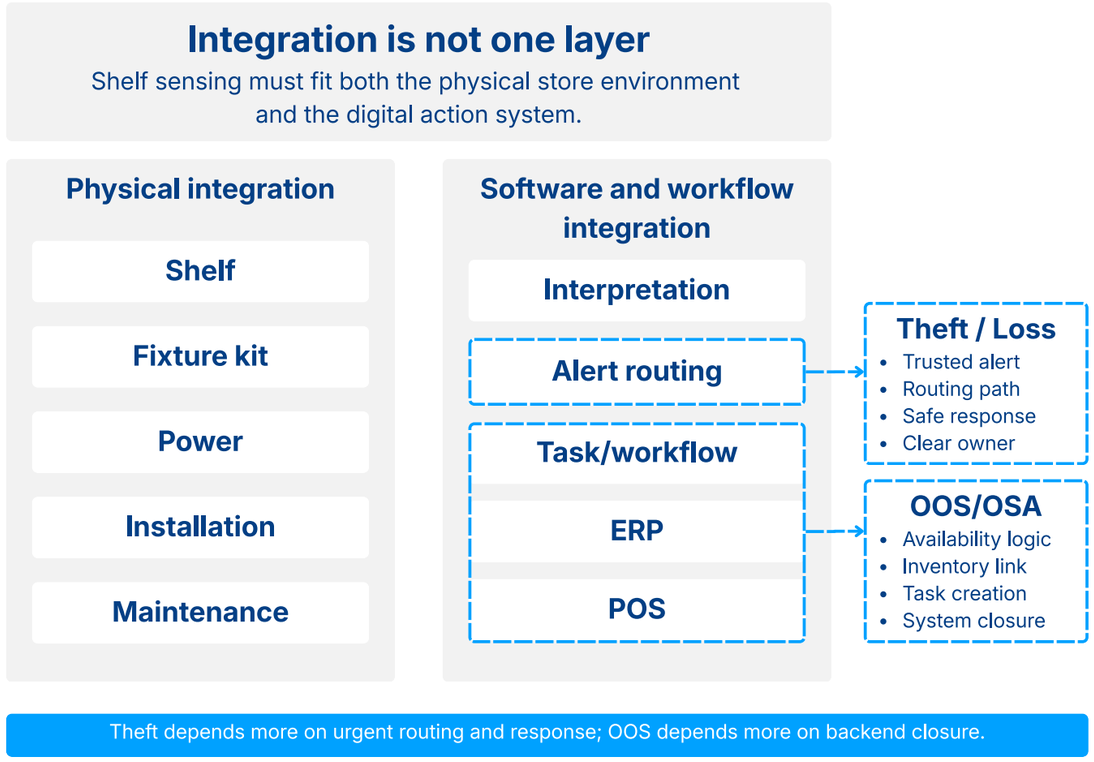


Figure 5.9. Two-layer integration view for theft and OSA.

5.2.5 Conclusion

The expert interviews show that shelf sensing depends on more than producing a useful signal. The signal must remain trusted, be routed into action, pass through organisational decision gates, and fit the required integration route. Four patterns were most visible: retail blindness, signal-to-action fragility, a fragmented buying centre, and layered integration.

These findings help explain why the store-level requirements from Part 1 cannot be assessed only from the store floor. The next section compares both datasets directly.

5.3 Cross-dataset synthesis

The value of the synthesis lies in comparison rather than repetition. Part 1 showed what store teams require from shelf sensing in daily use. Part 2 showed what the wider retail technology ecosystem must organise to deliver and maintain those requirements. Read separately, both datasets are informative. Read together, they show where actors agree, where their criteria differ, and where local store demands depend on conditions elsewhere in the chain.

5.3.1 What convergence reveals: the action chain is fragile at both ends

The clearest convergence is that both datasets point to fragility in the action chain. The store visits show this from the user side. Reliable signals, fast enough to act, and low extra workload define the threshold for adoption. The expert interviews show the same fragility from the system side. Trust can break through planogram drift, poor routing, master data errors, low alert quality, or unclear response ownership.

Both datasets describe the same chain from different sides. Store respondents describe the result they need: a signal they can trust. Experts describe why that trust breaks, for example through recalibration problems, poor routing, or alert fatigue. What stores experience as trust therefore depends on conditions they do not directly control.

A similar pattern appears around workload. Stores treat no extra staff work as a user requirement. Experts described the same issue as a wider execution problem. If the signal arrives through a separate app, requires manual checking, or depends on staff solving unclear exceptions, the burden shifts back into the store. What looks simple at store level can therefore depend on choices made elsewhere in the chain.

Speed also converges, but in a more pathway-specific way. Stores want the signal early enough to matter. Experts show that this means different things in different chains. For theft, it means credible routing into a live response. For OOS, it means timely correction through replenishment logic and routines. The store-level demand is the same in form, but the ecosystem burden behind it differs.

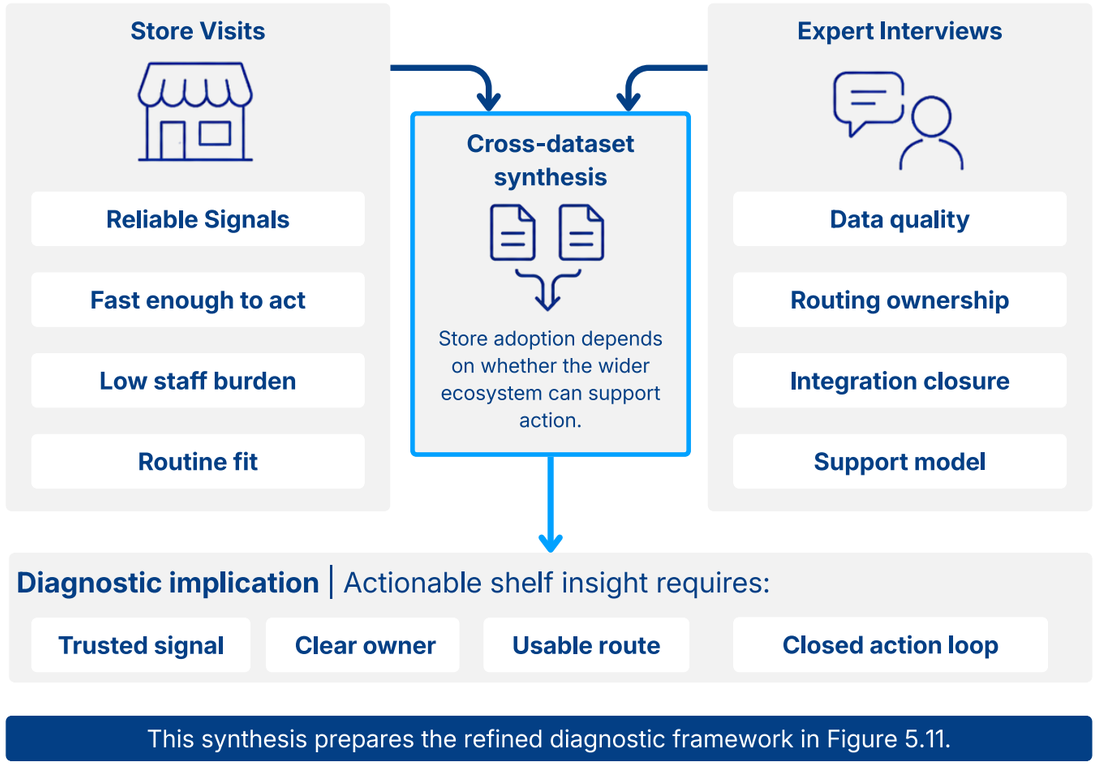


Figure 5.10. Cross-dataset synthesis chain.

Figure 5.10 shows how the store-level and ecosystem-level findings connect. The figure is relevant because it makes clear that store requirements, such as reliability, speed, and low workload, depend on wider ecosystem conditions around data, ownership, routing, integration, and support.

5.3.2 What perspective gaps reveal: the same proposition is evaluated through different criteria

The strongest tension in the combined material was not disagreement about whether shelf sensing matters. Most actors treated the problem as real. The difference was how the proposition was judged.

Store teams evaluate the system against immediate workflow criteria. They ask whether it works reliably, whether they can act on it quickly, and whether it protects time and attention. Organisational gatekeepers use different tests. They ask whether the case can be proven financially, whether it fits the architecture, whether it disrupts customer experience, and whether it can be supported at chain-level. These are not small differences in emphasis. They are different evaluation logics.

That gap matters because a solution can pass the store-level threshold and still fail in rollout. The actor who feels the pain is often not the actor who controls the next gate. This was visible in the interviews around the ROI gate, the SAP proof requirement, and the customer experience veto. It was also evident in the store data, where respondents often cared little about ownership, even though ownership later became central to sustained use.

The meaning of actionability also shifts across levels. For the store, actionability means that someone can do something useful now. For headquarters, it may mean that the signal can be translated into dashboards, replenishment logic, or enterprise proof. For loss-prevention actors, this may mean that the response model is legitimate and safe. The same proposition is therefore judged through different time horizons and risk concerns within the same retailer.

Perspective	*What counts as value*	*Main risk concern*	*What counts as proof*	*Possible rejection point*
Store users	Reliable signal, quick action, low extra workload	The system creates false alerts, takes time, or disrupts routines	It helps staff act in daily work	Staff do not trust it or stop using it
Store operations	Fits existing routines and staffing capacity	The task is not owned or cannot be handled during store work	It improves store execution without adding burden	The system creates more work than it removes
IT and architecture	Fits existing systems, data flows, and architecture	Integration effort is too high or technically hard to maintain	It can connect to current systems and be supported	It does not fit the architecture or requires too much IT capacity
Headquarters or business owner	Financial case, chain-level usefulness, repeatability	Pilot value does not translate into rollout value	It shows a clear business case across stores	The return on investment remains unclear
Loss prevention (LP)	Safe and legitimate response model	Alerts create unsafe or inappropriate staff responses	The signal supports credible escalation or intervention	The response model creates customer experience or safety concerns

Table 5.3: store users and organisational gatekeepers compared on what counts as value, risk, proof, and rejection.

Table 5.3 compares the store-level and ecosystem-level evidence. The table shows that store requirements are often simple at the point of use, but depend on wider conditions around data, routing, ownership, integration, and support.

5.3.3 What is hidden: simple store demands depend on wider conditions

The synthesis also shows that simple store demands often depend on wider conditions. Store teams usually name the outcome they need, not the full chain required to create that outcome.

Reliability is the clearest example. At store-level, it appears as a straightforward requirement: the signal must be trustworthy. The expert interviews show that this trust depends on a wider set of hidden conditions, such as stable configuration, accurate master data, credible routing, maintenance quality, and service response. The store does not usually name these mechanisms. It experiences their outcome.

The same applies to workload protection. Stores say the technology should not create extra work. Experts show what sits behind that demand: routing, ownership, remote updates, and an installation and maintenance model that fits existing infrastructure. In other words, low workload is not only a local preference. It depends on how the wider system is organised.

Works with existing technology showed the same pattern. Store respondents used this phrase to mean that the system should fit what is already there. Expert respondents showed that this can involve physical embedment, software openness, partner choice, and support after rollout.

5.3.4 What diverges after the signal: theft and OOS place pressure on different links

The synthesis confirms that theft and OOS both belong under actionable shelf insight, but they should not be treated as the same action chain. The store data hinted at this difference. The expert interviews made it clearer.

At store-level, theft was the dominant use case by volume. It is urgent, visible, and emotionally direct. OOS was also important, but it appeared less acute. At ecosystem-level, the balance shifts. Theft still matters, but OOS often carries the heavier integration burden because the value case depends on closing the replenishment and correction loop through other systems.

The sharpest divergence appears after the signal is generated. In the theft pathway, the weak point often sits at routing and response. The signal may be valid, but the response model can still fail due to

low credibility, unsafe intervention assumptions, or customer experience concerns. In the OOS pathway, the weak point often sits in data, integration, and correction logic. The signal may detect the shelf issue, but the value is limited if the backend loop does not close.

These pathways also show different risk patterns. Theft appears to carry more response and adoption risk, because the signal must be trusted, routed, and acted on in a sensitive situation. OOS appears to carry more integration and backend-closure risk, because the signal must connect to data, replenishment, and correction routines. Both pathways matter, but they do not depend on the same links.

5.3.5 What the governance gap reveals: the structural problem neither side fully owns

The clearest combined finding is that no single actor clearly owns the full path from shelf signal to store action. In the store visits, clear ownership ranked last. On its own, this could suggest that ownership is not very important to store teams. The expert interviews showed a different pattern. Ownership became more important when respondents discussed rollout, maintenance, data quality, support, and decision making.

Together, the findings show that responsibility is spread across several actors. Store teams may need the signal, but information technology, operations, LP, procurement, data owners, finance, or external partners may control whether that signal can be used. Configuration quality may sit with one actor. Response logic may sit with another. Budget approval may sit somewhere else.

This creates a risk during rollout and maintenance. A pilot can appear useful in one store, while wider adoption still becomes difficult because no actor owns the full chain over time. For Chapter 5, the main result is therefore: product performance is not enough. Shelf sensing also needs clear responsibility for data, routing, response, support, and follow-up.

5.4 Framework refinement

The empirical findings did not replace the framework from Chapter 3. They made it more specific. The framework still treats actionable shelf insight as a problem of connected activities, actors, links, and alignment conditions. The results mainly sharpened three parts: the split between OOS and theft, the points where the action chain can break, and the role of ownership, integration, and internal readiness after a pilot

The framework should still be read from top to bottom and from left to right. It starts with actionable shelf insight as the focal value proposition. It then shows the activity chain needed to move from shelf event to store action. The links in that chain are assessed through technical, data, operational, incentive, and governance alignment. The risk layer shows where the chain may break during pilot, rollout, store execution, sustained use, or scale. MOOS's internal readiness is kept separate because even a possible route may be difficult to deliver if MOOS cannot support it. Positioning is therefore not built into the framework. It follows after the diagnosis.

Figure 5.11 on the next page shows how the original framework from Chapter 3 was sharpened through the results. It keeps the same diagnostic logic, but makes three empirical refinements visible: the split between OOS and theft, the fragile links after detection, and the role of ownership, integration, and internal readiness in later positioning.

5.4.1 What became more specific through the findings

The main refinement concerns the activity chain. The original framework already described value realisation as a chain of activities, actors, positions, and links. The findings made this chain more concrete. Actionable shelf insight depends on detection, signal trust, routing, response ownership, and follow-up. Several problems found in the data were located between these steps rather than inside one step. Examples include false alerts, planogram changes, unclear routing, weak task ownership, and missing backend correction.

A second refinement concerns the difference between theft and OOS. Both pathways start from poor shelf visibility, but they do not fail in the same way. Theft places more pressure on urgency, alert routing, and realistic response. OOS places more pressure on data quality, system connection, and backend closure. The refined framework therefore separates these pathways after the shared visibility problem.

A third refinement concerns ownership and route to scale. The store visits showed that clear ownership was not a high store-level priority. The expert interviews showed that ownership becomes more important during rollout and sustained use.

This means that some important conditions are partly hidden at store level. They become visible only when the signal has to be maintained, integrated, supported, and acted on across several actors.

5.4.2 Why the framework remains diagnostic

The refined framework does not choose a final position for MOOS. Its purpose is to show where actionable shelf insight becomes fragile, which links need attention, and where the two main pathways differ. This distinction matters because positioning should follow from the diagnosis. If a preferred position were built into the framework itself, the analysis would risk confirming its own assumption.

Chapter 5 therefore ends with a refined diagnosis, not a final design choice. The results have narrowed the design space, but they have not closed it. Chapter 6 starts from this smaller problem space and uses it to frame the design brief, compare route directions, and develop the roadmap.

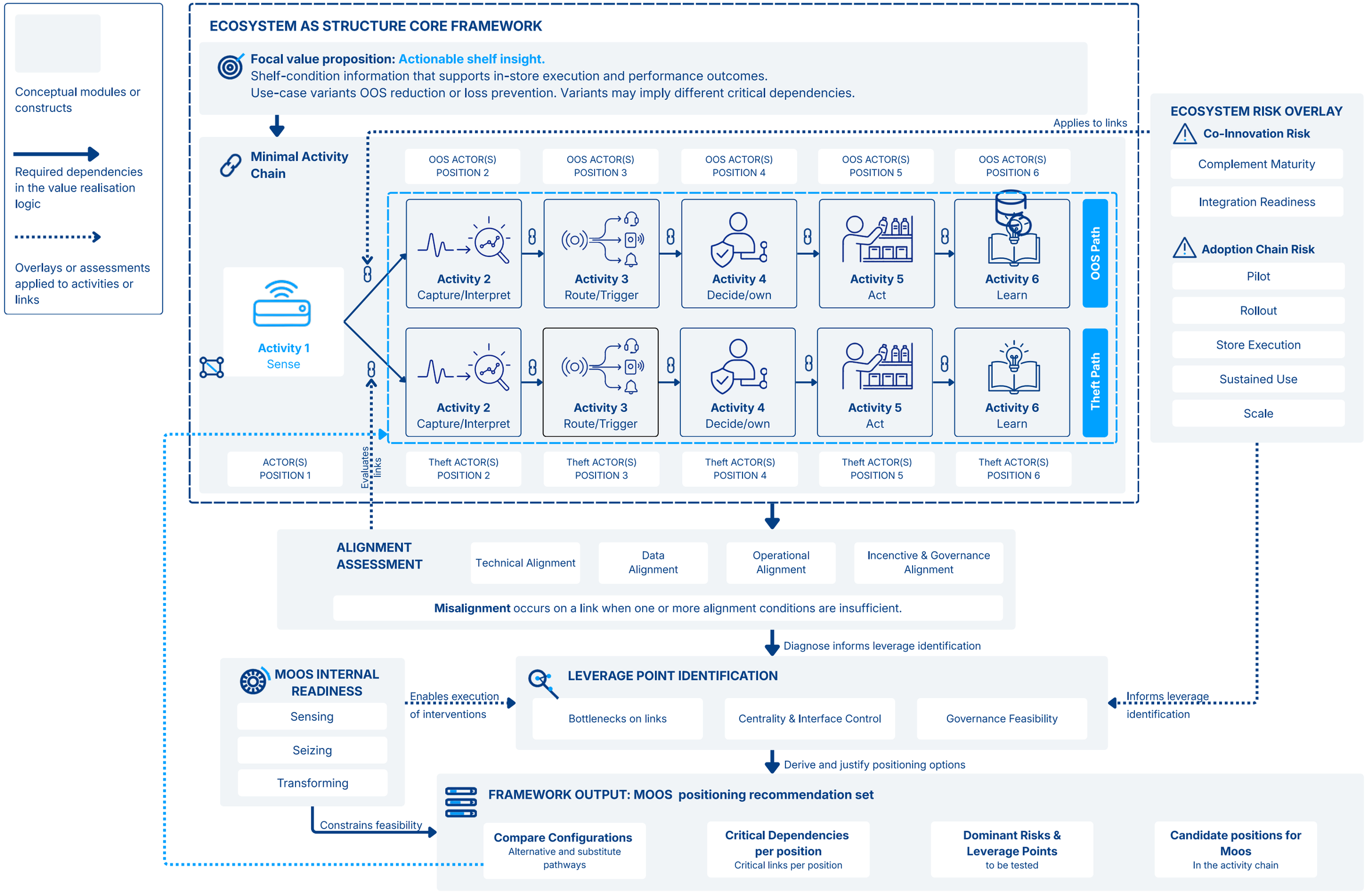


 Figure 5.11. Refined diagnostic framework after the empirical findings.

Chapter 6

Design

6.1 From diagnosis to design
6.2 Design process and role of co-creation
6.3 Co-creation outputs as design input
6.4 Design criteria
6.5 Future vision
6.6 Ideation and development of positioning directions
6.7 Weighted comparison and preferred direction
6.8 Strategic roadmap and time pacing
6.9 Tactical roadmap
6.10 Conclusion

Chapter 5 narrows the design space, but it does not yet choose a positioning direction. The results show where actionable shelf insight becomes fragile, which ecosystem links carry most weight, and why MOOS cannot be positioned through product logic alone. Chapter 6 translates this diagnosis into design criteria, positioning elements, a preferred initial direction, and a pre-validation roadmap.

The refined framework at the end of Chapter 5 forms the bridge into this chapter. It brings together the focal value proposition, the main pathway split between theft and OSA, the most binding actor links, the dominant bottlenecks, and the internal readiness themes that matter for MOOS. From this point onward, the task shifts from diagnosis to design.

The design output in this chapter is deliberately pre-validation. It proposes a direction and roadmap logic, but it does not claim that the roadmap has already been proven. Chapter 7 then tests whether this design output is clear, credible, useful, and relevant enough to be revised.

Figure 6.1 on the next page is relevant because it shows what the design phase builds on. It makes the shift from diagnosis to design visible: actionable shelf insight is treated as a chain from shelf event to store action, with different actors, links, bottlenecks, and readiness conditions shaping whether MOOS can hold a credible position. Figure 6.1 shows the diagnostic input used for the design phase. It connects the focal value proposition to the loss-prevention and on-shelf availability pathways, the key actor links, the main bottlenecks, and the internal readiness themes. This makes clear that the roadmap is not based on product features alone, but on the wider chain from shelf event to store action.

6.1 From diagnosis to design

6.1.1 Design problem

The central design problem is to define how MOOS can move from a promising shelf-sensing technology toward a credible position in the retail technology ecosystem. This is first a positioning question, not a product question.

Chapter 5 showed that shelf sensing only becomes valuable when a shelf event reaches the right operational layer in a usable form. In this chapter, actionable shelf insight is therefore understood as shelf-related information that is reliable, specific, and timely enough to support store action. The design work stays tied to that action chain.

6.1.2 Scope of the design task

The applied framework narrows the scope. It shows that LP and OSA do not follow the same pathway. LP can start through lighter alert routing, while on-shelf availability depends more on workflow links, planning routines, and system coordination. This difference means that MOOS cannot use one generic scaling route for all shelf-related use cases.

The scope is also limited by MOOS's current role as a component provider. MOOS is not designed here as a full retailer platform, workflow suite, or store operating system. The design task is to define a position in which MOOS can own a useful part of the chain between shelf event and store action, while other actors remain responsible for wider retail systems and routines.

6.1.3 Intended design output

The chapter develops four connected outputs: a future vision, a set of positioning elements, a preferred initial direction, and two roadmap layers. The strategic roadmap explains how MOOS's position could develop over time. The tactical roadmap shows which workstreams need to run underneath that movement.

These outputs are initial design outputs. They are based on the diagnosis, the framework, and co-creation input, but they are not yet validated. Chapter 7 tests whether the roadmap is clear, credible, useful, and relevant enough to be revised into the final roadmap of the thesis.

6.1.4 Design limits

Some limits are already visible before ideation begins. Not every segment is equally feasible. Not every use case should be addressed at the same time.

Based on the findings in Chapter 5, grocery remains relevant in the longer term, but it appears harder to enter too early because workflow, planogram dependency, and system integration become heavier there. Duty-free and selected Health and Beauty contexts appear more manageable in the near term because they are closer to the current trigger logic and contain clearer value concentration around theft-sensitive or high-value products. These limits make the design brief more useful by preventing the chapter from treating every opportunity as equally realistic.

6.2 Design process and role of co-creation

Element	*Input from earlier chapters*	*Meaning for the design phase*
Design challenge	Chapter 5 shows that actionable shelf insight depends on more than sensing quality. Value depends on the links between shelf events, actors, systems, routines, and store action.	Define how MOOS can move from promising shelf-sensing technology to a credible ecosystem position.
Core design focus	The focal value proposition remains actionable shelf insight. In this chapter, this means shelf-related information that is reliable, specific, and timely enough to support real store action.	Keep the design tied to store action, not to sensing in isolation.
Main pathway split	Chapter 5 shows that LP and OSA follow different dependency patterns. LP can start through lighter alert routing, while OSA depends more on workflow, planning, and system links.	Avoid one generic route for all use cases. Design choices need to respect pathway differences.
Scope boundary	The findings do not support positioning MOOS as a full retailer platform, workflow suite, or store operating system.	Define a bounded role in the chain between shelf event and store action.
Near-term market logic	Current proof is strongest in travel retail, especially through the Avolta case. Duty-free and selected Health and Beauty contexts appear more manageable than grocery in the near term.	Start from the current proof and adjacent contexts before moving into heavier retail environments.
Longer-term market logic	Grocery remains relevant, but Chapter 5 suggests heavier dependencies around workflow, planograms, store routines, and system integration.	Keep grocery visible as a later option, not as the first scaling route.
Co-creation input	Co-creation helped translate findings into route tensions, ownership boundaries, no-regret moves, and future role framing.	Use co-creation as a structured design input, not as the final decision source.
Intended output	The thesis aims to move from diagnosis to a designed positioning direction.	Produce a future vision, route directions, a preferred direction, and strategic and tactical roadmap layers.
Explicit exclusions	Full platform ownership, full workflow ownership, generic store optimisation, and solving all shelf-related use cases at once.	Keep the design realistic and connected to MOOS's current position.

Table 6.1: design brief overview, linking Chapter 2, Chapter 3, Chapter 5, and co-creation to the scope, outputs, boundaries, and exclusions of the design phase.

Conceptual modules or constructs

Required dependencies in the value realisation logic

Overlays or assessments applied to activities or links

Filled in information

ECOSYSTEM AS STRUCTURE CORE FRAMEWORK

Focal value proposition: Actionable shelf insight.
Shelf-condition information that is reliable, timely, routed, owned, and able to trigger store action.
The design problem is not only sensing the shelf, but making shelf events actionable through the right actors, links and routines.

Activity Chain

Activity 1
Sense

Interpret availability issue	Route replenish-ment task	Decide correction	Act in store	Close & learn
Connect shelf gap to product, stock, and replenishment logic.	Turn the signal into a task or replenish-ment trigger.	Decide whether to refill, correct data, ignore, or investigate.	Refill shelf, correct stock record, or close task.	Feed outcomes back into signal quality and replenishment logic.
ERP · Retailer · POS Data	Workflow tool · Retail IT · Store ops · Store communication tool	Store manager · Masterdata · Retail ops · Replenishment team	Store staff · POS · ERP · Backroom/ stock team	MOOS · IT Support · Resource planning · Retail data/ BI

OOS Path

Interpret signal	Route alert	Decide response	Act or escalate	Close & Learn
Interpret high-risk removal or suspicious shelf event.	Send alert to staff, headset, app or security route.	Decide verify, approach, monitor or escalate.	Respond, verify, recover or escalate.	Log event, review evidence and improve trigger logic.
MOOS · Shelf Infastructure	MOOS · POS · Computer vision · Loss prevention	Headset · Staff comun. app · Store team · Security	Store team · Store manager · Security · Loss prevention · Retail ops	Store staff · Security · Loss prevention · Camera	MOOS · Camera · Loss prevention · POS

Theft Path

ECOSYSTEM RISK OVERLAY

Co-Innovation Risk

- **Complement Maturity** — Headset, app, camera, POS, ERP/WMS
- **Integration Readiness** — Connect without owning the full system
- **Data readiness** — Product, shelf, inventory, POS, incident data
- **Configuration stability** — Planogram, shelf and process changes

Adoption Chain Risk

- **Pilot proof** — Bounded use case works
- **Rollout decision** — Budget, IT, operations and ownership
- **Store execution** — Staff can act in daily routines
- **Sustained use** — Support, maintenance and alert quality
- **Scale readiness** — Repeatable across stores and partners

ALIGNMENT ASSESSMENT

Technical	Data	Operational	Incenctive & Governance
Camera · ERP · Headset · Workflow · POS	POS · incident data · Masterdata · inventory · Planogram	Headset · Store routine · Replenishment · Security	Store ops · Retail IT · Loss prevention · Procurement

Diagnose informs leverage identification

MOOS INTERNAL READINESS

- **Sensing readiness** — Reliable detection, calibration, shelf-change handling
- **Seizing readiness** — Focused use cases, partner-ready trigger logic
- **Transforming readiness** — Repeatable deployment, APIs, governance support

Enables execution of interventions

LEVERAGE POINT IDENTIFICATION

1. **Event reliability** — Signal quality, thresholds, false alerts
2. **Trigger-layer standard** — Usable for headset, workflow, POS, reporting
3. **Use-case specific routing** — Theft = alert route / OOS = task closure
4. **Ownership protocol** — Who responds, corrects, maintains
5. **Selective partner embedding** — Integrate only where proof supports it
6. **Diagnostics feedback loop** — Learn from non-action, errors and closure

Informs leverage identification

Derive and justify positioning options

FRAMEWORK OUTPUT: MOOS positioning recommendation set

Design direction — Bounded trigger layer	**Primary pathway** — Loss prevention first	**Secondary pathway** — OOS where closure is feasible
Critical dependencies — POS, ERP, workflow, headset, camera	**Dominant risks** — Ownership, false alerts, weak closure	**Design input** — Brief, criteria, route directions, roadmap

Constrains feasibility

Figure 6.1. Applied positioning framework for MOOS.

6.2.1 Process logic

After the design task had been bounded, the refined framework from Chapter 5 was translated into a design brief. That brief defined what the design phase had to address: the activities between shelf event and store action, the actor positions around those activities, the links that could break, the alignment issues that could block adoption, and the internal readiness conditions that MOOS had to consider.

Co-creation was then used as a design intervention. It did not function as a third empirical dataset or as validation. Its role was to help translate the diagnosis into route choices around role boundaries, partner responsibilities, sequencing, and what MOOS can credibly own. These are design questions, but they are also ecosystem questions.

The process moved from framework to design brief, from design brief to co-creation, and from co-creation output to synthesis, criteria, ideation, comparison, and roadmapping. Figure 6.2 helps explain the role of each step. The roadmap did not come directly out of the workshop. It was built through a sequence of translation, exploration, comparison, and synthesis.

Figure 6.2 shows how the refined diagnosis was translated into the pre-validation roadmap. The figure separates diagnostic input, co-creation input, design criteria, positioning development, weighted comparison, and roadmapping. This is important because the roadmap was not taken directly from the workshop, but developed through several design translation steps.

6.2.2 Role of co-creation

Co-creation was used to translate, test, and structure route logics. It did not decide the final strategy on its own. The earlier context analysis, literature review, and empirical results remained the main basis for the design direction. The sessions helped make trade-offs visible, especially around proposition depth, repeatability, partner links, ownership boundaries, and internal readiness.

The process also developed through iteration. An initial workshop setup was tested in a pilot. That pilot showed that the first format was too abstract and too focused on binary distinctions, such as light versus deep integration, or theft versus OSA. Those distinctions were useful, but they did not yet help enough in designing a route forward.

The actual co-creation sessions were therefore adjusted. Instead of asking participants to complete a near-final roadmap, the sessions focused on route conditions, actor responsibilities, ownership boundaries, future role framing, and what MOOS should not try to own.

In practical terms, the co-creation material was documented through completed canvases, notes, and clustered discussion points. These outputs were reviewed after the sessions and grouped around recurring themes: future role, current proof, route tensions, ownership boundaries, and no-regret moves. This synthesis was then used to shape the design criteria in Section 6.4 and the positioning elements in Section 6.6.

The Delft Design Guide places ideation after the design problem and first requirements have been defined, and treats idea generation as a divergence step before selection begins (van Boeijen et al., 2020). The design phase in this thesis follows that pattern. The problem was framed first. The option space was then opened. Only later was a preferred initial direction selected.

6.3 Co-creation outputs as design input

6.3.1 Future role and current anchor

The co-creation process did not produce a ready-made roadmap. Its value was that it helped translate the diagnosis into design choices. The sessions clarified which future role seemed plausible for MOOS, where the strongest tensions sat, and which moves appeared useful across more than one possible route.

A first cluster concerned future role framing. Across the material, MOOS was positioned between shelf event and store action. The most stable direction was that MOOS could move toward a shelf intelligence and trigger layer for store operations. In that role, MOOS would own sensing, event logic, and the translation from shelf event to trigger. It would not own the retailer's full workflow system or enterprise architecture.

A second cluster concerned the current proof base. The current travel retail case was treated as a relevant starting point because it already shows trigger-based alerting in a live retail context. At the same time, it was not treated as proof for the full roadmap. It gave the design phase a credible starting position, but not a validated future strategy.

6.3.2 Route tensions

The strongest tension concerned what should be strengthened first. One logic pushed toward proposition deepening. In that line of thinking, MOOS would move more quickly toward richer theft logic, better diagnostics, and, later, selected on-shelf availability support. Another logic prioritises repeatability first, with an emphasis on signal reliability, easier installation and configuration, a lower support burden, and a more partner-ready operating model.

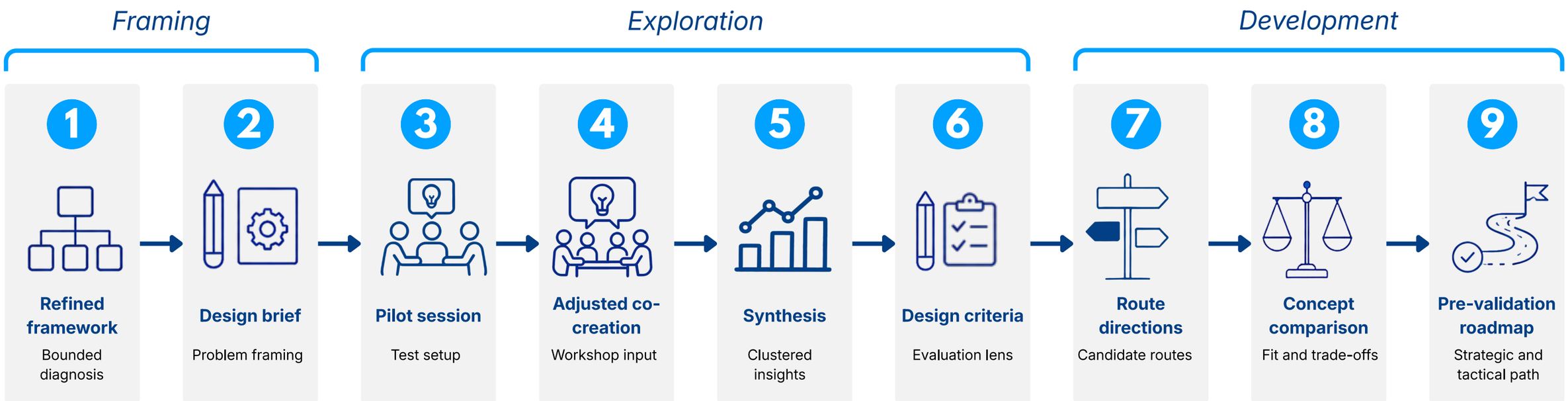


Figure 6.2. Design process from refined framework to roadmap.

Both logics remained plausible, but neither solved the problem on its own.

Depth formed a second tension. The sessions did not support a simple choice between shallow and deep. A more selective view appeared instead. Some deeper links may become necessary, especially where physical infrastructure, ESLs, camera analytics, or specific partner configurations add value to the route. Other interfaces should remain lighter for longer. Embedding is therefore not a yes-or-no choice. It depends on where depth creates enough value, and where it mainly creates dependency.

6.3.3 Boundary decisions and no-regret moves

The sessions also pointed to no-regret moves: stronger signal reliability, easier configuration, change history and rollback logic, clearer partner roles, and less first-line support dependence on MOOS. These moves do not decide the full strategy. They matter because they reduce adoption-chain risk across several routes. If installation, configuration, support, and responsibility remain unclear, even a strong proposition becomes difficult to repeat.

The boundary decisions were just as useful. Co-creation did not support a move into a broad retailer platform role. It also did not support solving for theft, OSA, engagement, and general store improvement simultaneously. The sessions opened the design work, but they also narrowed it.

Figure 6.3 summarises the co-creation output as design input. It clusters the material into future role framing, current proof base, route tensions, boundary decisions, and no-regret moves. The figure is used to show how the sessions informed the design criteria and positioning elements, not to present the sessions as validation evidence.

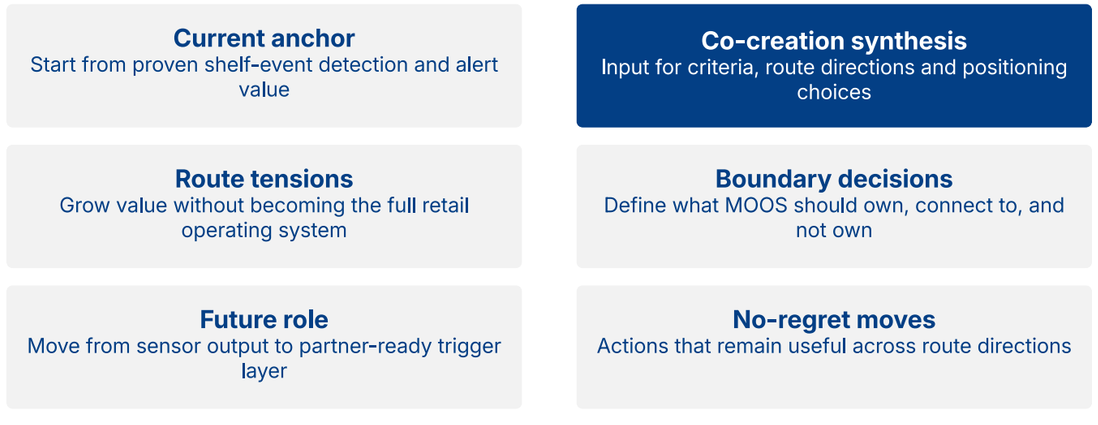


Figure 6.3. Co-creation output synthesis.

6.4 Design criteria

6.4.1 Purpose of the criteria

The design inputs needed one more step before concept development could begin. They had to be translated into criteria for comparing strategic directions. Without that step, the later selection would remain too intuitive.

The criteria are not general design requirements. They translate the diagnosis into design judgement. Each criterion connects back to a specific issue from the framework or Chapter 5: the focal value proposition, store actionability, ecosystem links, route to scale, partner dependence, and internal readiness. They also help the roadmap answer the research question more directly by connecting the preferred direction to market focus, use case focus, ecosystem role, partner logic, and internal readiness.

6.4.2 Criteria used for comparison

Strategic fit is the first criterion. A stronger route positions MOOS as a shelf-sensing component provider with a clear role in the ecosystem. It should strengthen MOOS in the chain between shelf reality and action, without pushing the company into a role that the research does not support.

Store actionability forms the second criterion. Chapter 5 shows that the value in store depends on reliable signals, timely action, and a low extra burden for staff. A route that creates richer data but weak actionability performs poorly here. The same applies to a route that creates too much maintenance or alert fatigue.

A third criterion is ecosystem fit. Theft and on-shelf availability do not follow the same route through the ecosystem. A stronger concept respects that difference. It should also make room for surrounding actors, such as ESL providers, camera analytics systems, POS systems, workflow tools, and shelf infrastructure partners, without assuming that MOOS should own all of these layers.

A route to scale is also needed. A concept should have a believable path from pilot to repeated deployment, continued use, and broader rollout. That includes installation, support, partner logic, and the extent to which daily operation remains dependent on MOOS.

Partner dependence adds another lens. Some partner depth may be needed, but the route should avoid locking MOOS too early into a narrow dependency structure. This criterion is especially relevant when considering links with ESLs, cameras, POS systems, and workflow tools, because each connection can strengthen the proposition but also add dependency.

Internal capability fit concerns whether the route can be built from the current situation. A path that only works if MOOS already has mature support, deployment, and partner structures is not a convincing design outcome.

The final criterion is future option value. MOOS should not remain stuck in thin alerting. Over time, it needs a path toward a more distinct and defensible role. That path still has to stay bounded.

Table 6.2 shows the criteria used to compare the positioning themes. The table connects each criterion to the research logic behind it, so that the preferred direction can be traced back to the diagnosis rather than presented as a personal design preference.

Criterion	*Definition*	*Research logic behind the criterion*
Strategic fit	The route should position MOOS as a shelf-sensing component provider with a clear role in the retail technology ecosystem.	The thesis question concerns positioning, not only product development. The route should strengthen MOOS's role without turning the company into a full retailer platform.
Store actionability	The route should help turn shelf events into reliable, timely, and usable store action.	Chapter 5 shows that store value depends on reliable signals, speed to action, and a low extra burden for staff.
Ecosystem fit	The route should match the dependency patterns around different use cases and actors.	Loss prevention and OSA do not follow the same ecosystem route. A strong direction should respect that difference.
Route to scale	The route should have a believable path from pilot to repeated deployment and continued use.	The findings show that value does not only depend on the first pilot. Installation, support, partner roles, and repeated rollout also shape feasibility.
Partner dependence	The route should use partners where needed, but avoid locking MOOS too early into narrow or risky dependencies.	MOOS depends on surrounding actors, but too much dependency can reduce flexibility and increase coordination risk.
Internal capability fit	The route should be ambitious enough to move MOOS forward, but still buildable from the current company situation.	A route that assumes mature support, deployment, partner, or integration capabilities too early would not be realistic.
Future option value	The route should keep a path open toward a stronger long-term position.	Remaining a thin alerting layer would be too weak, but moving too broadly too early would also go beyond the research findings.

Table 6.2. Design criteria used to compare positioning directions

6.5 Future vision

6.5.1 Vision statement

After the design brief, process logic, co-creation synthesis, and criteria had been made explicit, the chapter moved to a future vision. The vision is not used as a slogan. It acts as a strategic destination for the route directions that follow.

The future vision developed in this chapter is:

MOOS should become the shelf intelligence and trigger layer for store operations, known for reliable shelf sensing that increasingly operates without supervision.

This vision also defines what MOOS should not become. MOOS should not try to become the retailer's full operating system, the owner of all store workflows, or the central platform for every shelf-related problem. Those roles would require control over activities, systems, and organisational routines that sit outside MOOS's current position. The stronger design choice is more bounded: MOOS owns the sensing, event logic, trigger logic, and selected diagnostics around the shelf, while connecting to other systems only where this improves store action.

6.5.2 Boundary of the future role

The vision is ambitious, but still bounded. It does not describe MOOS as the retailer's central platform. Full workflow systems, enterprise resource planning, and the wider store operating model remain outside the intended role.

MOOS's future role sits closer to the shelf event itself. It owns sensing, event logic, the translation of shelf events into triggers, and selected diagnostics for that layer. Broader store action still depends on surrounding systems and partners.

This also clarifies the role of collaboration. ESLs may help connect shelf signals to shelf communication or pricing infrastructure. Camera analytics may add context for specific events. POS data may strengthen theft diagnostics. Workflow tools may help translate OSA signals into tasks. These layers can support MOOS's role, but they do not change the intended boundary. MOOS remains the trigger layer around shelf events, not the owner of the whole store technology architecture.

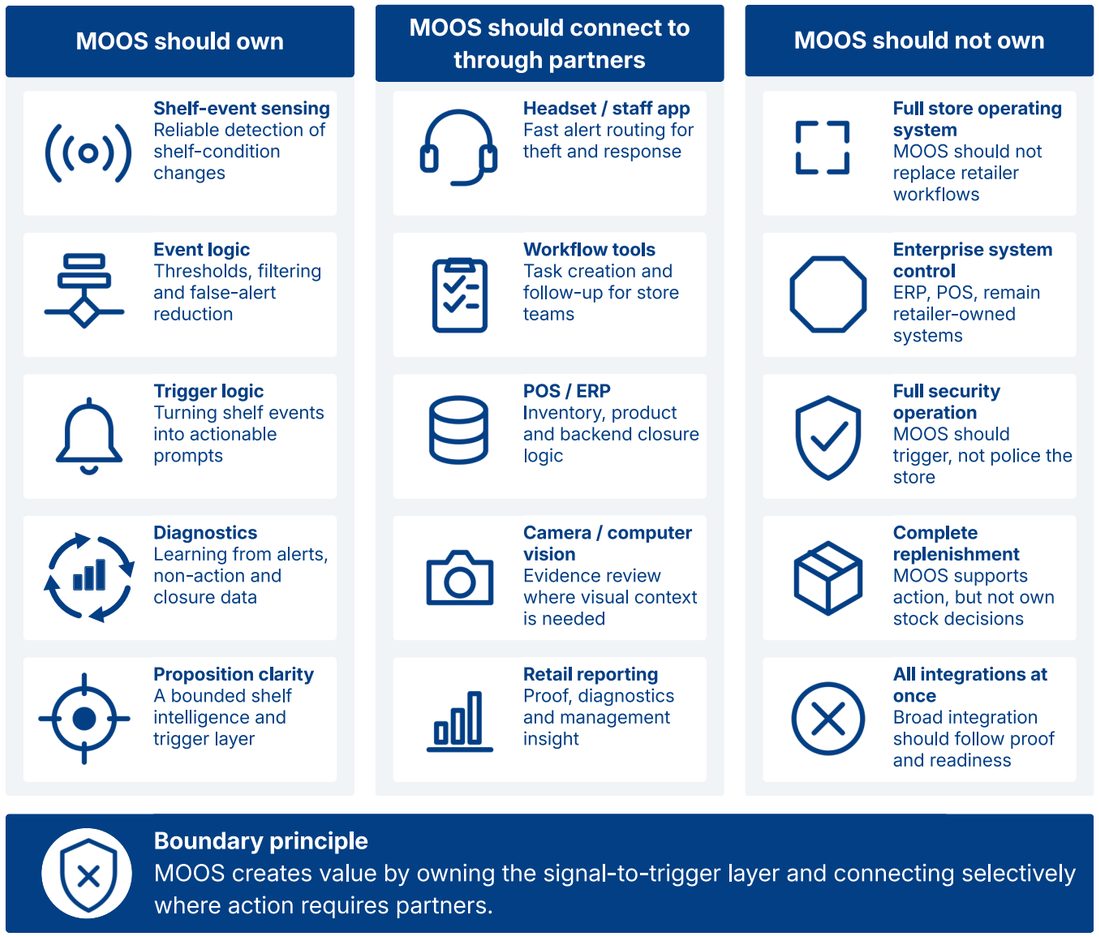


Figure 6.4. Future vision boundary map.

6.5.3 Reading "without supervision"

The phrase "increasingly operates without supervision" needs careful interpretation. It does not mean fully autonomous operation in the short term.

In this chapter, the phrase refers to a gradual move toward less setup work, less manual correction, fewer support interventions, and a more repeatable deployment model. In later horizons, it points to lower support burden, clearer partner involvement, and stronger deployability across sites.

The market side of the vision is also bounded. Theft, on-shelf availability, engagement, and related shelf intelligence opportunities remain visible, but not equally early. The near-term position is not "all shelf problems for all retailers." It is a focused move from trusted trigger-based alerting toward a stronger action layer in contexts where the dependency pattern remains manageable.

Figure 6.4 on the left page shows the boundary of MOOS's intended future role. It separates what MOOS should own, what it may connect to through partners, and what should remain outside its role. This helps prevent the future vision from being read as a move toward full retailer platform ownership.

6.6 Ideation and development of positioning directions

6.6.1 Opening the option space

The design phase did not begin with three fixed concepts. It began with a broader option space. That distinction is important because Chapter 5 had narrowed the problem, but had not yet justified one preferred direction.

Four inputs shaped this option space: the applied positioning framework from Chapter 5, the design brief and its boundaries, the co-creation outputs, and the design criteria from Section 6.4. Together, these inputs made the problem concrete enough to generate alternatives. They showed what kind of role MOOS may plausibly aim for, where the main tensions sit, and which limits should not be crossed. The ideas generated in this step were treated as design material rather than as new empirical findings.

A structured ideation step was used to move from a bounded problem to possible positioning directions. The Delft Design Guide describes methods such as brainstorming, brainwriting, brain drawing, SCAMPER, and the morphological chart as ways to generate alternatives after the design problem and first requirements have been defined (van Boeijen et al., 2020). In this thesis, these methods were used as design prompts to open and organise the option space. They were not treated as separate formal workshops, but as a structured way to make the reasoning from findings to positioning options more traceable.

The main ideation material is summarised in this section. The full SCAMPER exploration and morphological chart are included in Appendix G. These appendix materials show how individual ideas were generated, combined, and reduced before being translated into the positioning themes used in Section 6.7. This keeps the main chapter focused on the design reasoning, while still making the underlying ideation steps visible.

Table 6.3 on the next page shows how the option space was opened and organised. The table is not meant to prove the preferred direction on its own, but to show that the design phase did not move directly from Chapter 5 findings to a roadmap. The methods helped generate possible positions for MOOS around markets, use cases, partners, integration depth, deployment, and role definition. The more detailed SCAMPER and morphological chart outputs are provided in Appendix G.

6.6.2 Broad generation and SCAMPER exploration

SCAMPER was used to challenge the first idea pool in a more structured way. The method asks what can be substituted, combined, adapted, modified,

Ideation step	*How it was used in this thesis*	*Output for the design phase*
Brainstorming	Used to quickly open possible roles, use cases, markets, and partner routes for MOOS without judging them immediately.	A broad first pool of positioning ideas, including theft alerts, OSA, partner deployment, shelf compliance, and engagement-related signals.
Brainwriting	Used to reduce the risk that the most obvious route, theft-first alerting, would dominate the option space too early.	Additional ideas around repeatability, support burden, workflow links, ESl or camera collaboration, and future market sequencing.
SCAMPER	Used as a structured prompt to question what MOOS could substitute, combine, adapt, modify, put to another use, eliminate, or rearrange in the shelf sensing ecosystem.	More varied positioning elements, especially around replacing manual checks, combining with POSor camera layers, and avoiding unnecessary platform ownership.
Brain drawing and system sketching	Used to visualise where MOOS could sit between shelf events, staff action, partner systems, and retailer systems.	A clearer distinction between light trigger routes, selected integration routes, and deeper embedded routes.
Morphological chart	Used to combine variables such as market focus, use case focus, integration depth, partner connection, and MOOS role.	A set of possible route combinations, rather than three fixed concepts.
Clustering	Used to group individual ideas into broader positioning themes.	Five main themes: market sequencing, use case sequencing, selective partner connection, repeatable deployment, and role definition.
Weighted objective method	Used to compare positioning elements against the design criteria from Section 6.4.	A composed preferred direction, rather than one winning concept.

Table 6.3: Structured ideation methods used to open and organise the positioning space.

put to another use, eliminated, or rearranged (van Boeijen et al., 2020). In this thesis, these prompts were applied to the positioning problem rather than to one product feature.

The exercise helped sharpen several design choices. The substitution prompt made clear that MOOS should not replace the retailer's full operating system, but could replace part of the current store blindness around shelf events. The combination prompt opened partner directions, including POS data, workflow tools, ESLs, camera analytics, and shelf-edge or fixture infrastructure. These were not treated as mandatory integrations. They were considered possible links where they could improve actionability or reduce deployment problems.

The adaptation prompt supported a staged market route. Travel and Duty Free remained the current proof base, while Health and Beauty and drugstore appeared closer to the current theft-sensitive trigger logic than immediate grocery expansion. Grocery stayed relevant, but as a later and more conditional context because OSA depends more heavily on workflow, planning, store routines, and system coordination, as shown in Chapter 5.

The elimination and rearrangement prompts were especially useful for setting boundaries. They helped clarify that MOOS should avoid full workflow ownership, broad retailer platform ownership, and solving all shelf-related use cases at the same time. They also supported the idea that repeatability should be strengthened early, before deeper integrations become central.

6.6.3 System sketching and morphological chart

The morphological chart was used to organise the option space after the first ideas had been generated. This method is useful when a design direction depends on several connected choices rather than one isolated decision (van Boeijen et al., 2020). For MOOS, the relevant variables included market sequence, use case focus, action route, integration depth, partner connection, deployment logic, support model, and ownership boundary.

The chart showed that not all combinations were equally coherent. Travel retail, trusted alerting, light theft logic, and staff alert routing formed a realistic early route because they stayed close to the current proof base. Workflow-linked on-shelf availability and grocery created a heavier route because they required stronger links with store routines, planning systems, and task ownership. Partner links such as ESLs, camera analytics, POS data, workflow tools, and fixture partners were useful only when they supported the route. They were not strong enough to become a strategy by themselves.

This made the next step clearer. The preferred direction could not be built from one single idea. It had to combine market sequencing, use case sequencing, selective partner connection, repeatable deployment, and a bounded role for MOOS. The full morphological chart is included in Appendix D.2.

6.6.4 Initial positioning elements

The initial idea pool was wider than the final direction. It included trusted alerting in travel retail, theft-first trigger logic, richer theft diagnostics, basic OSA support, workflow-linked on-shelf availability, partner-ready deployment logic, selective workflow or task system connection, stronger physical shelf embedding, collaboration with ESL or camera layers, shelf compliance or brand execution support, and engagement or display-quality related shelf signals.

Not all ideas operate at the same level. Trusted alerting in travel retail is both a market and a use case idea. Workflow-linked OSA is mainly an integration and action logic. Partner-ready deployment concerns route to scale. Collaboration with ESLs or cameras concerns partner connection. Shelf compliance and engagement are adjacent opportunity areas. Making this difference explicit was necessary before the ideas could be grouped.

6.6.5 From positioning elements to themes

The ideation step did not lead to separate concepts, and forcing the output into that format would make the design process look cleaner than it actually was. The ideas were better understood

Initial positioning element	*Strategic logic*	*Main category*	*Role in convergence*
Trusted alerting in travel retail	Build from the current Avolta-based proof point, where shelf events can already be routed into store action.	Market focus and use case focus	Core starting point
Theft-first trigger logic	Start with LP, as it can begin with lighter alert routing and clearer immediate value.	Use case focus	Core starting point
Richer theft diagnostics	Move beyond basic alerts by interpreting theft-related shelf events more deeply over time.	Use case focus and proposition depth	Staged deepening
POSsupported theft logic	Link shelf events to transaction data where this improves theft interpretation and evidence.	Integration logic and proposition depth	Staged deepening
Camera-assisted incident review	Use camera layers selectively to enrich interpretation of high-risk shelf events.	Partner logic and diagnostics	Staged or partner-based option
Basic OSA support	Add simple availability signals where this can be done without heavy workflow or planning integration.	Use case focus	Later supporting route
Workflow-linked OSA	Connect shelf signals to store tasks or routines when OSA requires structured action.	Integration logic	Later staged route
ESL or shelf-edge collaboration	Explore collaboration with ESl or shelf-edge infrastructure actors to improve deployment, shelf fit, or data connectivity.	Partner logic and integration logic	Selective partner connection
Partner-ready deployment logic	Make installation, configuration, support, and role division easier to repeat across sites.	Route to scale	Core enabling condition
Selective workflow or task system connection	Connect to workflow systems only where the use case clearly needs it.	Integration logic	Selective connection
Stronger physical shelf embedding	Improve the fit between MOOS sensing, fixtures, and shelf infrastructure where this reduces deployment or reliability problems.	Integration logic and partner logic	Selective embedding
Shelf compliance or brand execution support	Use shelf sensing to support visibility around display quality, product presence, or execution, without making this the main route yet.	Adjacent opportunity	Background option
Engagement or display-quality signals	Explore whether product interactions or display signals could be useful later, while keeping the main route focused on in-store action.	Adjacent opportunity	Background option
Grocery-first OSA route	Enter grocery early through availability logic and planning links.	Market focus and integration logic	Deprioritised for the near term

Table 6.4: Initial positioning elements for MOOS.

as positioning elements. Some were concerned about where MOOS should start. Others are concerned about what kind of value it should deepen, which partners it should connect to, and how repeatable deployment should become.

The ideas were therefore clustered into five main positioning themes. Market sequencing concerns the order in which MOOS should move from Travel and Duty Free toward Health and Beauty, drugstore, and possibly selected grocery contexts. Use case sequencing concerns the order in which trusted alerting, theft logic, diagnostics, OSA, and adjacent opportunities should develop. Selective partner connection concerns the roles of ESLs, cameras, POS systems, workflow tools, and fixture partners. Repeatable deployment includes installation, configuration, support, rollback logic, quality assurance, and partner readiness. Role definition concerns the position MOOS should aim to hold in the ecosystem.

These themes create the bridge into the comparison step. They are not finished concepts. They are structured positioning elements that can be assessed against the criteria from Section 6.4. The preferred direction in Section 6.7 is therefore not chosen as one complete concept. It is composed from the strongest and most compatible elements.

Positioning theme	*Ideas Included*	*Main question*	*Role in the design direction*
Market sequencing	Trusted alerting in Travel and Duty Free, Health and Beauty fit validation, drugstore exploration, and later grocery entry.	Where should MOOS build proof first, and which segments should come later?	Starts the roadmap from the current proof base and avoids entering heavier contexts too early.
Use case sequencing	Theft-first trigger logic, richer theft diagnostics, basic OSA support, and workflow-linked OSA.	Which use cases are most feasible early, and which need more system maturity?	Places theft and trusted alerting earlier, while treating OSA as a staged route.
Selective partner connection	Collaboration with ESls, camera layers, workflow systems, POSsystems, and fixture partners.	Which partners can strengthen the route, and where would a partnership create too much dependency?	Makes partner connection part of the strategy, but only where it supports actionability and repeatability.
Repeatable deployment	Partner-ready deployment logic, configuration templates, clearer support roles, rollback logic, and installation rules.	How can MOOS move from pilot logic to repeated use across sites?	Becomes a core condition for moving beyond the first proof cases.
Role definition	Shelf sensing component, trigger layer, diagnostic layer, selected connector to wider systems.	What should MOOS own, and what should remain outside its role?	Leads to the preferred role of a partner-ready shelf intelligence and trigger layer.
Adjacent option space	Shelf compliance, brand execution, engagement, and display-quality related signals.	Which ideas might prove useful later without diverting from the main route now?	Keeps future options visible while preventing the strategy from becoming too broad.

Table 6.5: Clustering of initial positioning elements into positioning themes.

6.7 Weighted comparison and preferred direction

6.7.1 Purpose of the weighted objective method

After the positioning themes had been developed, they were compared using a weighted objective method. The method was used as a decision-support tool, not as mathematical proof. Its value lies in making the judgement process visible. The design problem contains qualitative choices, so the scoring cannot be fully objective. Still, a structured comparison is stronger than selecting a direction only by intuition.

The method was applied to positioning elements rather than to finished concepts. This fits the logic of Section 6.6. The ideation work did not produce three product concepts. It produced a set of possible positioning elements that had to be combined carefully.

The criteria came from Section 6.4: strategic fit, store actionability, ecosystem fit, route to scale, partner dependence, internal capability fit, and future option value. The weights were assigned based on how directly each criterion contributed to answering the main research question and addressing the bottlenecks found in Chapter 5. Strategic fit and store actionability received the highest weight because the thesis asks how MOOS can position itself around actionable shelf insight, not only how it can add more features. Partner

Criterion	*Weight*	*Why this criterion matters*
Strategic fit	20%	Measures whether the element helps answer the main research question by positioning MOOS around actionable shelf insight rather than loose feature expansion.
Store actionability	20%	Measures whether the element helps shelf data become usable store action through reliable, timely, and low-burden signals.
Ecosystem fit	15%	Measures whether the element fits the dependency patterns found in the ecosystem, especially the difference between LP and OSA.
Route to scale	15%	Measures whether the element can support repeated deployment beyond single pilots.
Partner dependence manageability	10%	Measures whether the element creates partner dependence that can be managed without locking MOOS too early into one route.
Internal capability fit	10%	Measures whether the element can be developed from MOOS's current position without assuming capabilities that are not yet in place.
Future option value	10%	Measures whether the element maintains an open path toward a stronger future role beyond merely alerting.

Table 6.6: Criteria, weights, and rationale used in the weighted objective method.

dependence and internal capability fit were used as feasibility checks, because even a strong direction becomes weak if MOOS cannot deliver it from its current position.

6.7.2 Scoring the positioning themes

The positioning themes were scored against the weighted criteria. A five-point scale was used, where 1 indicates a weak fit and 5 indicates a strong fit. The scoring should be read as a structured design judgement, not as an exact measurement. Its main purpose is to show why some themes become core parts of the preferred direction, why others are staged, and why adjacent ideas are not allowed to drive the main route.

Market sequencing scored strongly because it keeps the roadmap grounded. Travel and Duty Free build from the current Avolta-based proof. Health and Beauty and drugstore create a more plausible adjacent path than immediate grocery expansion. Grocery remains relevant, but the findings in Chapter 5 suggest that its dependency structure is heavier. For that reason, grocery is treated as a later and more selective move.

Use case sequencing also scored strongly. Trusted alerting and theft-first trigger logic fit the current proof base and can start through lighter routing. Richer theft diagnostics add depth, but only after the basic trigger route stabilises. On-shelf availability remains important, yet it needs more careful staging because workflow and planning links are more demanding. Engagement, shelf compliance, and brand execution scored lower as core directions. They may become useful later, but

Positioning theme	*Strategic fit 20%*	*Store action-ability 20%*	*Ecosystem fit 15%*	*Route to scale 15%*	*Partner dependence manageability 10%*	*Internal capability fit 10%*	*Future option value 10%*	*Weighted score*	*Design decision*
Market sequencing	5	4	5	4	4	4	4	4.35	Core roadmap logic
Use case sequencing	5	5	5	4	4	4	4	4.55	Core roadmap logic
Selective partner connection	4	4	5	3	3	3	4	3.80	Include selectively and stage over time
Repeatable deployment	5	5	4	5	4	4	3	4.45	Core enabling condition
Role definition	5	5	5	4	4	4	5	4.65	Core identity of preferred direction
Adjacent option space	2	2	3	2	3	3	4	2.55	Keep visible, but do not let it drive the strategy

Table 6.7: Weighted comparison of positioning themes.

they do not answer the main positioning problem as directly.

Selective partner connection received a mixed score. Collaboration with ESI providers, camera layers, POS systems, workflow tools, and fixture partners can strengthen MOOS's role. At the same time, deeper partner links create dependency. The comparison, therefore, does not support a general “partner with everything” logic. It points to selective connection: connect where the use case requires it, keep interfaces lighter where possible, and avoid making a single partner category the entire route.

Repeatable deployment scored high across several criteria. It supports route-to-scale, internal capability fit, and store actionability. This result fits the findings from Chapter 5 and the co-creation synthesis. Signal reliability, easier configuration, rollback logic, support structure, and clearer partner roles are not small operational details. They are conditions for making the position repeatable.

Role definition became the strongest organising element. A partner-ready shelf intelligence-and-trigger layer scored better than broader platform ownership or narrow sensor-only positioning. A sensor-only role would keep MOOS too thin. A full platform role would go beyond the evidence and the company’s current position. The trigger-layer role sits between those extremes. It gives MOOS a clearer position on shelf-event interpretation and action triggers, while leaving broader workflow and enterprise ownership to other actors.

6.7.3 Interpreting the comparison

The highest-scoring elements were not the most spectacular ideas. They were the elements that best connected current proof, store actionability, ecosystem fit, and route to scale. This outcome suggests that the strongest direction for MOOS is not to move as fast as possible into the broadest proposition, nor to remain only a simple alert provider.

A few ideas were kept, but with a different status. Engagement, display quality, and brand execution stayed as adjacent possibilities. They can be explored by strengthening the same trigger-layer logic, but they should not define the main route. Collaboration with ESLs, cameras, workflow tools, and POS systems also stayed in the direction of possible connection layers. The comparison showed, however, that these connections should be staged and selective rather than treated as immediate deep integrations.

The comparison also confirmed a tension from the co-creation synthesis. MOOS needs proposition depth, but not at the cost of becoming too custom too early. It also needs repeatability, but not in a way that keeps the company stuck in thin alerting. The preferred direction, therefore, has to combine both logics.

Source theme	*What is taken into the preferred direction*	*What is limited or delayed*
Market sequencing	Travel and Duty Free form the starting point. Health and Beauty and drugstore are treated as adjacent directions. Selected grocery entry remains possible later.	Grocery is not treated as an immediate main route because it brings heavier workflow, planning, and system dependencies.
Use case sequencing	Trusted alerting and theft-first trigger logic form the early use case base. Richer theft diagnostics and selected OSA can be added later.	OSA is not pushed directly into deep workflow or planning links.
Selective partner connection	ESL providers, camera analytics, POS systems, workflow tools, and fixture partners remain possible connection layers.	No single partner category becomes the whole route. Not every link needs to become deep at the same time.
Repeatable deployment	Reliability, configuration, rollback logic, support structure, and partner readiness become early conditions for the route.	Proposition deepening is not allowed to create too much custom work too early.
Role definition	MOOS positions itself as a partner-ready shelf intelligence and trigger layer for store operational action.	MOOS does not become the retailer’s full platform, workflow owner, POS owner, ERP owner, or store operating system owner.
Adjacent option space	Shelf compliance, brand execution, engagement, and display-quality signals remain visible as later options.	These ideas do not define the main direction in the near term.

Table 6.8: Composition of the preferred positioning direction from the strongest positioning themes.

6.7.4 Preferred positioning direction

The preferred direction can be described as follows: MOOS should position itself as a bounded, partner-ready shelf intelligence and trigger layer between shelf reality and store action. This direction builds on the current travel retail proof base, strengthens repeatability early, and deepens the proposition in staged and selective ways.

The preferred direction is composed from the strongest positioning themes. It does not copy one theme directly. Instead, it combines the early focus of market sequencing, the action focus of use case sequencing, the caution of selective partner connection, the feasibility of repeatable deployment, and the bounded role definition.

This composition fits the available material better than a pure route. Staying with basic alerting would keep MOOS too close to a thin component role. Moving straight into broad platform ownership would go beyond the current proof base and the company’s position. Deepening every integration at once would also create too much dependency. The preferred direction sits between these extremes. It starts from what MOOS can credibly show, then builds toward a stronger trigger-layer role without claiming ownership of the whole retailer architecture.

The design choice is therefore specific: MOOS should build a bounded, partner-ready trigger-layer position. It should deepen where this improves store action, reduces uncertainty, or helps repeated deployment. It should stay lighter where deeper ownership would create more complexity than value.

Figure 6.5 shows how the broad positioning elements were narrowed into five themes, compared against the design criteria, and combined into the preferred direction. The figure is relevant because it makes the convergence step visible. The preferred direction is not chosen as one finished concept, but composed from the strongest and most compatible elements.

6.7.5 Design consequences for the roadmap

The preferred direction has direct consequences for the initial roadmap. The roadmap cannot treat all markets, use cases, and partner links as equally near. It has to show a staged path from current proof toward a stronger but still bounded position.

First, market entry needs sequence. Travel and Duty Free remain the starting point because this is closest to MOOS’s current proof base. Health and Beauty and drugstore can follow as adjacent contexts. Grocery remains relevant, but it is placed later because Chapter 5 showed that OSA, planograms, workflow routines, and system links create heavier dependencies.

Second, the roadmap needs different use case speeds. Theft can develop earlier because it fits trigger-based action and lighter alert routing. OSA develops more slowly because it often depends on workflow, planning, store routines, and system coordination. Engagement and display-quality signals remain background options unless they support the same trigger-layer role.

Third, partner links need to be staged. ESL providers, camera analytics, POS systems, workflow tools, and fixture partners may all become relevant, but not all of them need deep integration from the start. Some links can remain light. Others only become useful when they

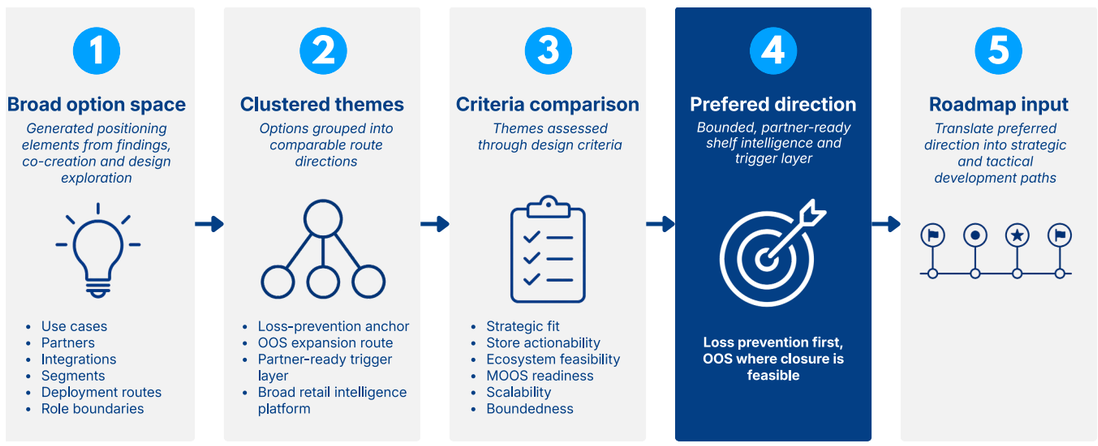


Figure 6.5. Convergence from positioning elements to preferred direction.

improve actionability or make deployment easier to repeat.

Finally, repeatability needs to start early. Reliability, configuration, rollback, remote support, quality assurance, and partner roles are not only operational details. They determine whether the initial position can be repeated beyond the first cases. For that reason, these elements have to appear in the roadmap before the proposition becomes deeper.

6.8 Strategic roadmap and time pacing

6.8.1 Reading the roadmap through horizons

The preferred direction from Section 6.7 needs a time structure before it can guide action. MOOS cannot move directly from its current proof base to the future vision. Market focus, use case depth, partner links, integration choices, and internal readiness need to develop over time.

The strategic roadmap in this chapter is therefore an initial, pre-validation design output. It translates the preferred direction into a staged route that can be discussed and tested in Chapter 7. The roadmap should not be read as a confirmed implementation plan. It shows the intended reasoning before validation: where MOOS starts, what it needs to prove first, and where deeper positioning may become possible later.

The current state is treated as the starting point rather than as Horizon 1. MOOS has a real but still narrow proof point in Travel and Duty Free, especially through the Avolta case. Its current role is closer to trusted shelf-event sensing and trigger-based alerting than to a broader store operational layer.

Horizon 1 is the first proposed stage in the pre-validation roadmap. Its purpose is to prove and repeat. Travel and Duty Free remain the main context, while Health and Beauty can enter as an adjacent context for fit validation. This horizon remains close to what MOOS can credibly do based on its current proof base. The main question is whether MOOS can turn trigger-based action into a more repeatable offer with a lower support burden.

Horizon 2 covers roughly 2028 to 2030. The emphasis shifts toward deepening and adjacent expansion. Health and Beauty and drugstore become more credible routes, while selected integrations become more relevant. Theft can move toward richer diagnostics supported by POS data. Selected OSA routes can also move toward workflow-linked use where feasible. In this horizon, MOOS starts to move from narrow trigger logic toward a clearer trigger-layer role.

Horizon 3 covers roughly 2030 to 2032. Selective embedding and broader maturity become more realistic here. Earlier segments do not disappear. Instead, the route becomes deeper and more stable. Selected grocery entry may become possible, but only where earlier proof, partner readiness, and MOOS's support model justify the added dependency. By this stage, MOOS needs to be clearer about where deeper links are worth the trade-off and where lighter connections remain better.

Beyond Horizon 3 sits the future vision. This future role remains bounded: MOOS becomes the shelf intelligence and trigger layer for store operations, known for reliable shelf sensing that increasingly operates without supervision. The future vision functions as a strategic destination beyond the detailed roadmap period, not as a fully specified fourth implementation horizon.

6.8.2 Strategic roadmap

The strategic roadmap translates the horizon logic into a visual overview. It shows how MOOS's position develops from the current proof base toward the future vision. The figure should be read from left to right, starting with the current state and moving through Horizons 1, 2, and 3, and ending with the future vision.

Figure 6.6 shows the initial strategic roadmap developed before validation. The figure translates the design synthesis into a staged direction for MOOS, starting from the current proof base and moving toward a bounded shelf intelligence and trigger-layer role. It is used as input for Chapter 7, where the roadmap logic is tested and revised.

The rows show what changes across the proposed stages: the strategic goal, the segment and use case focus, MOOS's role and offering, the technology and partner direction, and the proof or decision gate for each horizon. The roadmap is not a fixed project plan or a validated rollout plan. It shows the initial sequence that will be assessed in Chapter 7.

6.9 Tactical roadmap

6.9.1 Purpose of the tactical roadmap

The strategic roadmap shows the initial positioning direction for MOOS. The tactical roadmap shows what has to develop underneath that direction. It is not a project plan. It is also not a validated implementation plan. At this stage of the thesis, it should be read as a pre-validation design output that makes the main workstreams, dependencies, and decision points visible.

Figure 6.7 shows the workstreams behind the initial roadmap, including market development, use-case development, product capability, partner and integration logic, deployment, and decision gates. The figure is relevant because it makes the dependencies underneath the strategic roadmap visible. It is used as input for the validation in Chapter 7.

The figure should be read from left to right. The bars show when a workstream starts, when it becomes more important, and where it depends on earlier proof. Some workstreams continue across several horizons. This is intentional. Travel and Duty Free do not stop when Health and Beauty is explored. Reliability work does not stop when integration work begins. Trusted alerting does not disappear when richer theft diagnostics are added.

6.9.2 Market and customer development

Market development starts with Travel and Duty Free because this is closest to MOOS's current proof base. The Avolta case gives MOOS a live example of shelf events being translated into store action, but it should not be treated as proof that the full roadmap is already valid. In the initial roadmap, this case is used as a starting point for learning and repetition.

Health and Beauty enters as an adjacent context for fit validation. This does not mean immediate expansion. It means testing whether similar trigger-based value can work in a segment with theft-sensitive and high-value products. Drugstore follows later, because it is close to Health and Beauty but should not compete too early with the first expansion route.

Grocery remains a longer-term option. Based on Chapter 5, grocery appears harder to enter early because OSA depends more on workflow routines, planograms, planning systems, and store-level coordination. For that reason, the tactical roadmap treats grocery as later and conditional, not as the first route to scale.

6.9.3 Use case development

The use case sequence follows the asymmetry found in Chapter 5. Theft-related use cases can develop earlier because they fit more easily with trigger-based action. A shelf event can lead to a staff alert, a headset message, or later a theft-related diagnostic. This path still needs careful testing, but it does not require the same level of workflow and planning integration as OSA.

OSA develops more slowly. Basic availability signals can be explored earlier, but workflow-linked OSA requires stronger connections to store routines and task systems. The initial roadmap therefore keeps OSA visible, but it does not make it the main early route.

Engagement, display quality, and brand execution remain adjacent options. They may become useful if they strengthen the same shelf intelligence and trigger-layer position. They should not define the initial roadmap, because that would make the direction too broad.

6.9.4 Product development

The product workstream starts with reliability. This is the base condition for all later movement. If shelf signals are not trusted, they cannot support theft alerts, availability signals, diagnostics, or partner connections. Reliability is therefore not only a technical issue. It is part of the positioning logic.

Configuration, rollback, and change history also belong in this workstream. These capabilities make the system easier to install, adjust, and support across sites. They reduce the risk that every new deployment becomes a custom project. In the initial roadmap, these product capabilities support the move from a promising first case toward a more repeatable offer.

Event filtering and interpretation become more important over time. Early work can focus on avoiding unnecessary alerts and making signals clearer for store staff. Later work can support richer theft diagnostics or selected availability logic. This staged development keeps the proposition from becoming too complex too early.

MOOS

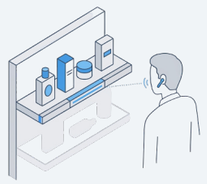
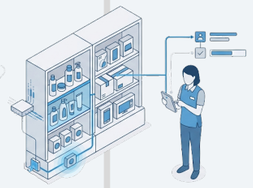
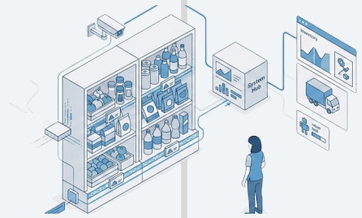
	CURRENT PROOF POINT	HORIZON ONE | NOW	HORIZON TWO | NEXT	HORIZON THREE | LATER	FUTURE AMBITION
	AVOLTA TRACTION CASE	IDENTIFY REPEATABLE TRACTION PATTERN	BUILD ADJACENT PROPOSITIONS	DEEPEN INTEGRATION SELECTIVELY	SHELF INTELLIGENCE LAYER
Goal	*Existing traction around shelf event → staff action in a travel retail context.*	*Understand why the current traction works and define where it can be repeated.*	*Test adjacent propositions that share similar operational conditions.*	*Add deeper and broader integrations only where proof and readiness justify it.*	
					
Context		Stabilise duty free and travel retail use cases Repeat the current travel retail logic in comparable settings Validate fit in selected Health and Beauty contexts Add basic on-shelf availability signals only where they do not create heavy workflow dependency	Expand from travel into Health and Beauty and drugstore settings Develop richer theft prevention use cases Test workflow-linked on-shelf availability in selected contexts Start grocery exploration, but not yet as a broad rollout route	Continue travel, Health and Beauty, and drugstore as active segments Enter selected grocery or convenience cases where earlier proof supports it Combine theft diagnostics with broader shelf-related store action Use on-shelf availability only where workflow and partner conditions are mature enough	*MOOS becomes the **shelf intelligence** and **trigger layer** for store-operational action, known for **reliable** shelf sensing that increasingly works **without supervision** and connects shelf events to useful action across selected retail environments.*
Use Case Focus		Reliable sensing and alerting component Clearer event-to-action proposition for travel retail More repeatable setup and support logic First step toward a partner-ready offering	Shelf intelligence and trigger-layer provider Offering moves beyond thin alerting toward event interpretation Selected diagnostics added around theft and availability use cases Partner roles become clearer in delivery, support, and integration	Selectively embedded trigger layer for store operations Stronger role in translating shelf events into store-operational action Deeper involvement only where the use case justifies it MOOS remains bounded and does not become the full retailer platform	
MOOS Role		Improve signal reliability and event filtering Make installation and configuration easier to repeat Strengthen basic alert routing Add change history and rollback logic where needed	Develop stronger event interpretation and diagnostics Explore theft diagnostics supported by point of sale (POS) data Add selected workflow or task-system links where realistic Build reusable integration patterns instead of one-off connections	Add richer diagnostics for theft and shelf execution Use deeper integrations only where they improve store action or rollout Connect to workflow, task, or planning systems only where needed Reduce manual correction, support burden, and supervision dependence	
	***MOOS** currently operates as a focused shelf-sensing solution that has shown clear value in selected retail contexts, especially around high-value shelves, but still depends on relatively light integrations and a hands-on deployment mode.*	Prove repeatable store action with lower support burden.	Prove that added diagnostics and integrations create value without too much custom work.	Prove that deeper embedding improves enterprise fit while MOOS' role stays bounded.	

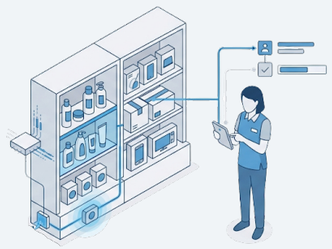
 Figure 6.6. Initial strategic roadmap before validation.

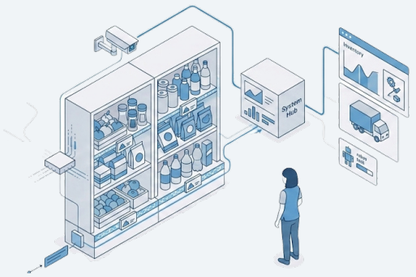
MOOS

	Now	HORIZON ONE PROVE & REPEAT *Repeatable first rollout*	HORIZON TWO DEEPEN & EXPAND *Adjacent proposition deepening*	HORIZON THREE EMBED & SCALE SELECTIVELY *Selective deeper store-ops embedding*	Future Vision
		2027	2028	2030	2032
Segment Focus	**Travel / Duty Free** | Avolta case stabilisation **Health & Beauty** | Fit validation	Retail Replication Pilot route **Drugstore** | Opportunity exploration	Reference segment and active customer base Active segment expansion Pilot and rollout route **Grocery / convenience** | Exploration	Active adjacent segment Selected entry	
Use Case Focus	**Trusted Alerting** | Base Proposition **Theft Prevention** | Light theft logic **On Shelf Availability** | Basic OSA signals	Deep theft preparation POS-supported theft Workflow-linked OSA tests **Engagement / display quality** | adjacent option exploration	Richer theft diagnostics Broader store-action layer Keep only if it supports trigger-layer logic		
Product	**Signal Reliability** | Stabilisation for repeatable use **Event Logic** | Event filtering and prioritisation **Configuration** | Guided setup	Production-grade monitoring Richer interpretation and diagnostics Repeatable templates Active segment expansion **Change History / Rollback** | Safer changes and recovery			
Integrations	**Alert Routing** | Basic headset and alert routing **Physical Shelf Embedding** | Fixture and sensor-fit rules **ESL** | Basic API connection	Reusable routing pattern **POS Integration** | Exploration and preparation Pilot pattern for theft use cases **Workflow / Task Systems** | Candidate workflow mapping Selected workflow-linked OSA **Planning / Ordering Links** | Future readiness scan Partner and fixture integration patterns Shelf-edge data mapping and alert context enrichment **Camera** | incident review exploration Trigger-to-camera validation and camera-assisted theft diagnostics	Reusable POS-supported theft logic Store-action trigger connections Selected links only where justified Reusable shelf-edge connection pattern and deeper shelf edge embedding Reusable incident review pattern		
Deployment and scale	**Installation** | Simpler install **Rollout Package** | Repeatable rollout package **Remote Support** | Reduce MOOS handholding **Quality Assurance** | Deployment check and test gates	Multi-site rollout logic Remote support and site QA	Less-supervised deployment model		
Partners and organisation	**Partner Roles** | Clarify who does what **Internal Readiness** | Capability gap management	**Partner Support** | First-line and second-line support split Segment-specific partner playbooks **Integration Ownership** | Ownership per integration type **Technology partner** | Mapping POS, workflow, ESL, camera, fixture roles	Cleaner role split for deeper embedding Ownership per integration type		

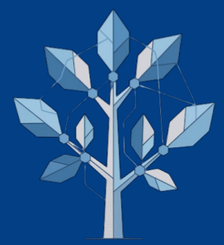








***MOOS** becomes the **shelf intelligence** and **trigger layer** for store-operational action, known for **reliable** shelf **sensing** that increasingly works **without supervision** and connects shelf events to useful action across **selected retail environments**.*



104 Figure 6.7. Initial tactical roadmap before validation.

6.9.5 Integrations

The integration stream explains which external systems or partner layers may need to connect to MOOS over time. In the initial roadmap, integration does not mean that MOOS should become deeply connected to every retail system. Some links can remain light. Others only become relevant when they clearly improve store action.

The first step is alert routing. Headset or staff-alert routing keeps the early use case close to store action. This fits the current trigger-based route because a shelf event can be turned into a practical alert without needing deep enterprise integration.

PPOS links are placed later. POS data may support richer theft diagnostics, but it is not treated as a mature offer from the start. MOOS first needs to show where transaction data adds enough value to justify the added dependency.

Workflow and task system links are also staged. They are more relevant for OSA than for light theft alerting, because availability problems often need to be connected to store routines, task ownership, or planning logic. For that reason, the roadmap first proposes workflow mapping, then selected tests where the use case requires it.

Planning and ordering links are placed furthest to the right. These links may become useful for stronger OSA value, but they depend more heavily on retailer systems and enterprise routines. They are therefore treated as later options, not as early requirements.

Physical shelf embedding runs alongside these software and data links. Fixture partners, shelf-edge infrastructure, ESLs, and camera analytics may all become relevant connection points. They are not mandatory integrations. Their role depends on whether they improve actionability, reduce deployment problems, or help MOOS repeat the trigger-layer route across sites.

6.9.6 Deployment and scale

Deployment and scale are included as a separate stream because repeatability is not only a product issue. MOOS can only move beyond the current proof base if installation, configuration, support, and quality checks become easier to repeat.

The early focus is simpler installation. This reduces the risk that every new site becomes a separate custom project. In Horizon 1, this develops into a repeatable rollout package. Later, the same stream can support multi-site rollout, but only if earlier deployments show that the support burden is manageable.

Remote support also starts early. The goal is to reduce direct MOOS handholding without losing control over quality. Partner involvement only becomes realistic when first-line and second-line support tasks can be separated clearly.

Quality assurance remains part of the full route. Deployment checks and test gates help prevent unreliable setups from entering daily use. Without this, faster rollout could create more support problems instead of reducing them.

6.9.7 Partners and organisation

The partner and organisation stream concerns responsibility. The key question is simple: who does what? If this remains unclear, the route can fail even when the technology works.

In the early phase, MOOS needs to define which activities stay inside the company and which can move to partners. Later, partner roles become more segment-specific. A Travel and Duty Free setup may not need the same partner approach as a Health and Beauty or drugstore setup.

Support roles need the same clarity. A first-line and second-line support split can reduce MOOS's direct support burden, but only if partners know what they own and when MOOS needs to step in. The same applies to integrations. As MOOS connects to POS, workflow tools, shelf infrastructure, ESLs, or camera layers, the responsibility for each link has to be explicit.

This stream keeps internal readiness visible. The roadmap asks MOOS to improve reliability, configuration, deployment, support, and partner work at the same time. That makes organisational readiness part of the design direction, not a separate operational detail.

6.9.8 Proof points and decision gates

The tactical roadmap includes decision gates because the route is still a pre-validation design proposal. Each horizon depends on proof before MOOS can move further.

The first decision gate concerns repeatable actionability. Before MOOS moves too far beyond the current proof base, Horizon 1 needs to show that trigger-based shelf sensing can create store action repeatedly with a lower support burden. This gate concerns technical reliability, alert usefulness, installation, configuration, and support effort.

The second decision gate concerns proposition depth. In Horizon 2, richer theft diagnostics, POS-supported logic, and selected workflow-linked OSA only make sense where they create enough value without making each deployment too custom.

The third decision gate concerns selective embedding. In Horizon 3, deeper links with partners, systems, or shelf infrastructure need to improve enterprise fit while MOOS's role remains bounded. Deeper embedding is only convincing if it strengthens the trigger layer without turning MOOS into the retailer's workflow owner or enterprise platform.

6.9.9 Reading the tactical roadmap as a layered path

The tactical roadmap should be read as a layered path, not as a list of separate projects. Travel and Duty Free do not stop when Health and Beauty starts. Reliability work does not stop when POS integration begins. Trusted alerting does not disappear when richer theft diagnostics emerge.

This overlap is necessary because MOOS has to strengthen the current proof base while preparing later depth. Some streams stabilise the initial position. Others prepare for later horizons. A few only become relevant when earlier proof and readiness are strong enough. Chapter 7 tests whether this proposed sequence is clear, credible, useful, and relevant enough to revise.

6.10 Conclusion

This chapter translated the diagnosis from Chapter 5 into an initial positioning direction and pre-validation roadmap for MOOS. The applied framework narrowed the design task by showing that actionable shelf insight depends on the chain from shelf event to store action, not on sensing quality alone.

The design process moved from co-creation input to ideation, weighted comparison, and route composition. Co-creation helped clarify tensions around proposition depth, repeatability, partner links, and ownership boundaries. The weighted comparison then showed that the preferred direction should not be a broad platform role or a narrow sensor-only role.

The initial design direction positions MOOS as a partner-ready shelf intelligence and trigger layer for store operational action. This direction starts from the current proof base in Travel and Duty Free, strengthens repeatability early, and deepens selectively where use cases, partner links, and internal readiness make this realistic.

The strategic roadmap shows how this position could develop as an initial sequence. The tactical roadmap translates that direction into workstreams around market development, use cases, product capability, integrations, deployment, partners, organisation, and decision gates. Both roadmaps remain pre-validation design proposals at this stage.

This initial design output is taken into Chapter 7, where its logic, clarity, and usefulness are tested and revised.

Chapter 7

Validation & roadmap revision

7.1 Object of validation
7.2 Participants and procedure
7.3 Validation criteria and analysis method
7.4 Validation findings
7.5 Roadmap revisions after validation
7.6 Final revised roadmaps
7.7 Limitations of validation

Chapter 6 resulted in a pre-validation roadmap for MOOS. That roadmap translated the empirical diagnosis, the preferred positioning direction, and the design synthesis into an initial strategic direction. It positioned MOOS as a bounded shelf intelligence layer and trigger layer in the retail technology ecosystem.

The validation tested whether this pre-validation roadmap was clear, credible, useful, and practically relevant for MOOS. The roadmap was tested as an internal strategic decision-support tool. This means that the session focused on whether the roadmap could help MOOS reason about focus, use cases, partners, integrations, sequencing, and future choices.

The validation did not test market demand, technical feasibility, commercial performance, retailer acceptance, or partner willingness. It also did not prove that the roadmap will lead to future success. The scope was narrower. The session tested whether the roadmap was strong enough as a design output and whether it needed revision before becoming the final roadmap of the thesis.

The main outcome was that the roadmap direction was not rejected. The positioning of MOOS as a bounded shelf intelligence layer and trigger layer remained relevant. However, the roadmap logic needed to change. The validation showed that the pre-validation roadmap was still too strongly based on time periods, retail segments, and broad expansion. The revised roadmap therefore shifts toward maturity stages, learning, repeatability, readiness, and decision criteria.

7.1 Object of validation

The validation focused on four connected parts of the design output.

First, the preferred positioning direction was tested. This concerned the idea that MOOS should not become the full operating system of the retailer. Instead, MOOS should focus on sensing shelf events, interpreting them, and turning them into triggers that can support store action.

Second, the strategic roadmap was tested. This roadmap showed the broad path from the current position toward the future ambition. In the pre-validation version, the roadmap moved from a current state into several horizons and then toward a future vision. The validation tested whether this sequence was understandable, credible, and useful for MOOS.

Third, the tactical roadmap was tested. This roadmap explained what the strategic direction meant for segments, use cases, product logic, integrations, partners, deployment, and scale. The validation tested whether this level of detail helped MOOS understand what to do, what to avoid, and what to prepare for.

Fourth, the use logic of the roadmap was tested. The validation did not only ask whether participants agreed with the roadmap. It also tested whether MOOS could use the roadmap when a new customer opportunity, use case, partner proposal, or integration request appears.

Together, these elements formed the object of validation. The session did not repeat the full design argument from Chapter 6. It tested whether the pre-validation roadmap was clear enough, specific enough, and practical enough to be revised into the final roadmap. The validation therefore assessed the roadmap as a strategic decision-support tool, not as a market test, technical test, or implementation plan.

7.2 Participants and procedure

The validation was conducted with three internal MOOS stakeholders. The participants are coded as V1, V2, and V3. Their roles covered company strategy, hardware development, and software development. This gave the validation input from different parts of MOOS that would need to use or act on the roadmap.

This internal group was suitable because the roadmap first needed to work inside MOOS. The roadmap is meant to support choices about focus, sequencing, partnerships, product direction, and integration scope. These choices require knowledge of the company's current traction, technical capacity, delivery limits, and strategic priorities.

The internal focus also creates a boundary for the findings. The session does not represent the full retail ecosystem. Retailers, system partners, integrators, and external advisors may assess the roadmap differently. For this reason, the validation can support the revision of the roadmap for internal strategic use, but it cannot be used as external market evidence.The session followed a guided review structure. First, the purpose and scope of the validation were explained. The participants then reviewed the pre-validation roadmap. The discussion focused on roadmap clarity, positioning, horizon logic, the current traction case

Validation criterion	*Core question*
Understandability	Is the roadmap clear enough to understand without long explanation?
Positioning clarity	Is MOOS' proposed role clear and bounded?
Practical usefulness	Does the roadmap help MOOS make choices about focus and sequence?
Partnership credibility	Are the partner roles believable and specific enough?
Client versus internal readiness distinction	Is it clear what creates client-facing value and what improves MOOS readiness?
Integration specificity	Is the integration logic specific enough for different use cases and stages?
Assumptions and risks	Are the main assumptions, risks, and decision points visible enough?

Table 7.1. Validation criteria used to assess the pre-validation roadmap

as proof point, partner roles, integration logic, and practical use. After the session, the structured notes were organised in a validation matrix. This matrix was then used to translate the main feedback points into roadmap revisions.

7.3 Validation criteria and analysis method

The validation criteria used during the session are summarised in Table 7.1. These criteria were used to assess whether the pre-validation roadmap was understandable, useful and specific enough to support MOOS' strategic decision-making.

Feedback was classified into four types. Confirmation was used when a point supported the existing roadmap direction. Clarification needed was used when an idea was relevant, but the wording or visual explanation was not clear enough. Revision needed was used when the roadmap structure or content had to change. Limitation was used when a point was outside the scope of the validation or could not be solved by the roadmap itself.

Because the validation was documented through structured notes rather than a full transcript, the chapter does not use verbatim participant quotes. The validation matrix in Appendix H is the evidence base for the findings. The matrix contains condensed feedback points and researcher interpretations, not literal participant statements. The findings in Section 7.5 should therefore be read as interpreted validation findings. Their purpose is to show how structured feedback changed the roadmap.

The analysis followed three steps. First, feedback points were listed in the validation matrix. Second, related feedback points were grouped into themes. Third, these themes were translated into roadmap revisions. The classification and interpretation of the feedback were done by the researcher and checked against the structured notes before being translated into design responses. This keeps the link between validation feedback and roadmap revision traceable.

The full validation matrix links feedback points to validation criteria, feedback types, interpretations, and roadmap revisions. This creates a traceable link between the validation session and the final design changes.

7.4 Validation findings

The findings below are based on the validation session. They are reported by theme, because several feedback points concerned the same underlying issue.

7.4.1 The roadmap direction was clear, but the visual was too wordy

The first finding was that the general roadmap direction was understandable, but the visual form was too dense. The validation matrix records this as a clarification and revision issue under understandability. Participants could follow the broad direction, but the roadmap contained too much text and too many parallel elements. This made it harder to use in a strategic discussion.

This feedback means that the issue was not only content, but also use. A roadmap that contains too many words and parallel elements can be difficult to use in a live strategic discussion. It may show many relevant details, but still fail to guide choices quickly.

The roadmap revision was therefore visual and structural. The revised roadmap separates the strategic roadmap from the tactical roadmap. The strategic roadmap shows the main maturity path. The tactical roadmap contains the more detailed assessment rows.

This revision matters because MOOS needs a roadmap that can be used as a shared reference.

The revised version reduces text in the main visual while keeping the detailed logic available in the tactical matrix.

7.4.2 The positioning direction remained relevant, but needed a stronger proof-based starting point

The validation supported the broad positioning direction. MOOS should still be positioned as a bounded shelf intelligence layer and trigger layer, not as a full store operating system. This confirmed that the core design direction from Chapter 6 remained usable.

However, the feedback also showed that the roadmap needed a stronger starting point. The pre-validation roadmap moved too quickly from the current position toward future segments and integrations. This made the roadmap look more like an expansion path than a staged movement from proof to repeatability.

The interpretation was that the preferred positioning direction remained useful, but it needed to start from current evidence. For MOOS, that evidence is the Avolta traction case. The revised roadmap therefore starts from Avolta as the current proof point.

This matters because positioning is more credible when it starts from what is already working. Avolta does not prove that MOOS can expand everywhere. It shows that a specific shelf alert route can create traction in a specific context. The next step is to understand why that traction exists and where similar conditions may be found.

7.4.3 The roadmap needed to work as a decision tool, not only as a presentation of options

The validation showed that the roadmap had to help MOOS make choices. The pre-validation roadmap showed many possible segments, use cases, partners, and integrations. This made the roadmap broad, but not always selective enough. The validation matrix records this as a high impact issue under practical usefulness and assumptions and risks.

The interpretation was that the roadmap needed sharper decision logic. MOOS needs to assess new opportunities under limited time, capacity, and proof. The roadmap therefore needs to help answer practical questions: does this opportunity fit now, should it wait, should it be done with a partner, should it be rejected, or is more learning needed first?

The roadmap revision was to add decision gates. These gates connect each stage to proof, readiness, and repeatability. They prevent the roadmap from becoming a list of attractive options.

This matters because MOOS is likely to face many possible routes. Some may look promising, but may require too much integration, too much support, or a new proposition before the company is ready. The revised roadmap helps separate fit from distraction.

7.4.4 The horizon logic was too time and segment led

The strongest structural finding was that the pre-validation horizon logic was too strongly based on time and segment sequence. The roadmap could be read as a movement from Travel and Duty Free, to Health and Beauty, and later to Grocery. It also suggested more certainty about timing than the evidence could support. This point was classified as revision needed because it changed the structure of the roadmap rather than only its wording. The revised roadmap therefore moves away from fixed calendar logic and uses maturity stages instead.

The interpretation was that progress should not be defined mainly by years or retail segment labels. Progress depends on what MOOS has learned, what can be repeated, which partners are in place, and how much complexity the next step adds. A segment label does not explain why an opportunity is suitable. The underlying conditions do.

This changed the roadmap logic. The revised roadmap no longer presents the stages as fixed time horizons. It uses maturity stages: current proof point, Now, Next, Later, and Future ambition. These stages show what must be understood, repeated, tested, and prepared before moving forward.

This matters because it makes the roadmap more realistic. MOOS may find a Health and Beauty context that is close to the current proof point, but it may also find a supermarket case that is too complex for the near term. The revised roadmap therefore does not ask which segment comes next first. It asks whether the opportunity matches the maturity and evidence of the current stage.

7.4.5 The Avolta traction case became the current proof point

The validation made Avolta more central to the roadmap. In the pre-validation roadmap, Avolta was part of the current context. After validation, it became the proof anchor for the revised roadmap.

The interpretation was that Avolta should not be treated as only a segment example. It is the strongest current evidence that MOOS can turn shelf events into store action. At the same time, it should not be treated as proof of broad expansion. It is a traction case that needs to be understood.

The roadmap revision was to add a separate first stage: current proof point, Avolta traction case. The Now stage then becomes the first active strategic step: identify and replicate the repeatable traction pattern.

This matters because it changes the first question of the roadmap. The question is not: how does MOOS scale from Avolta into the next segment? The question is: what conditions make the Avolta case work, and where can those conditions be repeated?

7.4.6 Theft and OSA do not scale in the same way

The validation reinforced a distinction that was already visible in the empirical findings: theft and OSA do not scale in the same way. Both can be linked to shelf sensing, but they create different action needs and different system dependencies. The validation matrix records this as a revision issue under integration specificity and assumptions and risks.

Theft is a use case with urgency, response risk, and intervention timing. The value depends on whether a shelf event can be detected and routed quickly enough for staff to act. This makes theft more suitable for an early trigger-based route, especially when the signal can be connected to a direct staff alert or response channel.

OSA is different. It concerns the gap between shelf reality and system assumptions. It often needs links to planning, replenishment, ordering, stock correction, or workflow systems. If the shelf signal does not reach the team or system that can correct the situation, the insight may remain unused. This creates backend closure risk.

The roadmap revision was to keep theft-related trigger logic closer to the early stages and to place OSA-heavy routes later, unless a lighter OSA variant can be tested with limited dependencies. This does not make OSA less important. It means that OSA usually requires more system links and clearer operational ownership.

This distinction matters for MOOS because the two use cases create different scaling risks. Theft can work through a direct action route. OSA often needs deeper retailer integration before the insight becomes actionable.

7.4.7 Partner roles needed clearer purpose

The validation showed that partner roles were too general in the pre-validation roadmap. The roadmap mentioned partners, but it did not always explain what each partner was needed for.

The interpretation was that partner purpose matters more than the partner label. Some partners strengthen the retailer proposition. They may help route alerts to staff, connect the trigger to a workflow, or make the action more useful for the client. Other partners help MOOS deliver the solution. They may support installation, maintenance, production, monitoring, or repeatable deployment.

Mixing these partner types creates confusion. A partner that improves internal delivery is not the same as a partner that creates client-facing value. Both can be important, but they need different decision criteria.

The roadmap revision was to split the partner logic into two rows in the tactical roadmap: client-facing integrations and partners, and MOOS readiness integrations and partners. This makes the role of each partner clearer.

This matters because MOOS should not treat every partnership as a market-facing value move. Some partnerships are needed to make the company ready to repeat the solution. Others are needed to improve the retailer proposition. The revised roadmap makes this distinction visible.

7.4.8 Integration logic needed more specificity

The validation showed that the earlier distinction between light and deep integration was too simple. It helped as an initial contrast, but it did not explain what kind of integration was needed, why it was needed, or when it should be added.

The interpretation was that integration has several dimensions. One dimension is depth: how strongly MOOS connects to another system. Another dimension is breadth: how many systems or components are involved. A third dimension is dependency load: how much the solution depends on other actors, systems, or routines to create value.

This matters because early and later integrations serve different roles. A narrow trigger connection to a staff response channel may fit the Now stage. Links with POS, camera systems, planning tools, ordering systems, replenishment logic, or workflow tools usually add more dependencies. These can increase value, but they also increase complexity.

The roadmap revision was to replace the simple light versus deep framing with more specific integration types. The revised roadmap separates client-facing integrations from MOOS readiness integrations and links integration choices to the use case and maturity stage.

This helps MOOS avoid early over-integration. It also keeps later ecosystem embedding visible, but only where the added complexity is justified by proof and readiness.

7.4.9 The main risk was premature expansion

The main risk identified through the validation was premature expansion. The pre-validation roadmap could be read as encouraging MOOS to move from one segment to the next before the current traction pattern had been understood and tested. This issue was recorded as high impact under assumptions and risks in the validation matrix.

The interpretation was that MOOS could be pulled into too many opportunities too early. This is risky because each new segment, use case, partner, or integration request may add custom work. It may also increase support burden and weaken the clarity of the company's role.

The roadmap revision was to slow down the logic of expansion. The revised roadmap begins with the Avolta proof point, then asks MOOS to identify repeatability conditions, then tests adjacent propositions, and only later moves toward deeper ecosystem embedding.

This matters because focus is part of the strategy. The roadmap should not only show where MOOS might go. It should also protect MOOS from moving too broadly before it has enough evidence.

Validation evidence	*Interpretation*	*Roadmap revision*
The roadmap direction was understandable, but the visual was too wordy.	The roadmap needed simpler communication and a clearer split between strategic logic and tactical detail.	The revised roadmap uses a simpler strategic figure and a separate tactical matrix.
The horizon logic was too strongly linked to time periods.	Progress should depend on proof, learning, readiness, and repeatability instead of fixed calendar stages.	The roadmap shifts from time horizons to maturity stages: current proof point, Now, Next, Later, and Future ambition.
Avolta was identified as the strongest current traction case.	The roadmap needed to start from current proof before discussing wider expansion.	Avolta becomes the current proof point and the anchor for the revised roadmap.
Segment sequence was too dominant.	Retail segments are less useful than the conditions that make a context repeatable.	Lookalike conditions replace broad segment sequence as the main filter for early opportunities.
Theft and OSA were treated too similarly in the roadmap.	Theft can fit an early trigger route, while OSA often needs more system links and operational ownership.	Theft-related trigger logic stays closer to the early stages. OSA-heavy routes move later, unless a lighter variant can be tested.
Partner and integration logic mixed client value with MOOS delivery needs.	External value and internal readiness require different choices.	The tactical roadmap splits client-facing value from MOOS readiness.
Partner and integration categories were too general.	Partner and integration choices need to be linked to purpose, system type, stage, and dependency load.	Partner roles and integration types are specified in the tactical roadmap.
The roadmap did not yet force enough choices, and the future vision could be read as a near-term plan.	MOOS needed clearer decision points and a more bounded long-term direction.	Decision gates are added, and the future vision is reframed as future ambition: a bounded shelf intelligence layer.

Table 7.2. Main roadmap revisions after validation

7.5 Roadmap revisions after validation

The main roadmap revisions that followed from the validation are summarised in Table 7.2. The table does not repeat the full validation matrix, but shows the main changes that shaped the revised strategic and tactical roadmaps.

Table 7.2 shows how the main validation findings were translated into roadmap revisions. The largest change was not a new positioning direction, but a change in roadmap logic. The revised roadmap moves away from fixed time periods and broad segment expansion, and instead starts from the current proof point, repeatable traction conditions, readiness, and decision gates.

7.6 Final revised roadmaps

7.6.1 How the revised roadmaps should be read

The revised roadmap consists of two connected figures. The strategic roadmap shows the maturity path. The tactical roadmap explains how each stage can be assessed in more detail.

The roadmaps should not be read as a fixed rollout plan. They do not state that MOOS must enter a specific segment in a specific year. They show how MOOS can move from current proof toward future ambition through evidence, learning, repeatability, and readiness.

This reading responds directly to the validation. The pre-validation roadmap risked looking like a time-based expansion plan. The revised roadmaps make the sequence conditional. MOOS should move forward when the previous stage has produced enough proof and when the next step does not create too much complexity too early.

7.6.2 Revised strategic roadmap

Figure 7.1 on the next page shows the revised strategic roadmap after validation. It presents the roadmap as a maturity path with five stages: current proof point, Now, Next, Later, and Future ambition. The visual should be read from left to right. Each stage represents a different level of proof, learning, repeatability, and readiness. The figure should not be read as a fixed calendar plan or as a fixed segment expansion path.

The first stage is the current proof point: Avolta traction case. This stage shows where MOOS already has concrete traction. It is used as the evidence base for the roadmap. It is not treated as proof that MOOS can move directly into all retail contexts.

The Now stage is: identify and replicate the repeatable traction pattern. This stage asks what makes the Avolta traction work and where similar conditions may exist. These conditions may include a clear shelf event, urgent value, direct staff response, a suitable alert route, a stable shelf context, and limited integration burden.

The Next stage is: test and build adjacent propositions. This stage concerns related opportunities that build on the same trigger logic, but require a new proposition, buyer logic, partner setup, or action route. These opportunities are not selected because they belong to a named segment. They are selected because they extend the current traction pattern in a controlled way.

The Later stage is: deepen integration selectively. This stage includes more complex retail contexts and deeper links with systems such as POS, camera systems, planning tools, replenishment logic, ordering systems, or workflow tools. These moves are placed later because they require stronger proof, clearer partner roles, and higher internal readiness.

The final stage is the future ambition: bounded shelf intelligence layer. This keeps the long-term role visible. MOOS aims to connect shelf reality to store action, but without becoming the retailer's full operating system. This keeps the future direction aligned with the positioning developed in Chapter 6.

The strategic roadmap therefore changes the meaning of progression. The pre-validation roadmap suggested movement through time and segments. The revised version shows movement through maturity. This makes the roadmap more useful for MOOS because it links each step to evidence and readiness.

7.6.3 Revised tactical roadmap

Figure 7.2 on the next page shows the revised tactical roadmap after validation. It is structured as a matrix. The columns follow the same five stages as the strategic roadmap: current proof point, Now, Next, Later, and Future ambition. The rows describe the practical questions that MOOS must answer in each stage. The bars show when a theme starts, how long it remains relevant, and where it becomes less central. They do not show a fixed timeline. They show the expected maturity path of each activity or dependency.

The first row is context and lookalike conditions. This row explains which conditions make an opportunity comparable to the Avolta proof point. It prevents MOOS from using segment labels as the main guide. A new opportunity is not relevant only because it is in Travel, Health and Beauty, or Grocery. It is relevant when the underlying conditions fit the stage.

The second row is use case and proposition focus. This row shows which problem MOOS is solving in each stage. It also keeps theft and OSA separate. Theft is closer to early trigger-based action when the response route is direct. OSA is placed later when it requires planning, replenishment, ordering, stock correction, or workflow connections.

The third row is product and trigger logic. This row explains what MOOS needs to sense, interpret, and trigger in each stage. In the early stages, the focus is on reliable shelf events and useful triggers. Later stages may require richer interpretation, more configuration, and stronger links to other systems.

The fourth row is client-facing integrations and partners. These are integrations and partners that strengthen the retailer proposition. They help the retailer act on the shelf insight. They may support alert routing, action ownership, workflow connection, or the value of the trigger for store or head office teams.

The fifth row is MOOS readiness integrations and partners. These are different. They help MOOS deliver, install, support, monitor, or repeat the solution. This distinction matters because a partner that improves MOOS' delivery capacity does not always create direct client-facing value. Both types are useful, but they should not be mixed.

The sixth row is deployment and scale. This row describes what must be true before MOOS can repeat the solution more widely. It includes delivery burden, installation logic, support load, monitoring, and the risk of non-repeatable custom work.

The final row is the decision gate. This row turns each stage into an assessment point. It asks what proof, readiness, partner role, or integration clarity is needed before MOOS moves forward.

The tactical roadmap adds detail without changing the strategic direction. Its role is to test an opportunity against the maturity stage. This is why the matrix is important: it connects the validation feedback to practical choices.

7.6.4 How MOOS can use the two roadmaps together

The two roadmaps have different roles. The strategic roadmap locates the opportunity. It helps MOOS decide whether an opportunity belongs to the current proof point, Now, Next, Later, or the future ambition. The tactical roadmap then tests the opportunity in more detail.

This combined use is useful because opportunities can look similar at first, but differ in complexity. A new customer request may look close to the Avolta traction case, but may need a different response route. A partner proposal may sound useful, but may mainly improve MOOS readiness rather than client-facing value. An integration request may improve the proposition, but may also add too much dependency too early.

For each new customer opportunity, use case, partner, or integration request, MOOS can use the two roadmaps to choose between five decision options. These options are summarised in Table 7.3.

This use logic is the practical result of the validation. It helps MOOS keep future growth routes visible while avoiding premature expansion.

Decision option	***Meaning***
Do now	The opportunity fits the current stage and uses existing proof or readiness.
Do later	The opportunity is relevant, but requires proof, readiness, or partners that are not yet in place.
Do with partner	The opportunity fits the direction, but MOOS should not carry the full value delivery or delivery burden alone.
Do not do	The opportunity does not fit the bounded positioning or creates too much distraction.
Learn more first	The opportunity may fit, but the assumptions are not clear enough yet.

Table 7.3. Decision options for using the revised roadmaps

7.7 Limitations of validation

The first limitation is empirical scope. The validation was conducted with three internal MOOS stakeholders. This was appropriate because the roadmap first needed to work as an internal strategic tool. However, it does not represent the full retail ecosystem. Retailers, integrators, technology partners, and external advisors may respond differently to the revised roadmap.

The second limitation is validation status. The session tested clarity, usefulness, credibility, and practical relevance. It did not test market demand, technical feasibility, commercial performance, retailer acceptance, or partner willingness. Because the validation was internal, the revised roadmap is validated for internal strategic use, not as externally confirmed market evidence.

The third limitation is implementation uncertainty. The revised roadmap depends on future pilots, partner discussions, technical choices, and retailer priorities. These conditions may change. The roadmap should therefore be treated as a strategic design output that can guide decisions, not as a final answer for all future situations.

These limitations do not make the validation irrelevant. They define what the validation can and cannot claim. Within this scope, the revised roadmap can be used as the final design output of the thesis. The validation made the roadmap stronger by shifting it from a broad expansion path toward a proof-based decision-support tool. The next chapter discusses what this output means for MOOS and for ecosystem-based positioning of component providers.

	MOOS	HORIZON ONE | NOW	HORIZON TWO | NEXT	HORIZON THREE | LATER	FUTURE AMBITION
	CURRENT PROOF POINT	IDENTIFY REPEATABLE TRACTION PATTERN	BUILD ADJACENT PROPOSITIONS	DEEPEN INTEGRATION SELECTIVELY	SHELF INTELLIGENCE LAYER
	AVOLTA TRACTION CASE				
Goal	*Existing traction around shelf event → staff action in a travel retail context.*	*Understand why the current traction works and define where it can be repeated.*	*Test adjacent propositions that share similar operational conditions.*	*Add deeper and broader integrations only where proof and readiness justify it.*	
					
Context	Start from Avolta traction case Define and explore similar conditions Focus on contexts with clear shelf event and staff response	Move beyond one retail setting Select contexts by condition, not segment label Test high-value or theft-sensitive categories	Enter complex retail settings selectively Include grocery or supermarket only with stronger proof Move where system conditions are ready		
Use Case	Theft-related shelf trigger Direct alert-to-action route Loss prevention before broader OSA	Adjacent loss prevention cases Direct Protected product or sweep alert logic-to-action route Selected light OSA tests only where action route is clear	OSA and workflow-linked shelf action Planning, replenishment or ordering links Shelf insight where the backend loop can close		
Role	Reliable sensing and alerting component Repeatable trigger-layer proposition Bounded role, not workflow owner	Shelf intelligence and trigger-layer provider Richer event interpretation Partner-ready proposition	Selectively embedded shelf intelligence layer Stronger role in translating shelf events into action Still bounded, not full retail platform		
Key conditions for progress	Can the Avolta logic be repeated? Are the same conditions present?	Does the proposition build on current proof? Does added complexity stay manageable? Are partner roles clear enough?	Does integration create enough client value? Does dependency load stay acceptable? Is MOOS ready to support this repeatedly?		
	Repeat only where the same traction conditions exist	Expand into adjacent propositions with manageable added complexity.	Embed deeper only when value outweighs dependency load.		

***MOOS** currently operates as a **focused shelf-sensing** solution that has shown clear value in **selected retail contexts**, especially around **high-value shelves**, but still depends on **relatively light integrations** and a **hands-on deployment mode**.*

MOOS** becomes a bounded **shelf intelligence** and **trigger layer** for **store-operational action.

*It connects **shelf events** to **useful action** through **selected partners and integrations**, without becoming the **full retailer operating system.***

 Figure 7.1. Revised strategic roadmap after validation

MOOS

	CURRENT PROOF POINT	HORIZON ONE | NOW	HORIZON TWO | NEXT	HORIZON THREE | LATER	FUTURE AMBITION
	AVOLTA TRACTION CASE	IDENTIFY REPEATABLE TRACTION PATTERN	BUILD ADJACENT PROPOSITIONS	DEEPEN INTEGRATION SELECTIVELY	SHELF INTELLIGENCE LAYER
Goal	*Existing traction around shelf event → staff action in a travel retail context.*	*Understand why the current traction works and define where it can be repeated.*	*Test adjacent propositions that share similar operational conditions.*	*Add deeper and broader integrations only where proof and readiness justify it.*	
					
Context	**Travel / Duty Free** | Avolta case proof point	**Similar as Avolta criteria** | Define repeatable fit **High theft, high value** | test similar conditions **Adjecten contexts** | same operating conditions	**Complex Store contexts** | Only if system ready		
Use Case	**Trusted Alerting** | proven store-action route	**Theft Trigger** | Urgent direct responses **Protected products** | restore open access **Adjacent proposition** | new use logic **OSA signal** | limited test only	**OSA workflow** | backend closure needed		
Product	**Signal reliability** | trusted shelf events	**Event filtering** | reduce false alerts **Repeatable setup** | lower custom work **Trigger rules** | fit to context **Diagnostics** | explain shelf events	**Autonomy** | less supervision needed		
Integration Client Value	**Headset route** | direct alert path	**ESL or display** | selected shelf action **POS support** | theft context link **Camera review** | incident context	**Workflow link** | only if action-owner is clear **Ordering link** | later dependency		
Integration MOOS Readiness		**Partner install** | reduce handholding **Fixture embedding** | repeat shelf setup **Remote support** | monitor sites **Event filtering** | reduce false alerts **Quality gates** | repeat rollout checks **Support split** | first and second line			
Deployment & Scale	**Avolta stabilisation** | learn first	**Rollout package** | repeat route **Lookalike pilot** | same conditions	**Partner-led delivery** | reduce MOOS load **Multi-site pattern** | only after proof	**Selective scale Selective scale** | **avoid overreach**	
Decision Gate	**What works here?**	**Can this pattern repeat?**	**Is this a new proposition?**	**Is deeper embedding worth it?**	

MOOS** becomes a bounded **shelf intelligence** and **trigger layer** for **store-operational action.

*It connects **shelf events** to **useful action** through **selected partners and integrations**, without becoming the **full retailer operating system.***

Figure 7.2. Revised tactical roadmap after validation

Chapter 8

Discussion

8.1 Theoretical contribution
8.2 Methodological and design contribution
8.3 Practical implications for MOOS
8.4 How the roadmap should be used
8.5 Broader practical relevance
8.6 Limitations
8.7 Future research
8.8 Closing reflection

This chapter discusses what the findings and revised roadmap mean for theory, method, practice, and future research. The main argument is that shelf sensing becomes strategically relevant only when it is connected to action. Detection alone is not enough: a shelf event must become a trusted signal, reach the right actor or system, and lead to follow-up without creating too much extra work.

This shifts the positioning problem from product performance to ecosystem fit. The issue is not only whether the technology works, but whether the proposed role fits the systems, routines, partners, and decision gates around retail execution. The revised roadmap matters because it turns this issue into a practical decision logic: each opportunity can be assessed against current proof, repeatability, client value, internal readiness, and ecosystem fit. Chapter 9 gives the final answer to the research question.

8.1 Theoretical contribution

The theoretical contribution of this thesis is applied. It does not develop a new ecosystem theory. It operationalises ecosystem-as-structure for diagnosing the positioning problem of a component provider in store-level retail execution. Positioning is treated as an outcome of ecosystem diagnosis, not as a starting assumption.

Ecosystem-as-structure defines an ecosystem around a focal value proposition and examines the actors, activities, positions, and links needed to realise that proposition (Adner, 2017). In this thesis, the focal value proposition is actionable shelf insight. The framework shows that this value depends on the links between shelf events, data interpretation, operational ownership, partner interfaces, and store action.

This link-level view is the main conceptual contribution. A broad stakeholder map can show who is involved, but it does not show where value may break down. The framework helped identify where handovers, dependencies, and risks appear in the activity chain. For shelf sensing, the weak point is often not the sensor itself, but the movement from signal to action.

Co-innovation risk and adoption-chain risk were used to make this diagnosis more precise (Adner & Kapoor, 2010). Co-innovation risk helped show where MOOS depends on other actors, such as POS providers, ESL providers, camera vendors, workflow tools, or system integrators. Adoption-chain risk helped show where scale can break down across pilot approval, business-case approval, IT capacity, store execution, routinised use, support, renewal, and wider rollout.

The internal readiness layer adds a design-oriented contribution. Ecosystem theory explains external dependencies, but MOOS's ability to deal with those dependencies also depends on its own capabilities. By adding internal readiness, the framework connects ecosystem position to deployment, support, documentation, integration discipline, and proof building. This makes the framework useful not only for analysis, but also for roadmap development.

The contribution remains bounded. The framework was developed through one case and one retail-technology context. It should not be treated as a validated model for all retail ecosystems. Its broader value lies in showing how ecosystem-as-structure can be used as a diagnostic and design-oriented approach for component-provider positioning.

8.2 Methodological and design contribution

The thesis also makes a methodological and design contribution. It shows how a store-level and ecosystem-level diagnosis can be translated into a strategic design output. The store visits identified practical adoption thresholds, while the expert interviews explained wider ecosystem conditions. The cross-dataset synthesis connected these levels before co-creation translated the diagnosis into design criteria and roadmap logic.

This process matters because the roadmap was not created as a future vision alone. It was built from empirical findings about store-level adoption thresholds, expert insights about ecosystem dependencies, co-creation input, and validation feedback. The final roadmap therefore connects research findings to practical decision-making.

The validation further refined the design logic. It did not prove market success, but it did test whether the roadmap was clear, relevant, credible, and useful. Earlier roadmap thinking relied more on time periods and segment expansion. The revised version became more maturity-based. It starts from the current proof point, then asks what can be repeated, what adjacent propositions can be tested, and where selective ecosystem embedding becomes realistic. This shift made the roadmap more useful as a decision filter.

8.3 Practical implications for MOOS

The main practical implication is that positioning should be treated as an ecosystem decision. A promising segment is not enough. MOOS should assess each opportunity through the conditions that make shelf insight actionable: client value, action route, integration load, ecosystem fit, and internal readiness. This leads to five practical recommendations.

First, MOOS should start from current proof and define the repeatable pattern behind it. A successful pilot or client case does not automatically create a repeatable position. The company should document which conditions made the current traction work, such as use-case type, store context, hardware setup, alert logic, support model, decision owner, and the route from signal to action. This prevents one proof point from being treated as evidence that the same route will work across all retail contexts.

Second, MOOS should use lookalike conditions before entering new contexts. A new opportunity should not only be judged by segment size or commercial interest. It should be compared with the conditions that already work. If the store context, use-case urgency, staff role, integration need, or decision owner is very different, the opportunity should be treated as a learning case or not-yet option. This would help MOOS grow from evidence rather than from broad market ambition.

Third, MOOS should keep theft and OSA on different scaling paths. LP is the stronger near-term route because it has clearer urgency and a more direct trigger-to-action path. However, MOOS should still manage false positives, unclear staff responsibility, alert fatigue, and customer-facing intervention risk. OSA has broader long-term potential, but it should not be scaled in the same way. It requires stronger links to replenishment, planning, workflow, planogram, and master data logic before it can become repeatable.

Fourth, MOOS should assess partners by purpose and dependency load. A partner may reduce deployment friction, provide infrastructure, improve actionability, support evidence quality, or open access to retailer systems. The question should not be whether more partnerships are useful in general, but what a specific partner link is meant to solve. The timing and depth of each partnership should depend on integration breadth, integration depth, system type, and the dependency it creates for MOOS.

Fifth, MOOS should build internal readiness before scaling the preferred position. The findings show that actionability depends on reliability, fast follow-up, and low additional workload. For MOOS, this means that deployment, configuration, alert filtering, documentation, support capacity, and proof material should become more repeatable. Without these internal conditions, a promising opportunity can still become difficult to sustain.

These recommendations turn the revised roadmap into a practical decision filter. New opportunities should be tested against three questions: does the opportunity create client value, is MOOS ready to deliver and support it, and does the ecosystem around the opportunity allow actionability? If one of these conditions is weak, the opportunity should be treated as not yet ready rather than as a direct growth route.

8.4 How the roadmap should be used

The revised roadmap should be used as a decision-support tool, not as a fixed rollout plan, market forecast, technical proof, or proof of commercial success. Its value lies in helping MOOS make choices under uncertainty.

The roadmap supports three uses. First, it helps prioritise what should be proven now and what should wait. Second, it helps compare new opportunities through the same decision logic. Third, it supports internal alignment between sales, product development, technology, deployment, and leadership.

These uses keep the roadmap practical beyond its visual form. It should help MOOS discuss focus, timing, partnerships, and readiness with the same logic, without treating the roadmap as a proven action plan for rollout.

8.5 Broader practical relevance

Although the thesis is centred on MOOS, the findings may also be useful for other early-stage retail technology providers with component-based offers. This transfer is limited. It is most relevant for firms that depend on retailer systems, store routines, data access, and investment decisions to create value.

For these firms, positioning should start from the activity chain required to deliver value. It is not

enough to define a product category or list customer benefits. Firms should map who must act, which systems must connect, which partner interfaces are needed, and where adoption can stop.

This is especially relevant for technologies that enter physical stores. Stores combine labour pressure, legacy systems, local routines, and head-office decision-making. A roadmap for such technologies should therefore show dependencies, sequencing, and readiness conditions, not only future ambition.

8.6 Limitations

The first limitation concerns empirical scope and actor coverage. Part 1 consisted of 41 store visits and short conversations with a ranking exercise. This provided useful breadth and helped identify store-level adoption thresholds, but the visits were not designed as in-depth ethnographic research. Part 2 consisted of eight semi-structured expert interviews. The respondents were selected purposively to cover different ecosystem positions, which was suitable for analytical insight, but does not allow statistical generalisation. Some perspectives were also less visible, including store employees, procurement, legal and privacy roles, enterprise software providers, and some supply-chain roles.

The two datasets also differed in depth and purpose. Part 1 provided broader but shallower store-level input. Part 2 provided fewer but deeper explanations of ecosystem dependencies. They were therefore not treated as equal evidence sources. Instead, they were combined through analytical triangulation: Part 1 helped identify store-level adoption thresholds, while Part 2 helped explain the ecosystem mechanisms behind them.

The second limitation concerns design and validation status. The co-creation session supported the translation from findings to design criteria and roadmap logic, but it should not be treated as independent validation. The conducted validation helped assess clarity, relevance, credibility, and usefulness, and it informed the revised roadmap. However, it did not prove market success, technical performance, commercial viability, partner willingness, or long-term operational effectiveness. Further external validation is still needed.

The third limitation concerns practical implementation. The revised roadmap is based on maturity, repeatability, and decision criteria rather than fixed year-based planning. This makes it more suitable for uncertainty, but it also leaves timing open. The roadmap has not been tested through long-term rollout or actual opportunity selection. It should therefore be treated as a strategic guide and decision filter, not as a detailed action plan.

The company-embedded nature of the project also affects interpretation. The research was conducted from late October to 1 June by an external graduation student working around MOOS. This position helped build sector understanding and gave access to company discussions, especially through contact with Marc and formal project moments. At the same time, company input could influence interpretation, because MOOS was already working on positioning, partnerships, and use-case focus. This risk was reduced by keeping the empirical findings, framework, and validation criteria leading, but it remains part of the research context.

8.7 Future research

Future research should first test the revised roadmap with actors who were not involved in the co-creation or earlier validation process. Relevant participants include retail operations experts, retail IT or integration experts, loss-prevention stakeholders, potential partners, and MOOS stakeholders who were not central in the design phase. This would show whether the design logic is understandable and credible beyond the immediate project context.

A second step should use pilot-based evidence. For the loss-prevention route, useful indicators include alert accuracy, false positives, response time, staff response, and usefulness of diagnostic evidence. For the OSA route, useful indicators include reduction in manual checks, replenishment response time, integration effort, planogram accuracy, and fit with availability routines. This evidence would show whether the design assumptions hold in store practice.

A third step should test partner feasibility. MOOS should examine whether possible partners, such as ESL providers, shelf infrastructure firms, camera vendors, POS providers, workflow tools, or system integrators, recognise the proposed role of MOOS and see a feasible collaboration logic. This would test whether the partner-ready position is useful not only for MOOS, but also for the actors around MOOS.

Further research could apply the framework to other retail technology components. Possible cases include camera analytics, RFID infrastructures, smart carts, or autonomous checkout technologies. Comparing these cases would show whether the framework can transfer beyond shelf sensing and where it needs adjustment.

8.8 Closing reflection

This thesis started from a positioning problem. MOOS had promising technology, but its long-term role in the retail technology ecosystem was not self-evident. The research shows that this uncertainty cannot be solved by choosing a market label alone. It requires understanding how value is created through actors, interfaces, routines, and adoption gates.

The project also showed the difficulty of doing strategic design work as an individual graduation project in a small company context. MOOS provided valuable access to product knowledge, strategic discussions, and the practical reality of a start-up. At the same time, the project required enough distance to keep the research evidence and framework leading. For me, the main learning was that strategic design is not only about developing a strategic direction, but also about taking ownership of the process, asking for input at the right moments, and deciding what not to include.

These limits are important for how the thesis should be read. The revised roadmap clarifies a direction and decision logic, but the final answer remains bounded by the evidence gathered in this project.

Chapter 9

Conclusion

9.1 Answer to the main research question
9.2 Answer to SQ1: structure and actionability
9.3 Answer to SQ2: dependencies and alignment
9.4 Answer to SQ3: risks and feasibility
9.5 Answer to SQ4: points of influence and readiness
9.6 Final remarks

9.1 Answer to the main research question

This thesis set out to answer the following research question:

How can MOOS, as a shelf-sensing component provider, position itself in the retail-technology ecosystem around actionable shelf insight?

MOOS can most credibly position itself as a bounded, partner-ready shelf intelligence and trigger layer between shelf reality and store action. Bounded means that MOOS should not become the full retail operating system. Partner-ready means that the company must connect selectively to adjacent systems and actors. As a shelf intelligence and trigger layer, it should focus on reliable shelf events, interpretation, and action routing.

This position fits the evidence because actionable shelf insight depends on more than sensing. A shelf event becomes valuable only when it is reliable, timely, connected to a clear action route, and supported by the actors and systems needed for follow-up. A narrow sensor-supplier role would leave too much of this value creation to others. A broad platform role would require MOOS to own workflows, systems, and decisions that sit outside its current role.

The final revised roadmap translates this answer into a staged decision logic. It is not a rollout plan or proof of market success. It helps MOOS decide what to focus on now, what to prepare, what to postpone, and what to avoid.

9.2 Answer to SQ1: structure and actionability

The first subquestion asked:

What activity structure, actor clusters, and actionability conditions are required to turn shelf-condition information into store action?

Actionable shelf insight requires an activity chain that starts at the shelf and continues into store action. A shelf event must be sensed, interpreted, filtered, routed, and connected to a decision or action. Depending on the use case, this may lead to a staff alert, theft diagnostic, POS comparison, camera review, replenishment signal, or workflow input.

This chain is distributed across several actor groups. MOOS controls the shelf-sensing component and related event logic, but retailers, store teams, IT departments, loss-prevention teams, system providers, and integration partners control other parts of the route to action. The position should therefore be designed around the full activity chain, not around sensing alone.

9.3 Answer to SQ2: dependencies and alignment

The second subquestion asked:

Where do key dependencies, bottlenecks, and misalignments occur across ecosystem positions and links?

The main dependency is the link between shelf signal and store action. The store-level findings showed three adoption thresholds: reliable signals, fast enough actionability, and no extra staff work. These thresholds are practical. Store teams need to trust the signal, understand what to do, and fit the action into existing routines.

The expert interviews showed that these thresholds depend on broader ecosystem conditions. Reliability is affected by sensor performance, product data, planogram changes, installation quality, alert filtering, and system connections. Actionability depends on who receives the signal, who owns the response, and whether the response fits store routines. This shows that alignment must be assessed at link level. The key issue is whether the route from shelf event to action can become reliable and repeatable.

9.4 Answer to SQ3: risks and feasibility

The third subquestion asked:

How do co-innovation risk and adoption-chain risk affect the feasibility of different positioning options for MOOS?

The feasibility of MOOS's position differs by use case. LP and OSA share a sensing base, but they do not follow the same adoption path.

LP appears to be the stronger near-term route. It addresses a visible and urgent problem and can be connected to a more direct trigger-to-action path. Theft-related events can be linked to loss, response, and diagnostic evidence. This does not remove risk. False positives, unclear staff responsibility, alert fatigue, and customer-facing intervention remain important concerns.

OSA has broader long-term potential, but it requires deeper ecosystem alignment. Availability problems are linked to replenishment routines, ordering logic, master data, planograms, workflow tools, and enterprise systems. If MOOS detects an empty shelf but cannot connect that signal to the retailer's execution process, the value remains limited.

This means that not all positioning routes are equally feasible. The revised roadmap should start where actionability can be proven with lower integration burden, while preparing more complex availability routes later.

9.5 Answer to SQ4: points of influence and readiness

The fourth subquestion asked:

Which leverage points and internal readiness conditions should guide MOOS in selecting and sustaining a viable ecosystem position?

The main point of influence for MOOS is the ability to turn shelf events into trusted triggers. A trigger is valuable when it is reliable enough to trust, specific enough to act on, and simple enough to fit existing routines. This makes signal reliability, event logic, operational actionability, and clear integration boundaries central to MOOS's position.

A second point is selective partnership. MOOS does not need to own every part of the value chain. Partners can reduce adoption friction, provide infrastructure, improve actionability, or help connect MOOS to existing store systems. However, partner links should be chosen carefully, because deep dependency too early can slow the company down.

A third point is internal readiness. To sustain the preferred position, the company needs repeatable deployment, configuration logic, support capacity, integration discipline, product documentation, and proof structures that retailers can understand. These conditions explain why the revised roadmap is based on maturity and decision criteria rather than mainly on time or segment expansion.

9.6 Final remarks

MOOS's opportunity lies in making shelf reality actionable without taking ownership of the full store technology architecture. Sensing alone is not enough. Value appears when shelf events can be trusted, routed, and acted on.

The final contribution of this thesis is a structured positioning direction and revised roadmap. It helps MOOS reason about focus, timing, partnerships, and readiness, while keeping clear that further testing is needed before wider rollout.

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Appendix

A. Official project documentation

A.1 Approved project brief

A.2 Human Research Ethics Committee approval

B. Supplementary Context Analysis.

B.1 Full Depest

B.2 Full Actor Maps

B.3 Full Competitor analysis / alternative solutions

B.4 Capability Map Competitors

C. Store Visit Research Material

C1. Store Visit Protocol

C2. Store Visit Question list

C3. Store Visit Results

D. Expert Interview Research Material

D.1 Interview Protocol

D.2 Interview Participants

D.3 Interview consent forms

E. Data Analysis

E1. Data preparation process

E2. Data cleaning and handling rules

E3. Codebook

E4. Interview x codes

E5. Themes

F. Co-creation

F.1 Co-creation session 1 slides

F.2 Co-creation session 2 slides

F.3 **Filled in Canvas**

G. Design Development

G.1 SCAMPER

G.2 Morphological Chart

G.3 Positioning Option Development

G.4 Clustering of positioning themes

H. **Validation**

H1. Validation Slides

H2. Validation Matrix + Roadmap Revision

Appendix A. Official project documentation

A.1 Approved project brief

DESIGN FOR our future

TU Delft

IDE Master Graduation Project

Project team, procedural checks and Personal Project Brief

In this document the agreements made between student and supervisory team about the student's IDE Master Graduation Project are set out. This document may also include involvement of an external client, however does not cover any legal matters student and client (might) agree upon. Next to that, this document facilitates the required procedural checks:

- Student defines the team, what the student is going to do/deliver and how that will come about
- Chair of the supervisory team signs, to formally approve the project's setup / Project brief
- SSC E&SA (Shared Service Centre, Education & Student Affairs) report on the student's registration and study progress
- IDE's Board of Examiners confirms the proposed supervisory team on their eligibility, and whether the student is allowed to start the Graduation Project

STUDENT DATA & MASTER PROGRAMME

Complete all fields and indicate which master(s) you are in

Family name	de Meester	IDE master(s)	IPD ☐ Dfl ☐ SPD ✔
Initials	G. T.	2nd non-IDE master	
Given name	Gijs	Individual programme *(date of approval)*	
Student number	4876237	Medisign	☐
		HPM	☐

SUPERVISORY TEAM

Fill in he required information of supervisory team members. If applicable, company mentor is added as 2nd mentor

Chair	Shahrok Nikou	dept./section	DOS - RMCR
mentor	Nikolaos Kyriakopoulos	dept./section	DOS - RMCR
2nd mentor			
client:	Marc Reunis		
city:	Amsterdam, Delft	country:	Netherlands
optional comments	The chair and mentor represent different sub-groups and bring complementary expertise. One focuses on digital transformation and ecosystem strategy, the other on scenario-based design and strategic foresight. This combination is essential to cover the full scope of the project.		

! Ensure a heterogeneous team. In case you wish to include team members from the same section, explain why.

! Chair should request the IDE Board of Examiners for approval when a non-IDE mentor is proposed. Include CV and motivation letter.

! 2nd mentor only applies when a client is involved.

APPROVAL OF CHAIR on PROJECT PROPOSAL / PROJECT BRIEF -> to be filled in **by the Chair** of the supervisory team

Sign for approval (Chair)

Shahrokh Nikou — Digitally signed by Shahrokh Nikou Date: 2025.10.28 11:17:25 +01'00'

Name Shahrokh Nikou Date 20 Oct 2025 Signature

CHECK ON STUDY PROGRESS

To be filled in **by SSC E&SA** (Shared Service Centre, Education & Student Affairs), after approval of the project brief by the chair.
The study progress will be checked for a 2nd time just before the green light meeting.

Master electives no. of EC accumulated in total	EC
Of which, taking conditional requirements into account, can be part of the exam programme	EC

★	**YES**	all 1st year master courses passed
☐	**NO**	missing 1st year courses

Comments:

i.v.m. curriculumherziening een MSc 1 ruimte van 58EC

Sign for approval (SSC E&SA)

K. Veldman — Digitally signed by K. Veldman Date: 2025.10.30 15:19:26 +01'00'

Name K. Veldman Date 30 Oct 2025 Signature

APPROVAL OF BOARD OF EXAMINERS IDE on SUPERVISORY TEAM -> to be checked and filled in by IDE's Board of Examiners

Does the composition of the Supervisory Team comply with regulations?

YES	★	Supervisory Team approved
NO	☐	Supervisory Team not approved

Comments:

Based on study progress, students is ...

★	**ALLOWED** to start the graduation project
☐	**NOT** allowed to start the graduation project

Comments:

Sign for approval (BoEx)

Paul Mommers — Digitally signed by Paul Mommers Date: 2025.12.05 10:01:42 +01'00'

Name Paul Mommers Date 5 Dec 2025 Signature

DESIGN FOR our future

TU Delft

Personal Project Brief – IDE Master Graduation Project

Name student Gijs de Meester **Student number** 4,876,237

PROJECT TITLE, INTRODUCTION, PROBLEM DEFINITION and ASSIGNMENT
Complete all fields, keep information clear, specific and concise

Project title Strategic Positioning of MOOS in the Future Retail Ecosystem

Please state the title of your graduation project (above). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

Introduction

Describe the context of your project here; What is the domain in which your project takes place? Who are the main stakeholders and what interests are at stake? Describe the opportunities (and limitations) in this domain to better serve the stakeholder interests. (max 250 words)

Retail is undergoing a fundamental transformation, driven by digital technologies that change how value is created and delivered. Traditionally, in-store operations have relied on manual labor, leading to inefficiencies such as stockouts and theft, also known as shelf shrinkage. Rising labor costs and staff shortages have increased the urgency to adopt new digital solutions (Mostaghel, 2022).

In response, retailers have introduced technologies such as electronic shelf labels, RFID tagging, and point-of-sale analytics to enhance operational efficiency and customer experience (Inman & Nikolova, 2017). While these tools improve specific processes, they often function as isolated solutions and fail to address systemic challenges (Roggeveen et al., 2020). Recent developments point towards greater integration, where technologies such as camera vision and shelf-sensing are combined to enable formats like unmanned or scan-and-go stores (Thaichon, 2024).

This shift illustrates that competition in retail no longer takes place between individual firms but between ecosystems of interconnected actors and stakeholders. Ecosystem theory describes these constellations as networks of firms, technologies, and institutions that co-create value (Palmié et al., 2022). Retail ecosystems increasingly operate as “meta-ecosystems,” where physical and digital layers interact to deliver seamless shopping experiences. This trend creates opportunities, but also uncertainties, for smaller technology providers aiming to secure a role in these evolving systems.

The context of this project is a technology provider company known as MOOS. MOOS has developed a shelf-sensing technology that generates real-time product-level insights. This capability has the potential to improve inventory accuracy, operational efficiency, and customer satisfaction. However, to capture value from this innovation, MOOS must navigate the complexities of the retail-tech ecosystem and identify how to position itself strategically within it.

→ *space available for images / figures on next page*

DESIGN FOR our future

TU Delft

Personal Project Brief – IDE Master Graduation Project

Problem Definition

What problem do you want to solve in the context described in the introduction, and within the available time frame of 100 working days? (= Master Graduation Project of 30 EC). What opportunities do you see to create added value for the described stakeholders? Substantiate your choice.
(max 200 words)

Although MOOS provides a technologically advanced shelf-sensing solution, its long-term strategic position within the evolving retail-tech ecosystem remains unclear. Retailers are increasingly adopting a variety of digital technologies such as camera vision, RFID tagging, electronic shelf labels, and point-of-sale analytics to improve operational efficiency and customer experience. However, these technologies are often developed and implemented in isolation, resulting in a fragmented landscape where integration and interoperability remain limited.

Ecosystem research shows that innovation outcomes are shaped not only by the performance of individual technologies but also by how firms coordinate and align their roles within broader systems of collaboration (He et al., 2023). For MOOS, this complexity creates uncertainty about how its shelf-sensing technology should be positioned in relation to complementary or competing solutions. As multiple actors including large retailers, technology vendors, and system integrators are competing to define new standards and data architectures, MOOS faces the risk of being technologically capable yet strategically overlooked. The challenge lies in understanding how different technologies and players interact within the emerging retail-tech ecosystem and in identifying strategic opportunities for MOOS to create and capture value in this evolving environment.

Assignment

This is the most important part of the project brief because it will give a clear direction of what you are heading for. Formulate an assignment to yourself regarding what you expect to deliver as result at the end of your project. (1 sentence) As you graduate as an industrial design engineer, your assignment will start with a verb (Design/Investigate/Validate/Create), and you may use the green text format:

Design a strategic positioning framework and roadmap to guide MOOS in identifying and developing future business and partnership strategies within the evolving retail-tech ecosystem.

Then explain your project approach to carrying out your graduation project and what research and design methods you plan to use to generate your design solution (max 150 words)

This research combines three complementary theoretical perspectives to analyse and design MOOS’s strategic positioning within the evolving retail-tech ecosystem. Innovation Ecosystem Theory (Adner, 2017) forms the foundation for analysing the external environment, explaining how interdependent actors within the retail-tech ecosystem co-create and capture value through alignment and collaboration. Dynamic Capabilities Theory (Teece, 2007) focuses on the internal dimension, describing how MOOS can sense opportunities, seize them through strategic action, and reconfigure its resources and partnerships to remain adaptive in a changing context. Strategic Foresight Theory (Rohrbeck, 2012) provides the temporal bridge between today and tomorrow, enabling the exploration of technological and societal developments that may shape the future of retail and inform long-term strategic choices.

Together, these frameworks connect environmental analysis, organizational adaptability, and future orientation, supporting both the analytical and generative phases of the project. This integrated lens guides the creation of a strategic positioning framework and roadmap that enable MOOS to make informed, future-ready decisions.

Project planning and key moments

*To make visible how you plan to spend your time, you must make a planning for the full project. You are advised to use a Gantt chart format to show the different phases of your project, deliverables you have in mind, meetings and in-between deadlines. Keep in mind that all activities should fit within the given run time of 100 working days. Your planning should include a **kick-off meeting**, **mid-term evaluation meeting**, **green light meeting** and **graduation ceremony**. Please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any (for instance because of holidays or parallel course activities).*

Make sure to attach the full plan to this project brief.
The four key moment dates must be filled in below

Kick off meeting	14 Oct 2025
Mid-term evaluation	12 Jan 2026
Green light meeting	24 Mar 2026
Graduation ceremony	21 Apr 2026

In exceptional cases (part of) the Graduation Project may need to be scheduled part-time. Indicate here if such applies to your project

Part of project scheduled part-time	✔
For how many project weeks	25
Number of project days per week	4,0

Comments:
In this planning I work 4 days in the week on my graduation. I do have Christmas holiday, but no TU holiday between Q2 and Q3.

Motivation and personal ambitions

Explain why you wish to start this project, what competencies you want to prove or develop (e.g. competencies acquired in your MSc programme, electives, extra-curricular activities or other).

Optionally, describe whether you have some personal learning ambitions which you explicitly want to address in this project, on top of the learning objectives of the Graduation Project itself. You might think of e.g. acquiring in depth knowledge on a specific subject, broadening your competencies or experimenting with a specific tool or methodology. Personal learning ambitions are limited to a maximum number of five.
(200 words max)

What excites me most about this graduation project is the opportunity to bring together the three aspects of design that I value most: strategy, technology, and the ability to make sense of complex systems. During my master's in Strategic Product Design, I have learned how design can connect human needs, business goals, and technological developments. For me, design is not just about creating solutions, but also about shaping long-term direction and purpose.

Collaborating with MOOS feels like a natural fit. As a young and growing tech start-up, MOOS offers a dynamic and hands-on environment. I see it as a chance to be part of daily decisions and learn from real-life challenges. Something I have missed in the more academic parts of my studies. I'm especially interested in how design and strategy come together in this context, and I hope to gain a better understanding of what kind of team, organization, and culture suits me best.

I also want to grow in specific areas. One of my goals is to deepen my knowledge of ecosystem strategy and digital innovation. I am curious how smaller players like MOOS can find their position and voice within larger systems. At the same time, I want to improve my ability to translate complex insights into clear, visual frameworks that support better decisions. In this way, I hope to combine design thinking with real impact in the field.

A.2 Human Research Ethics Committee approval

Date 02-Feb-2026
Correspondence hrec@tudelft.nl

TU Delft Delft University of Technology

Human Research Ethics Committee TU Delft
(http://hrec.tudelft.nl)

Visiting address
Jaffalaan 5 (building 31)
2628 BX Delft

Postal address
P.O. Box 5015 2600 GA Delft
The Netherlands

Ethics Approval Application: Strategic Positioning of MOOS in the Future Retail Ecosysten
Applicant: Meester, Gijs de

Dear Gijs de Meester,

It is a pleasure to inform you that your application mentioned above has been approved.

Thanks very much for your submission to the HREC, which has been approved. We do additionally note/advise the following:
1. Please use NVIVO instead of Miro for the qualitative data analysis. Miro is not considered GDPR compliant.
2. You mention that the collected data can be sensitive to competitive advantage or brand reputation. Our suggestion is to ask the interviewees to read the transcript and, if they think the information in it can be shared, you are fine.

Good luck with your research!

Sincerely,

Dr. C. Shelley-Egan
Chair HREC
Faculty of Technology, Policy and Management

H: More on Informed Consent and Data Management

NOTE: You can find guidance and templates for preparing your Informed Consent materials) here

Your research involves human participants as Research Subjects if you are recruiting them or actively involving or influencing, manipulating or directing them in any way in your research activities. This means you must seek informed consent and agree/ implement appropriate safeguards regardless of whether you are collecting any PIRD.

Where you are also collecting PIRD, and using Informed Consent as the legal basis for your research, you need to also make sure that your IC materials are clear on any related risks and the mitigating measures you will take – including through responsible data management.

Got a comment on this checklist or the HREC process? You can leave your comments here

IV. Signature/s

Please note that by signing this checklist list as the sole, or Responsible, researcher you are providing approval of the completeness and quality of the submission, as well as confirming alignment between GDPR, Data Management and Informed Consent requirements.

Name of Corresponding Researcher (if different from the Responsible Researcher) (print)

Signature of Corresponding Researcher:

Date:

Name of Responsible Researcher (print)

Shahrokh Nikou
Signature (or upload consent by mail) Responsible Researcher:

Date: 10.11.2025

V. Completing your HREC application

Please use the following list to check that you have provided all relevant documentation

Required:

- **Always:** This completed HREC checklist
- **Always:** A data management plan (reviewed, where necessary, by a data-steward)
- **Usually:** A complete Informed Consent form (including Participant Information) and/or Opening Statement (for online consent)

Appendix B. Supplementary Context Analysis.

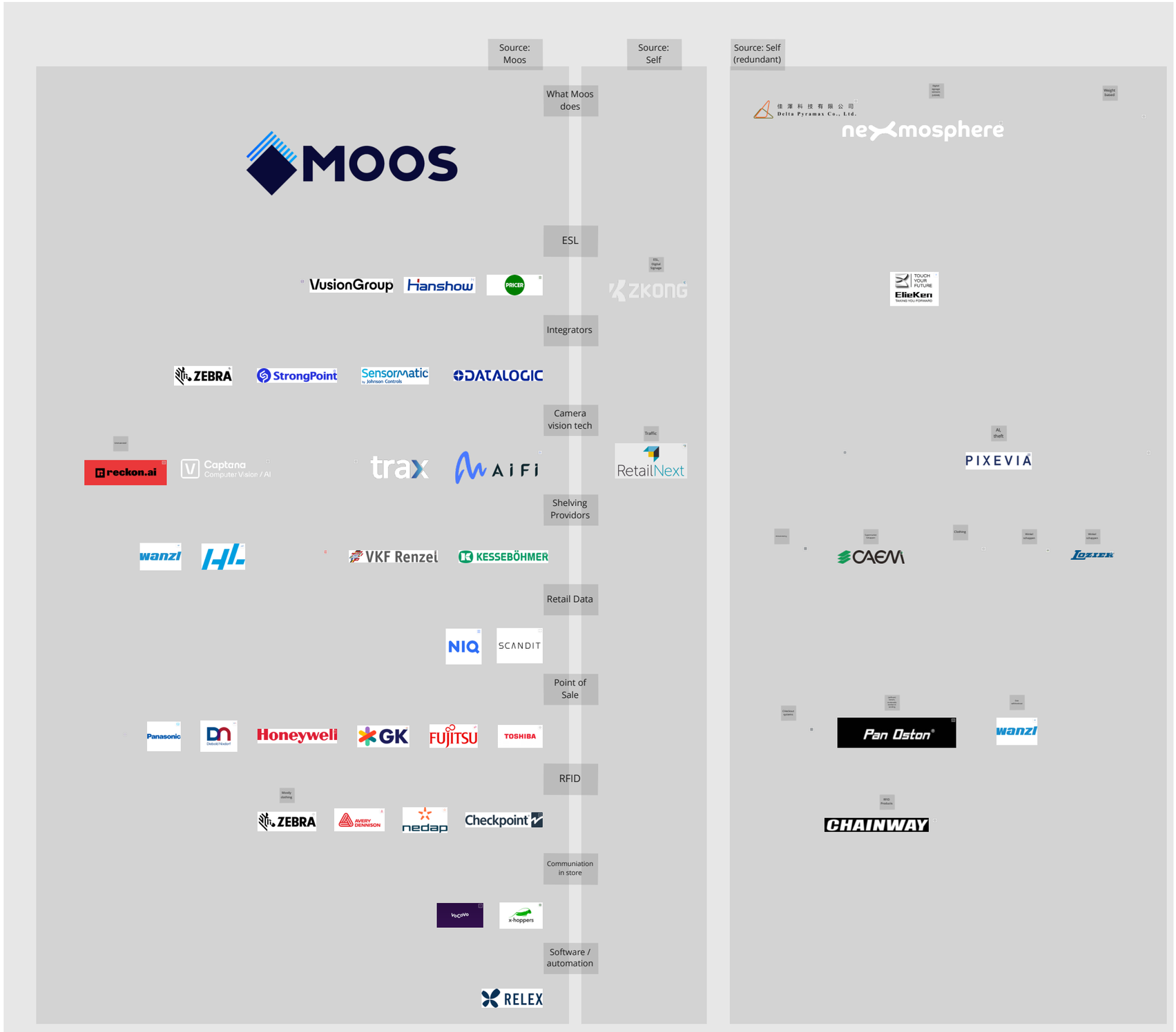
B.1 Full Depest

Domain	*TrendTitle*	*Description*	*APA7Reference*
DEMOGRAPHIC	Older shoppers shift demand to health, convenience and nearby formats	Ageing populations in Europe and North America increase demand for easy-to-shop formats, health-oriented offers, and stores closer to home.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
DEMOGRAPHIC	Ageing retail workforce increases pressure on automation and reskilling	Retailers face an ageing workforce and skills shortages, pushing them to automate more work and invest in reskilling.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
DEMOGRAPHIC	Time-poor shoppers increase demand for reduced-friction shopping	Retail pressure on time and convenience supports demand for lower-friction shopping and technologies that simplify store execution.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
ECONOMIC	Margin pressure makes productivity and automation top priorities	Weak volume growth and rising labour, energy, and technology costs make productivity gains and automation central retail priorities.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
ECONOMIC	Value-seeking consumers accelerate private label and discount growth	Consumers under financial pressure are trading down, comparing prices more aggressively, and shifting spend toward cheaper options such as private label and discount formats.	Deloitte. (2025, February 6). Retail trends 2025. https://www.deloitte.com/no/no/Industries/consumer/perspectives/retail-trends.html
ECONOMIC	Product availability remains a baseline trust signal and recurring loss driver	Availability is increasingly treated as a trust baseline: shoppers expect the right product at the right time, and OOS remains a recurring commercial loss driver.	Deloitte. (2025, November 19). The revolution and evolution of retail stores. https://www.deloitte.com/us/en/industries/consumer/articles/revolution-evolution-of-retail-stores.html
ECONOMIC	Shrink and organised retail crime become structural cost drivers	Retail shrink remains a material cost item and is strongly linked to organised retail crime, theft, and staff safety concerns.	National Retail Federation. (2023). National retail security survey 2023. https://nrf.com/research/national-retail-security-survey-2023
ECONOMIC	Organized retail crime becomes AI-augmented and cross-channel	ORC is no longer only a store problem: NRF flags generative AI, digital fraud, supply-chain coordination, and cross-channel attack patterns as rising risks.	National Retail Federation. (2026, January 7). NRF experts on what to watch in 2026. https://nrf.com/blog/nrf-experts-on-what-to-watch-in-2026
ECONOMIC	Retail media opens new profit pools beyond product margin	Retailers are actively looking for alternative revenue streams, with retail media standing out as a new top- and bottom-line growth engine.	Deloitte. (2025, February 6). Retail trends 2025. https://www.deloitte.com/no/no/Industries/consumer/perspectives/retail-trends.html
ECONOMIC	Faster AI-related ROI expectations shape retail tech investment choices	Retail leaders increasingly expect AI-led supply-chain and operational initiatives to show positive ROI within short time horizons, tightening investment discipline.	Deloitte. (2026, March 11). 2026 global retail industry outlook. https://www.deloitte.com/mt/en/Industries/consumer/perspectives/global-retail-industry-outlook.html
POLITICAL	FSMA 204 pushes food retailers and suppliers toward end-to-end digital traceability	The FDA's Food Traceability Rule keeps pushing high-risk food chains toward digital recordkeeping and end-to-end traceability capabilities.	U.S. Food and Drug Administration. (2025, August 6). FDA proposes to extend compliance date for Food Traceability Rule and issues new FAQs and other resources. https://www.fda.gov/food/hfp-constituent-updates/fda-proposes-extend-compliance-date-food-traceability-rule-and-issues-new-faqs-and-other-resources
POLITICAL	Digital Product Passport shifts from policy concept to implementation architecture	The Digital Product Passport is moving from broad regulation into concrete implementation work around identifiers, access rights, registries, and product-level data exchange.	European Commission. (2025, April 9). Commission launches consultation on the Digital Product Passport. https://single-market-economy.ec.europa.eu/news/commission-launches-consultation-digital-product-passport-2025-04-09_en
POLITICAL	The AI Act increases the need for safe and trustworthy retail AI deployment	EU AI regulation makes AI governance, transparency, and risk management more important for retailers deploying AI in operations, analytics, and customer-facing flows.	European Commission. (n.d.). European approach to artificial intelligence. https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence
POLITICAL	The Data Act raises the importance of usable, shareable and well-governed industrial data	As connected devices generate more operational data, the EU Data Act raises the strategic importance of clear data access, sharing, and governance rules.	European Commission. (2025, December 15). Data Act explained. https://digital-strategy.ec.europa.eu/en/factpages/data-act-explained
POLITICAL	Policy focus on retail crime and staff safety drives tech-based loss prevention	Retail crime and violence are increasingly treated as policy and governance issues, which strengthens the case for tech-enabled loss prevention.	National Retail Federation. (2023). National retail security survey 2023. https://nrf.com/research/national-retail-security-survey-2023
ECOLOGICAL	Sustainability, digitalisation and skills form a triple transition for EU retail	European retail is under simultaneous pressure to invest in sustainability, digitalisation, and workforce capabilities rather than treating them as separate agendas.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
ECOLOGICAL	Energy-efficient stores and DCs become core decarbonisation levers	Energy efficiency in stores, refrigeration, and distribution centres is becoming a core path to reduce both emissions and operating costs.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
ECOLOGICAL	Food waste reduction becomes a strategic operating KPI	Retailers are under rising pressure to cut food waste through better forecasting, labelling, rotation, and operational processes.	European Commission. (n.d.). Food waste. https://food.ec.europa.eu/safety/food-waste_en
ECOLOGICAL	2D product data carriers help reduce waste and improve expiry management	GS1's retail 2D barcode guidance shows how richer product-level data can support expiry control, automatic markdowns, traceability, and waste reduction.	GS1. (n.d.). 2D barcodes at retail point-of-sale implementation guideline. https://ref.gs1.org/guidelines/2d-in-retail/
SOCIALCULTURAL	Consumers expect seamless, engaging and low-friction shopping journeys	Retailers are expected to deliver easier, more invisible and more engaging journeys across physical and digital touchpoints.	EY. (2023, February 17). How retailers' value propositions need to evolve for success. https://www.ey.com/en_gl/insights/consumer-products/defining-the-future-of-retail
SOCIALCULTURAL	Stores are being reimagined as service, fulfilment, brand and community ecosystems	The physical store is not disappearing; it is taking on broader roles in fulfilment, service, community-building, and brand experience.	Deloitte. (2025, November 19). The revolution and evolution of retail stores. https://www.deloitte.com/us/en/industries/consumer/articles/revolution-evolution-of-retail-stores.html
SOCIALCULTURAL	Demand for healthy, transparent and trustworthy products grows	Consumers increasingly reward clear labels, healthier products, and trustworthy sustainability and ingredient information.	EY. (2023, February 17). How retailers' value propositions need to evolve for success. https://www.ey.com/en_gl/insights/consumer-products/defining-the-future-of-retail
SOCIALCULTURAL	Retail media shifts toward closed-loop, omnichannel measurement	Retail media is expanding from impression-selling toward closed-loop, omni-channel measurement that links exposure to in-club, online, and repeat-purchase outcomes.	Sam's Club MAP. (n.d.). The new definition of retail media: Omnichannel, full-funnel, closed-loop. https://map.samsclub.com/resources/articles/new-retail-media
TECHNOLOGICAL	Retailers overhaul tech architecture and operating models to unlock store tech value	McKinsey frames tech transformation in retail as an architecture and operating-model challenge, not just a tooling challenge.	McKinsey & Company. (2022, May 20). The tech transformation imperative in retail. https://www.mckinsey.com/industries/retail/our-insights/the-tech-transformation-imperative-in-retail
TECHNOLOGICAL	Software-driven operating models become a competitive capability for retailers	Retailers are under pressure to behave more like software organizations, with stronger software cultures, operating models, and customer-centric innovation capabilities.	McKinsey & Company. (2023, September 6). Turning consumer and retail companies into software-driven innovators. https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/turning-consumer-and-retail-companies-into-software-driven-innovators
TECHNOLOGICAL	AI adoption shifts from experimentation to operational use in retail and supply chains	Retail AI is moving from broad experimentation toward practical operational deployment, especially in supply-chain visibility, optimization, and decision support.	Deloitte. (2026, January 8). 2026 retail industry outlook. https://www.deloitte.com/us/en/insights/industry/retail-distribution/retail-distribution-industry-outlook.html
TECHNOLOGICAL	In-store automation expands through RFID, smart carts, sensors and connected workflows	Retail technology continues to broaden through RFID, smart carts, traffic sensors, and other building blocks for more instrumented store execution.	McKinsey & Company, & EuroCommerce. (2022, October 25). Transforming the EU retail and wholesale sector. https://www.mckinsey.com/industries/retail/our-insights/transforming-the-eu-retail-and-wholesale-sector
TECHNOLOGICAL	Electronic shelf labels turn the shelf into a managed digital surface	Shelf infrastructure such as ESL is increasingly part of the digital store stack, enabling more central control of pricing and promotion execution.	Deloitte. (2025). Global powers of retailing 2025. https://www.deloitte.com/global/en/industries/retail/research/global-powers-of-retailing.html
TECHNOLOGICAL	Agentic commerce becomes a new decision layer before checkout	AI agents increasingly influence product discovery and decision-making before purchase, creating a new layer above retailer interfaces.	McKinsey & Company. (2025, October 17). The agentic commerce opportunity: How AI agents are ushering in a new era for consumers and merchants. https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-agentic-commerce-opportunity-how-ai-agents-are-ushering-in-a-new-era-for-consumers-and-merchants
TECHNOLOGICAL	Merchandising shifts from dashboards to agentic AI workflows	Retail merchandising is starting to move from reporting support toward agentic AI workflows that reshape roles, decisions, and ways of working.	McKinsey & Company. (2026, January 9). Merchants unleashed: How agentic AI transforms retail merchandising. https://www.mckinsey.com/industries/retail/our-insights/merchants-unleashed-how-agentic-ai-transforms-retail-merchandising
TECHNOLOGICAL	Physical AI moves closer to practical deployment in stores and supply chains	Deloitte describes physical AI and robotics as moving toward practical enterprise use as reliability, economics, and hardware maturity improve.	Deloitte. (2025, December 10). Physical AI and humanoid robots. https://www.deloitte.com/us/en/insights/topics/technology-management/tech-trends/2026/physical-ai-humanoid-robots.html
TECHNOLOGICAL	QR codes powered by GS1 move from pilots to live supermarket infrastructure	Next-generation barcodes are moving from trials into live supermarket infrastructure, making richer product, traceability, and consumer data more operationally usable.	GS1 UK. (2026, April 17). Tesco becomes the first UK supermarket to transition an entire product range to QR codes powered by GS1. https://www.gs1uk.org/insights/news/Tesco-becomes-the-first-UK-supermarket-to-transition-an-entire-product-range-to-QR-codes-powered-by-GS1
TECHNOLOGICAL	Retailers reduce tech debt to unlock faster AI-led innovation	Retail leaders are explicitly reducing technology debt so they can innovate faster, integrate AI more effectively, and scale operational improvements.	Deloitte. (2026, March 11). 2026 global retail industry outlook. https://www.deloitte.com/mt/en/Industries/consumer/perspectives/global-retail-industry-outlook.html
TECHNOLOGICAL	Retail AI governance becomes a capability, not just a compliance topic	Retailers are treating responsible deployment, governance, and risk management as integral capabilities for scaling AI rather than after-the-fact controls.	National Retail Federation. (2025, December 17). Retail AI Trends 2025. https://nrf.com/research/retail-ai-trends-2025

B.2 Full Actor Maps



B.3 Full Competitor analysis / alternative solutions



B.4 Capability Map Competitors

Bedrijf	Store Infrastructure & Fixtures	Electronic Shelf Labels (ESL)	Shelf Sensing (Non-Vision)	Shelf Camera's (Vision at Shelf)	Wegen / Weight-Based Intelligence	Computer-Vision Store Automation (buiten het schap)	Scanning & Mobile Devices	RFID & Item-Level Tracking	Loss Prevention & Security (EAS & LP-software)	Checkout & Payments (POS, SCO, terminals)	Store Operations Platforms / Store ERP	Supply Chain & Forecasting	Merchandising & Space Planning	In-Store Communication	Retail Data & Analytics	Market Measurement Providers (NIQ-type)	Cloud & Hyperscaler Solutions	System Integration & Managed Services	Samenvatting per bedrijf	Belangrijkste punten / focus
Accenture															x			x	Accenture is een consultancy en systems-integration actor voor retail data, technology architecture en implementatie.	Kern: gatekeeperrol via architectuur, integratie en managed transformation work.
Ahold Delhaize																			Ahold Delhaize is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
AiFi						x				x	x				x				AiFi is een computer-vision platform voor autonomous en frictionless store automation.	Kern: brede store automation en checkout-logica, niet primair een dedicated shelf-sensing component.
Amazon Just Walk Out						x				x					x		x		Amazon Just Walk Out is een frictionless checkout technologiepropositie rond computer vision, sensoren, payments en cloud infrastructure.	Kern: store automation en transaction flow; shelf data is onderdeel van een bredere autonomous-store stack.
Amazon Web Services (AWS)						x									x		x		AWS is een cloud en retail technology platform dat computer vision, data pipelines en analytics voor retail use cases ondersteunt.	Kern: schaalbare cloud/data layer; infrastructuurpartner in plaats van near-shelf component.
AS Watson																			AS Watson is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Avery Dennison								x	x						x				Avery Dennison is vooral gepositioneerd rond RFID-enabled item visibility en loss prevention, met gescoorde capabilities in RFID/item-level tracking, loss prevention/security, retail data/analytics.	Rol: item visibility / security technology provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Avolta																			Avolta is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Bizerba					x					x									Bizerba is vooral gepositioneerd rond precisie-shelf-sensing / weight intelligence, met gescoorde capabilities in weight-based intelligence, checkout/payments.	Rol: specialised component / niche complementor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Brain Corp						x		x							x				Brain Corp is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, RFID/item-level tracking, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Capgemini																	x	x	Capgemini is een systems integrator en cloud implementatie partner voor enterprise retail technology.	Kern: implementatie- en IT-routingrol; relevant om componenten in enterprise omgevingen te schalen.
Captana				x											x				Captana is gepositioneerd als shelf-camera en AI analytics oplossing voor on-shelf availability en shelf execution.	Kern: shelf-facing vision; waarschijnlijk alternatief of complement voor non-vision sensing.
Carrefour																			Carrefour is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Chainway							x	x											Chainway is vooral gepositioneerd rond RFID en item-level tracking, met gescoorde capabilities in scanning/mobile devices, RFID/item-level tracking.	Rol: item visibility / security technology provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Checkpoint Systems								x	x				x					x	Checkpoint Systems is een RFID en EAS/loss-prevention provider met inventory en display-compliance capabilities.	Kern: security en RFID item visibility; logische complement rond loss-prevention execution.
Dataiku															x				Dataiku is een enterprise AI en analytics platform voor retail data preparation, modelling en decision support.	Kern: analytics layer; complementair aan sensing maar zonder ownership van het schapinterface.
Datalogic					x	x	x		x	x									Datalogic is vooral gepositioneerd rond precisie-shelf-sensing / weight intelligence, met gescoorde capabilities in weight-based intelligence, computer-vision store automation, scanning/mobile devices, loss prevention/security (+1 extra).	Rol: specialised component / niche complementor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Delaware											x						x	x	Delaware is een SAP/enterprise systems implementation actor met store operations, cloud en integration capabilities.	Kern: ERP- en integratieroute; relevant om shelf data met enterprise systemen te verbinden.
Deloitte																		x	Deloitte is een consulting en managed-services actor rond retail technology transformation.	Kern: advisory en implementation gatekeeper; geen near-shelf technology provider in deze matrix.
Diebold Nixdorf						x			x	x								x	Diebold Nixdorf is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments, system integration/managed services.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Fujitsu						x			x	x	x			x					Fujitsu is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments, store operations/store ERP (+1 extra).	Rol: suite / enterprise platform; relevantie: aangrenzende ecosysteemactor of implementatielaag.
GK Software										x	x						x	x	GK Software is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in checkout/payments, store operations/store ERP, cloud/hyperscaler, system integration/managed services.	Rol: suite / enterprise platform; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Google Cloud												x			x		x		Google Cloud is een hyperscaler met retail analytics, forecasting en cloud infrastructure capabilities.	Kern: cloud/data backbone; relevant voor schaalbare analytics en AI deployment.
Hanshow		x		x		x									x				Hanshow is een digital-store en ESL-provider die shelf displays combineert met vision en analytics capabilities.	Kern: ESL-led shelf digitisation met aanvullende AI/shelf visibility modules.
HL Display	x																	x	HL Display is vooral gepositioneerd rond physical store infrastructure en fixtures, met gescoorde capabilities in store infrastructure/fixtures, system integration/managed services.	Rol: integrator / implementation partner; relevantie: aangrenzende ecosysteemactor of implementatielaag.
HMY	x									x									HMY is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in store infrastructure/fixtures, checkout/payments.	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Honeywell							x							x					Honeywell is vooral gepositioneerd rond in-store communication en staff coordination, met gescoorde capabilities in scanning/mobile devices, in-store communication.	Rol: store communication provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Impinj								x											Impinj is vooral gepositioneerd rond RFID en item-level tracking, met gescoorde capabilities in RFID/item-level tracking.	Rol: item visibility / security technology provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
ITAB	x								x	x									ITAB is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in store infrastructure/fixtures, loss prevention/security, checkout/payments.	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Kesseböhmer	x																	x	Kesseböhmer is vooral gepositioneerd rond physical store infrastructure en fixtures, met gescoorde capabilities in store infrastructure/fixtures, system integration/managed services.	Rol: integrator / implementation partner; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Microsoft Azure												x			x		x		Microsoft Azure is een hyperscaler met cloud, analytics en supply-chain/forecasting capabilities voor retail.	Kern: cloud/data backbone; relevant als platformlaag voor integratie van store signals.
MOOS			x		x				x						x				MOOS is een gespecialiseerde shelf-sensing component provider voor real-time shelf insights via non-vision sensing en weight-based intelligence.	Kern: precieze shelf-level signalen; relevant voor OOS execution en theft/loss-prevention triggers.
NCR Voyix						x			x	x					x		x		NCR Voyix is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments, retail data/analytics (+1 extra).	Rol: data/cloud platform of enterprise backbone; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Nedap								x	x		x	x			x			x	Nedap is een RFID/item-visibility en retail platform provider met loss-prevention en store visibility capabilities.	Kern: item-level visibility via RFID; sterk in inventory accuracy en LP-contexten.
NIQ																x			NIQ is een market measurement en retail intelligence provider.	Kern: externe markt- en category data; nuttig voor benchmarking maar geen store-execution sensor layer.
Oracle										x	x	x	x		x		x		Oracle is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in checkout/payments, store operations/store ERP, supply chain/forecasting, merchandising/space planning (+2 extra).	Rol: data/cloud platform of enterprise backbone; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Panasonic	x						x			x				x	x				Panasonic is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in store infrastructure/fixtures, scanning/mobile devices, checkout/payments, in-store communication (+1 extra).	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
PIXEVIA						x				x					x				PIXEVIA is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, checkout/payments, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
POS Tuning	x												x						POS Tuning is vooral gepositioneerd rond physical store infrastructure en fixtures, met gescoorde capabilities in store infrastructure/fixtures, merchandising/space planning.	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Pricer		x									x				x				Pricer is een ESL en store execution provider met platformfunctionaliteit rond digital shelf operations.	Kern: shelf price/display infrastructure met workflow- en analytics-potentieel.
Reckon.ai						x			x	x	x				x				Reckon.ai is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments, store operations/store ERP (+1 extra).	Rol: suite / enterprise platform; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Relex												x	x		x		x		Relex is vooral gepositioneerd rond store operations, planning en enterprise retail systems, met gescoorde capabilities in supply chain/forecasting, merchandising/space planning, retail data/analytics, cloud/hyperscaler.	Rol: data/cloud platform of enterprise backbone; relevantie: aangrenzende ecosysteemactor of implementatielaag.
RetailNext						x			x						x				RetailNext is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
SAP											x	x	x		x				SAP is vooral gepositioneerd rond store operations, planning en enterprise retail systems, met gescoorde capabilities in store operations/store ERP, supply chain/forecasting, merchandising/space planning, retail data/analytics.	Rol: suite / enterprise platform; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Scandit				x			x								x				Scandit is een mobile scanning en computer-vision solution provider voor store operations en shelf-related analytics.	Kern: smartphone-based data capture; alternatief/complement voor vaste sensing.
Schwarz Group																			Schwarz Group is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Sensei						x				x					x				Sensei is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, checkout/payments, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Sensormatic						x		x	x	x		x	x		x				Sensormatic is een loss-prevention, RFID, analytics en retail operations technology provider.	Kern: sterke security/LP-positie; verbindt shrink, item visibility en store intelligence.
Snowflake															x		x		Snowflake is een cloud data platform voor het opslaan, delen en analyseren van retaildata.	Kern: data infrastructure layer; relevant voor enterprise shelf-data pipelines.
SoluM		x		x							x				x				SoluM is een ESL-provider met aanvullende shelf monitoring en retail data capabilities.	Kern: ESL-basis plus shelf visibility; dicht bij het schap maar breder dan precisiesensing.
StrongPoint						x			x	x									StrongPoint is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Tegometall	x																	x	Tegometall is vooral gepositioneerd rond physical store infrastructure en fixtures, met gescoorde capabilities in store infrastructure/fixtures, system integration/managed services.	Rol: integrator / implementation partner; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Tesco																			Tesco is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Toshiba	x					x			x	x									Toshiba is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in store infrastructure/fixtures, computer-vision store automation, loss prevention/security, checkout/payments.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Trax				x			x						x		x				Trax is een vision-based shelf analytics en execution platform voor shelf conditions, merchandising en retail execution data.	Kern: sterke camera/software route voor shelf visibility; alternatief voor OOS en compliance insights.
TRIGO						x			x	x					x				TRIGO is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, checkout/payments, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
VKF Renzel	x													x					VKF Renzel is vooral gepositioneerd rond physical store infrastructure en fixtures, met gescoorde capabilities in store infrastructure/fixtures, in-store communication.	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
VoCoVo														x	x				VoCoVo is vooral gepositioneerd rond data, analytics en cloud infrastructure, met gescoorde capabilities in in-store communication, retail data/analytics.	Rol: store communication provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Vusion Group		x									x				x		x		Vusion Group is een ESL en digital-shelf platform provider met cloud en retail data capabilities.	Kern: sterke nabijheid tot het schap via ESL-infrastructuur; mogelijke platform/hub rond shelf data.
Walmart																			Walmart is opgenomen als retailer, brand of ecosysteemactor, maar niet als gescoorde commerciële retail-tech capability provider.	Rol: potentiële adopter, pilotcontext, data owner of channel partner; geen x omdat er geen capability is gescoord.
Wanzl	x								x	x									Wanzl is vooral gepositioneerd rond checkout, POS en transaction infrastructure, met gescoorde capabilities in store infrastructure/fixtures, loss prevention/security, checkout/payments.	Rol: physical infrastructure provider; relevantie: aangrenzende ecosysteemactor of implementatielaag.
X hoppers						x			x					x	x				X hoppers is vooral gepositioneerd rond computer-vision store automation, met gescoorde capabilities in computer-vision store automation, loss prevention/security, in-store communication, retail data/analytics.	Rol: vision analytics platform / automation vendor; relevantie: aangrenzende ecosysteemactor of implementatielaag.
Zebra								x	x	x					x				Zebra is een scanning, mobile-computing, RFID en retail analytics provider.	Kern: staff/device en item-visibility layer; sterke complement voor store execution.
ZKONG		x															x		ZKONG is vooral gepositioneerd rond ESL en digital shelf infrastructure, met gescoorde capabilities in ESL, cloud/hyperscaler.	Rol: digital shelf platform; relevantie: near-shelf alternatief of partner voor MOOS.

C.Store Visit Research Material

C1. Store Visit Protocol

Part 1. Interview Protocol – MOOS (EN)

1. Goal and Stance

The purpose is to understand store-operator perspectives on:

a) To identify which adoption attributes matter most to store operators when implementing shelf sensing
b) To capture short explanations and concrete examples for the top priorities
c) To generate comparable data across many stores, with light qualitative colour

Interviewer stance and quality requirements:

- Neutral and curious, not selling and not defending the technology
- Focus on store reality and trade-offs, not ideals
- Ask for examples and last week situations, not opinions only
- Avoid leading language like better, best, should, obviously

1. Checklist to Bring

- Printed one-page info and consent sheet, short version
- Printed ranking sheet or phone version with the 8 attributes and the open questions
- Pen plus backup pen
- Phone timer
- Small notebook for notes
- TU Delft student card if you have one
- Small visual of the sensor, only if they ask what it looks like

1.

2. Checklist for start

- Confirm they have 10 to 15 minutes
- Confirm role and whether they know store routines
- Explain anonymity, no store name, no person name
- Ask permission to take notes
- If you want audio, only do it if it is truly feasible in-store. Otherwise do notes only
- Assign participant code

2.

3. Introductory script

Hi, my name is Gijs. I am doing my master thesis at TU Delft.

I am collecting short inputs from store teams to understand what matters most in daily work if a shelf sensing solution is introduced. This is not a sales conversation. There are no right or wrong answers.

Your answers are anonymous. I will not write down your name or your store name. You can stop at any moment.

I will ask you to rank 8 attributes and then ask one or two short follow-up questions. It takes about 10 to 15 minutes. Is that okay?

To ensure we talk about the same concept, I will first show a short MOOS introduction video (about 1 minute). After the video.

[Show Video]

The context of this research is at the MOOS. MOOS is in developing shelf-level sensing technology to measure product presence and movement and turn this into real-time shelf event signals and insights. The technology helps stores better understand what is happening on the shelf and to support timely action by store teams.

In practical terms, MOOS aims to help with two operational domains:

- On-Shelf Availability (OSA): detecting when products are missing from the shelf and supporting replenishment actions. Out-of-Stock (OOS) is when there is nothing available on the shelf.
- Loss/shrink/theft: detecting shelf situations that may indicate loss risk and supporting appropriate in-store responses.

MOOS can operate as a stand-alone component, but the value for store teams may increase when MOOS' technology is combined with other technologies already used in retail. Examples of such combinations (for context only) include:

- Workflow or task management tools (so alerts become clear tasks for specific roles).
- Ordering and planning systems (so signals can inform replenishment decisions without creating extra manual work).
- Electronic shelf labels or planogram-related tools (to stay accurate when layouts change).
- Camera-based systems (to add context about placement or incidents where relevant).
- In-store communication tools (e.g., headsets) to enable fast responses when time matters.

6. Checklist for closure

- Thank them
- Confirm anonymity again
- Ask if I may contact them later for one clarification, optional
- Immediately after, write my own notes on the why explanation and the examples

C2. Store Visit Question list

1. Interview question guide

Note: Ask the core questions in order. Use probes selectively based on the participant's role and the depth needed. Total target: 9–12 core questions plus closing.

1. Agreement:

- ☐ I agree to participate in this 10–15 minute anonymous interview for TU Delft research, where the researcher will take notes; I understand I can skip questions or stop at any time.
- ☐ I do not agree.

2. What is your role in this store?

Sector:
- ☐ Grocery
- ☐ Convenience
- ☐ Health and beauty

Store format
- ☐ Small
- ☐ Medium
- ☐ Large

Governance
- ☐ Branch
- ☐ Franchise
- ☐ Independent

Location type
- ☐ Urban
- ☐ Rural

3. Below are eight features of a shelf sensing solution. Could you rank them from 1 (most important) to 8 (least important), based on how important you think these features are for integration and use in this shop?

1. 1 means most important for your store team to make this workable, 8 means least important
2. ___ No extra staff work
3. ___ Hard to notice in store
4. ___ Reliable signals
5. ___ Fast enough to act
6. ___ Low effort to keep it running
7. ___ Fits how the store already works
8. ___ Works with existing store technology
9. ___ Clear ownership

4. You ranked the attributes. Explain the most important:

_____

_____

_____

•Can you give a concrete example from last week
•What happens today when this goes wrong
•Who is affected most, customers, staff, manager

5. If you must pick one main reason to improve the shelf in your store, what is the priority today, and why?

- ○ Availability and out of stock
- ○ Loss and shrink
- ○ Other:_____

6. What is the biggest practical barrier that would stop your store from using a shelf sensing solution successfully?

_____

_____

_____

- Is it time, staffing, trust, process fit, support, or cost
- What would need to change to remove this barrier

7. Is there anything important I did not ask that I should know?

_____

_____

_____

8. Could you give me a reference to someone in your network who also would be valuable for me to interview?

_____

_____

_____

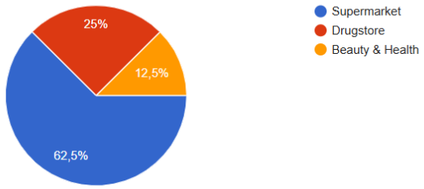
C3. Store Visit Results

Respondent	Store type	Size	Governance	Location	Specialty	Tech level	[No extra staff work]	[Hard to notice in store]	[Reliable signals]	[Fast enough to act]	[Low effort to keep it running]	[Fits how the store already works]	[Works with existing store technology]	[Clear ownership]	Wat is het meest belangrijk voor uw winkel?	What is the main reason for your store to choose this sensor?	Why?	What is the biggest practical barrier to successfully using this sensor in this store?	Anything else?
1	Supermarket	Medium	Branch	Urban		High	1	8	2	5	3	4	6	7	De prijs is super belangrijk. Geen extra werk voor winkelpersoneel en het moet altijd werken.	Loss and shrink	algoritmes zijn nu al goed voor het voorspellen van de producten en wanneer je leeg loopt. En met het bestellen van je producten.	Dat het te duur kan zijn, het levert onvoldoende op. Bij zuivel bijvoorbeeld moeten de platen in de schappen vaak worden vervangen omdat daar veel vuil op komt of schimmel	
2	Supermarket	Large	Branch	Urban	Discount	Medium	2	8	3	4	5	1	6	7	Er moet weinig verandering zijn bij de huidige werkwijze	Loss and shrink	Aangezien hier meer wordt gestolen	praktisch niets, wellicht met hygiene. Dit is een oud pand, Wellicht past dit bij specifike producten	
3	Drugstore	Medium	Branch	Urban		Medium	6	7	1	2	5	3	4	8	Vertrouwen van het systeem. het moet makkelijk te gebruiken zijn voor het personeel (zij moeten hier niet over nadenken (weining over nadenken) en alleen begrijpen om mee te werken. Winkelmedewerkers hebben geen tijd en geen zin,om dit soort dingen te doen	Availability and OOS		Het hoofdkantoor moet de kosten afwegen. Als branch heb je hier weinig over te zeggen. Een franchise kan dit wel doen en zelf beslissen	
4	Drugstore	Medium	Franchise	Urban		Medium	5	4	1	2	3	7	8	6	Het moet tijd besparend zijn. Er was een voorbeeld dat iemand het hele Wasparfum schap had leeg gehaald (sweep). Uiteindelijk is eerst het personeel hiervan de dupe, daarna de eigenaar die geld mis loopt	Loss and shrink		het moet 100% werken. In 2 weken verandert er veel in de schapsindeling. Er zijn bijvoorbeeld bulkacties. Als het schap leeg is kunnen we dat nu al met onze eigen ogen zien.	Er is een verschil met een branch. franchise heeft zijn eigen kosten en geen subsidie. Het moet zo min mogelijk moeite kosten. Wat gebeurt er bijvoorbeeld als de stroom uitvalt of dat er een product verkeerd wordt teruggeplaatst op een andere plek?
5	Supermarket	Medium	Branch	Urban		High	7	5	3	6	4	2	1	8	Er zijn al veel manieren die legen vakken voorkomen. Je hebt bijvoorbeeld hardlopers, deze moeten al worden bijgevuld op een dag. Er wordt gekeken naar de verkoopstand en de verkoopgegevens	Loss and shrink	Zijn al goed bezig met voorraadbeheer en hebben hier al een software voor	Zelfbeschermend moet het zijn, stootbestendig. Het moet in 1 keer geinstalleerd kunnen worden en je moet er nooit meer naar omkijkeken. Dit moet via het hoofdkantoor worden bepaald.	Nu aan de hand van de verkopen worden de voorraden gelezen en een marge van diefstal. Niet iedereen moet achter de computer om de statistieken te lezen die sensor levert. Welke signale komen naar wie? In de stad is er meer diefstal
6	Drugstore	Medium	Branch	Urban	Discount	Medium	4	5	1	2	3	7	6	8	Het moet echt werken, er moeten gelijk meldingen komen als de dief in de winkel is. Er zijn mensen die net te veel in de kar stoppen. Klanten grijpen mis bij diefstal omdat het schap dan leeg is na een sweep. het kan dan niet worden aangevuld	Loss and shrink		tijd en personeel. de winkel moet ook een aantal dagen dicht om de sensoren te installeren en kunnen hier niet voor dicht gaan (omzet mislopen)	
7	Supermarket	Large	Branch	Urban	Discount	Medium	2	5	3	1	4	8	7	6	het moet snel zijn om op te handelen, dit verhoogt de vulgraad en dan is er meer omzet. Je hebt dan minder nee leveringen en als je die hebt kan je hem nog sneller corrigeren	Availability and OOS	diefstal is hier geen prioriteit	het verschil tussen het huidige systeem en de sensor. Deze winkel loopt achter qua tech. een kosten baten analyse zou goed zijn	Er zijn zoveel indicatoren in de supermarkt. Er gebeurt hier zoveel raars, mensen schijten op de vloer in hoekjes en stopen dingen.
8	Supermarket	Medium	Branch	Urban	Discount	Low	1	2	3	7	6	4	5	8	Het financiele oogpunt is belangrijk, het moet de meeste winst opleveren. De supermarkt manager is finnst belastend. Ze doen manko rondes (kijken welke schappen leeg zijn of iets anders mee mis is). Ze hebben minimale en maximale voorraad. Klanten en medewerkers worden het meeste geraakt bij lege schappen	Availability and OOS	er zijn meerdere manieren om je verlies, dervingen tegen te gaan	dat het een systeemswitch is. voorraad dat over is gaat naar achteren en het duurt lang voor dat dit weer gevuld kan worden. er is bijna geen tijd om restanten te checken. Hij is wel voorstander van goede tech. de prijs moet dmv een kosten baten analyse worden bepaald en worden gepresenteerd aan het hoofdkantoor	Als de sensor zichtbaar is kan het storend zijn en er moet vertrouwen komen dmv pilots en het bedrijf wil zelf ervaring opdoen ermee
9	Supermarket	Small	Branch	Urban	Discount	Low	2	3	1	8	7	6	4	5	Er moet iemand verantwoordelijk zijn, afval wordt nu in zakken gescheiden. bij dieftals is er minder overzicht en geen bestelling van het product. Er is nu ook al minder burgerbeveiliging want het is te duur. Klanten zijn de dupe van lege vakken en diefstal. Voorbeelden van veelgestolen producten zijn vlees en kaas	Availability and OOS, Loss and shrink	Beiden belangrijk, maar ook goed om nauwkeurigere verkoopcijfers te presenteren	mensen gaan de winkel wantrouwen als ze de sensor zien. Ook vraagt hij zich af wie dit in de winkel gaat installeren, wie gaat wat doen in dit proces?	
10	Drugstore	Small	Branch	Urban	Discount	Medium	8	7	2	1	4	5	3	6	Het moet samenwerken met het bestellingssysteem, zodat het systeem automatisch bij kan bestellen. Op dit moment gaan er nog veel dingen fout op het schap en hier hebben de klanten last van	Availability and OOS, Loss and shrink		Het is misschien te deur, maar de keuze ligt niet hier in de winkel maar bij het hoofdkantoor	
11	Supermarket	Medium	Branch	Urban		High	3	5	4	6	2	8	1	7	Met huidige technologie samenwerken is heel belangrijk en geen nieuwe tech. de werkdruk is al verhoogd en geen zin en energie in weer iets nieuws. missschien plaatsen bij diefstalgevoelige producten. Nu komen we er te laat achter wanneer er iets is gestolen	Loss and shrink		dat de tech te gevoelig is zoals bij verschuiven van producten of verkeerd terugplaatsen. Of dat het installeerproces te veel tijd in beslag neemt en er is een heel instyallatieproces. klanten zijn ook niet voorzichtig en kan de techpologie die gevoeligheid wel aan?	Het moet zo makkelijk mogelijk gemaakt worden, er zijn meerdere winkels met PDA terminals (handheld devices)
12	Supermarket	Small	Branch	Urban		High	4	8	1	3	7	5	2	6	betrouwbaarheid is het belangrijste, dat hij het blijft mdoen. Als de sensor niet werkt. Hij is ideaal voor een sweep (diefstal). kosten liggen dan bij het filiaal en daardoor krijgen de klanten een neeverkoop. Er zijn ook logistieke problemen bij leveringen	Availability and OOS, Loss and shrink		Als er nog kinderziektes in zitten, dan wordt de betrouwbaarheid minder. Wat gebeurt er als producten bijvoorbeeld ergens anders worden neergezet?	Het zou moeten samenwerken met de PDA terminals (handheld devices) of met de schapslabels. het moet makkelijk en 100% werken en betrouwbaar zijn. de kosten baten moeten goed zijn
13	Drugstore	Small	Independent	Urban		Low	1	6	2	3	4	7	8	5	het moet nite te veel tijd kosten, we hebben hier net een nieuw voorraad systeem en het werkt nog niet goed. het zou automatisch moeten bestellen	Availability and OOS	Meer inzichten krijgen in het schap	instalatie zou een heel groot probleem zijn, dit is arbeidsintensief, dit kunnen we niet zelf doen. ze zijn heel erg low tech en dit moment en de kosten zijn voor de eigenaar. Nee verkoop komt door leveringsproblemen	
14	Supermarket	Small	Branch	Urban	To Go	High	4	6	1	3	2	8	7	5	Bier en energy drankjes worden vaak gestolen. we hebben nu al 100 en red bulls per week aan diefstal. Er wordt nu te weinig aan gedaan. de prijs gaat omhoog voor duurdere producten die gestolen wordt en daar hebben de klanten last van.	Loss and shrink	Er is nu veel diefstal en er wordt al veel gedaan aan beschikbaarheid optimaliseren. een nee verkoop kan je aangeven met de zebra (handheld device) of een fout telling te doen	Geld is natuurlijk belangrijk. Het is ook midden in de stad hier. Het moet makkelijk gemaakt worden en meteen in het werkproces passen. De hQ moet bepalen aangezien wij een branch zijn	
15	Beauty & Health	Large	Franchise	Urban	Premium	Medium	1	4	8	5	6	7	3	2	deze winkel is erg gericht op de service voor de klant, zelfs met een thee die wordt aangeboden bij entree, er meot een meaningful connection komnen hier. hier moeten eerder stock problems worden gesolved. sell products (gap between shelf reality) manual stock checks nu. het stock team wordt het meeste geaffect (correction of the system)	Availability and OOS, Loss and shrink		shelves are glass in this tore or marble or wood. its a high end store. the designers of the store need to be convinced.	Het zou moeten samenwerken met het programma (EVA?)
16	Drugstore	Small	Franchise	Urban		Medium	1	8	5	7	2	4	6	3	het is belangrijk dat er geen extra werk of extra personeel als gevolg is. het gebruiksgemak is heel belangrijk. nu wordt alles gedaan met een PDA (handheld) bijvullen gbeurt vanaf achter. je hoeft niet meer zelf te kijken. het is een kleine winkel. misschien is er in een grotere winkel wel een meetbaar verschil. En wat is het verschil tussen normaal een product pakken en wanneer een product wordt gestolen? Hoeveel tijd zit hiertussen bijvoorbeeld?	Loss and shrink	ze zitten al redelijk goed in voorraad en de het verschil tussen de werkelijkheid en het systeem wordt gemaakt door de diefstal	dat het extra werk zou zijn om te gebruikenn of te onderhouden. het moet duidelijke gebruiksaanwijzingen hgebben, welke technologie of software systemen gebruikt het?	leveringsproblemen, daar kom je pas heel laat achter en dan is het niet meer te declareren. Misschien dat je dat nu sneller ziet? ik zou het gebruiken voor de duurdere exclusieve producten
17	Drugstore	Small	Independent	Urban		Low	6	8	2	1	3	5	4	7	antidiefstal is goed bij de gevoelige producten. Ik zou graag een pop up op mijn scherm willen bij de kassa aangezien ik hier altijd sta. er verdwijnt wekelijks huidverzorging	Loss and shrink		dat het nog niet ge finetuned is. ik zou graag willen dat de sensor ook een product kan identificeren, dit moet verbeterd worden. er is nu een probleem bij het veranderen van producten op het schap.	
18	Drugstore	Medium	Branch	Rural		Medium	7	8	3	5	4	1	2	6	voorraad wordt nu al gedaan met de handheld devices. kassa verbinding zou mijn zijn. er komen veel bekende dieven en die pakken regelmatig veel spullen (stelen) maar dit post heel veel tijd voor het personeel. uiteindelijk is de leidinggevende degene die hierdoor wordt geraakt	Loss and shrink	er zit nu heel veel tijd in het verwerken van diefstal	installeren in de winkel, dit moet buiten openingstijden. het inwerken van het systeem moet ook soepel gaan in de dagelijkse werkwijze	nu doen we tegen diefstal: stickers met chips die afgaan bij de poortjes, we hebben dummy's en dichte boxen die we openmaken bij de kassa
19	Supermarket	Medium	Branch	Rural		High	6	8	1	7	5	3	2	4	diefstal kan je toch niet voorkomen, niet alles bedoelt hij. Zichtbaarheid van de sensor kan juist positief werken en afschrikken. Producten die veel gestolen worden: biefstuk, koffie, energy. de winkel wordt hierdoor veel geraakt. Maar de klant heeft hier ook last van.	Loss and shrink	beschikbaarheid wordt nu al goed geregeld. er worden 0/1 rondes gelopen. vak scans en de lege vakken geven dmv een knipperend lampje op de els's al signalen welke vakken leeg zijn	kosten voor het hoofdkantoor, het moet passen in de huidige AH systemen en het moet een AH sausje erover heen krijgen	
20	Beauty & Health	Medium	Independent	Rural		Low	7	2	8	1	6	5	4	3	de betrouwbaarheid moet kloppen met de voorraad. bij een nee verkoop kan het komen doordat het product niet leverbaar is. medicijnen bijvoorbeeld. We vinden wel eens lege verpakkingen in de oude hoeken in de winkel, hier zijn dan de producten uitgehaald. Hier wordt de klant door geraakt omdat het product dan opeens op is, maar wij als zelfstandige winkel worden hier ook door geraakt	Availability and OOS, Loss and shrink	Vroeger hadden we codeerstickers en woortjes. dit kost allemaal extra tijd om al die dingen te plakken, we hadden poortjes, maar dan hoorden we het te laat. als mensen willen stelen doen ze het sowieso wel. Als er iets gaat knipperen in ons zicht op het moment van pakken kunnen we er veel sneller op anticiperen	kosten, wij zijn zelfstandig. Het schap moet strak zijn dus we willen geen losse kabels etc. we moeten overtuigd zijn dat de sensor iets oplevert voor ons	
21	Supermarket	Large	Branch	Rural	Discount	Low	6	4	3	5	7	2	1	8	Het moet samenwerken met ons huidige systeem. Een andere app is een no go. Een deel van de winkel (Distributie Centrum) is geautomatiseerd, maar ook een groot deel is nog met de hand, mensen werk. We zien een gap in de werkelijkheid. we maken meldingen naar intranet.com naar dc. We lopen omzet mis als de schappen leeg zijn en klanten gaan naar andere winkels	Loss and shrink	we hebben last van veel voorraad verschillen, met name bij de producten: red bull, koffie, vlees. klein en veel waarde	Schapsonderhoud, mutaties van producten indeling, planogram verwisseling	Het kostenplaatje, deze winkel werkt met meters
22	Supermarket	Medium	Branch	Rural	Discount	Medium	6	8	1	2	4	5	3	7	bij voorraadbeheer, de verkeerde artikelen kunnen worden geleverd. bij diefstal, de vakken kunnen meens leeg zijn. bijvoorbeeld babyvoeding. We vinden wel eens een berucht persoon op camera, maar als we kijken is het al te laat. de klanten zijn hier de dupe van en de winkel financieel de dupe	Availability and OOS	we moeten voorkomen om neeverkopen te hebben. en deze gaten worden veroorzaakt door het gat tussen wat het systeem ziet en de werkelijkheid	het moet goed zijn, het is onwennig, het onbekende. het betalingssysteem plus een marge is nu al voldoende voor je voorraadbeheer. Dit zou via het hoofdkantoor moeten gaan. pilot resultaten moeten overzicht en overtuiging brengen.	je hebt te maken met zomer en winter trends, maar over het algemeen kopen mensen hier altijd hetzelfde. er fluctueert weinig met het aantal producten die we verkopen. Het hoofdkantoor bepaalt hier over technologie. UITeindelijk moet alles functioneren, en elke schakel meer kan weer voor een probleem zorgen
23	Supermarket	Medium	Franchise	Rural	Premium	Medium	6	8	3	2	7	5	4	1	Antidiefstal. op voorraad zijn we al geautomatiseerd, alles wordt bijgehouden via de kasse. het snelheid van handelen bij diefstal is belangrijk. Ik zou dit zien als vervangen voor detectie stickers, bij producten met hoge prijzen	Loss and shrink	het is de vervanger van een ander systeem.de kassa gegevens doen het afboeken van de voorraad	geld is lastig. ik moet echt overtuigd wordfen. Ik moet een toepassing bedenken, maar het geeft wel meer inzichten tussen wat er gebeurt tussen het schap en de kassa. het signaal moet worden gedefinieerd, welke eigenschappen heeft het signaal, wanneer gaat iets wel of niet goed. Nu wordt het verschil bepaald door zicht, hoe gedraagt iemand zich? Het moet gaan om controle van de werkelijkheid. na dat uit het schap pakken.	camea vision toepassing werkt niet hier in de winkel, de klant die bij deze winkel past wil niet gefilmd worden. korter op het verschil zitten dan
24	Supermarket	Large	Branch	Rural		High	6	7	2	8	4	5	1	3	Er is hier best veel diefstal, de producten worden meerder momenten een signaal geven. Al veel dingen geprobeerd hier in de wikel. de sensor zou behulpzaam zijn voor de beschikbaarheid in de winkel.als het vak leeg is en wij zouden een signaal krijgen zou dat geweldig zijn	Availability and OOS	klanten hier zijn mensen met ged, en ze zijn snel geirteerd als er een product niet op voorraad is (ook bijvullen). klanten klagen over beschikbaarheid en als het er niet is gaan ze naar de concurrent.	hoe lang blijft de sensor functioneel, wat is de levensduur? Ik ben benieuwd naar het prestatievermogen. Pilots zouden dit moeten laten zien en testen, zodat het hoofdkantoor getest kan worden. Wat is de performance onder 0 graden? kan het voor alle schappen?	Wat gebeurt er met schapsverdelers die het schap raken? Kan het tegen een sopje, hoe kunnen we de (zuivel)koeling schoonmaken als deze sensor er in zit?
25	Supermarket	Large	Franchise	Rural		High	2	8	6	7	3	4	1	5	als deze sensor geplaatst zou worden dan is efficientie het belangrijkst, het zal geen extra tijd moeten kosten, de productiviteit moet omhoog gaan. als er een signaal komt dat een vak leeg is, is er geen tijd voor omdat we zo veel producten hebben. voor diefstal zou ik dit wel goed vinden. de voorraad komt dagelijks binnen en elka avond wordt er bijgevuld, we hebben weinig voorraad achter.	Loss and shrink	ook omdat producten die achter zijn, niet te vinden zijn	ik zie nog geen voordelen. de oplossing voor leegstaand zit in een proces. ipv artikeliniveau, vakken (grootte) worden aangepast als het product vaker leeg loopt	ik weet niet of het voor deze branch (supermarkt) een toevoeging is. de huidige dynamiek en de omloopsnelheid van producten is te hoog. Misschien goed voor non-food
26	Drugstore	Medium	Branch	Rural		Medium	8	7	1	5	2	3	4	6	de omloopsnelheid gaat hier snel, we kunnen al veel voorspelien. dit de populaire merken worden vaak gestolen, hier proberen we zelf zicht op te houden. extra beveiliging door zelf in de gaten te houden. Een neeverkoop zorgt voor dubbele kosten	Loss and shrink	we hebben al wel een ordersysteem. Ook maken we gebruik van tags en deurtjes waar een geluidssignaal aan verbonden zit. en dit zorgt voor een afgeschermd gebied.	kosten zou een bariere kunnen zijn, de vulmomenten hebben al een vast schema, je kan niet direct inspringen bij een leeg schap	diefstal kan je niet voorkomen. Als iemand echt wil stelen doen ze het wel, kijk maar naar die bendes
27	Supermarket	Small	Franchise	Urban	To Go	Medium	4	3	2	7	1	6	5	8	de betrouwbaarheid is belangrijk in deze winkel, hoe lang gaat het mee, blijft de performance good en de kosten zijn belangrijk. klanten hebben last van lege schappen maar ook de winkel zelf.	Availability and OOS	diefstal gaat hier zo snel (kleine winkel), dit is nog niet voldoende om diefstal tegen te gaan. bewegingen zijn opvallend, we hebben hier camera's die beweging volgen	dat het niet samenwerkt met het huidige systeem. Kosten moeten opleveren. heeft het bedrijf dit wel echt nodig? kleine winkel is makkelijk te managen	De samenwerking van de sensor moet samen met de camera en het POS (point of sale). Zichtbaarheid moet ook beperkt worden, winkels iwllen namelijk unioform zijn. Voor het afschrikken gebruiken wij bewegende camera's al.. we gebruiken SABA - SCS - het bestelsysteem van de winkel
28	Supermarket	Medium	Branch	Urban	Premium	Medium	8	2	1	3	4	5	6	7	het moet echt werken, geen opstartproblemen, het moet getest zijn en je moet er meteen mee aan de slag kunnen. Nieuwe tech heeft vaak kinderziektes. We hadden bijvoorbeeld nieuwe ESL's, maar er zaten problemen in de houders waardoor de ESL's er vanaf vielen. hierdoor moest het personeel ze steeds oprapen, straalt ook negatief uit naar de klanten.	Loss and shrink	we lopen dagelijks 0/1 rondes om te kijken welke schappen leeg of bijna leeg zijn. Ik vind het niet heel veel toevoegen voor je voorraad beheer, we vullen al dagelijks aan, dit gaat automatisch, we hebben een slim bestelsysteem dat werkt op de voorraad.	je moet de stellingen leeg maken, dit kan niet overdag, moet buiten openingstijd, we zijn 7 dagen in de week open.	we gebruiken rails in de schappen, hier valt vuil door heen en verzamelt geen stof, deze sensor is dicht en werkt hier niet op.
29	Supermarket	Small	Branch	Urban		High	2	8	3	7	4	1	5	6	het moet echt betrouwbaar zijn, geen extra handelingen toevoegen en geen moeite zijn om te onderhouden. geen worsteling met technologie. voorraadproblemen bij bonus/actie 1+1 gratis. ze scannen dan 1 product bij de zelfscan ipv 2, ook is er veel diefstal bij de zelfscan	Availability and OOS	je Out of stock bepaalt je vracht, nu moeten we met de hand corrigeren voor diefstal. De sensor kan helpen met de voorraad te verbeteren.	vulploeg moet hier niets mee te maken hebben/krijgen. dit moet je niet uitleggen aan ze, de triggers die de sensor geeft moeten verwerkt worden in hun bestaande takenpakket.	toen een andere winkel hier heel dicht ging (3weken) ging onze voorspelling van voorraad volledig verkeerd
30	Drugstore	Medium	Branch	Urban		Medium	6	1	2	5	4	7	3	8	het moet niet zichtbaar zijn hier, want dan gaan klanten er naar klagen. Het is belangrijk dat het geen extra kost	Availability and OOS, Loss and shrink	diefstal valt hier wel mee, klanten willen hier gewoon heel veel van je	Als het druk is, als een schap leeg is ben je bijvoorbeeld nog bezif met een vracht verwerken. In deze winkel is er niet veel personeel	
31	Supermarket	Medium	Branch	Urban	Discount	Medium	4	6	1	2	5	7	3	8	het moet hufterporrf zijn, het mag niet kapot gaan en handig voor diefstal. in het huidige systeem gaat het meeste fout dat er pick verschillen zijn bij het distributiecentrum. wel is het zo dat je dat sneller door hebt met deze sensor als een schap niet is gevuld. Wellicht zijn supermarkten te groot voor deze sensor	Loss and shrink	tandpasta, cosmetica, slijterij, dure flessen wijn	als het niet in het proces past. bijvoorbeel crispy chili oil*dat wordt 70x per dag gekocht, dat vullen we sws al 2x per dag aan, dan is de omloopsnelheid te hoog. Dan heeft het geen zin om een melding te krijgen, want het staat dan al op de planning	Dit is een goed idee bij kleinere producten met een hoge waarde en winkels met een lagere omloopsnelheid
32	Drugstore	Small	Independent	Urban		Low	3	8	5	1	2	6	7	4	het moet betrouwbaar en snel zijn. we hebben op dit moment weinig voorraadadministratie. we zijn een ouderwetse kleine winkel.		niet van toepassing, misschien dat dit past bij een grotere winkel met meer personeel, nu gaan we elk schap zelf langs. nu doen we zelf controle	we bestellen elke dag, we hebben geen computer en geen kassa en ook weinig voorraad. we zien meteen op er iets mist of niet.	We hebben weinig last van diefstal en hebben een fijn publiek midden in de jordaan. Er zijn uitzonderingen zoals toeristen. De kleine artikelen kunnen dan interessanr zijn. grotere winkels gebruiken testers voor de duurdere producten
33	Supermarket	Small	Franchise	Urban		High	1	8	3	6	5	4	2	7	bij ons is cosmetica interessant. voor duurdere producten zie ik het werken, zoals koffie wijn (diefstalgevoelige producten) we hebben mazzel dat de parkeerkosten hoog zijn in de stad en geen bendes hebben die sweeps komen doen.	Loss and shrink	beschikbaarheid is al goed gekoppeld met SAP	implementatie, hoe komt de informatie op je handheld (PDA) terecht? past het in het proces. we zijn wel een franchiser (maar een kleine van alleen deze winkel) en zijn nog steeds best afhankelijk van het hoofdkantoor	Het moet in de wetgeving passen in het wetboek van de jumbo. de werkzaamheden van de werknemers moet goed gedaan worden vanwege duurzaamheid van het product
34	Supermarket	Medium	Branch	Urban	Premium	Medium	4	1	5	2	3	8	6	7	er gebeurt nu al veel automatisch, zoals bestellingen. de investering van de sensor zou moeten worden terugbetaald. het gaat niet helpen bij het verbeteren van de voorraad. vlees is duur, daar kan het invloed op hebben net als cosmetica, goed voor risico procten denk aan drogisterij	Loss and shrink	als je diefstal kan voorkomen dan zou het voor deze winkel realistisch zijn	het is een investering, het bedrijf moet winst maken, hier is het hoofdkantoor belangrijk	We gebruiken ASPOS (fdc solutions) hier vertrouwen we op, volgt het hoofdkantoor en het moet in dit stukje retail passen
35	Supermarket	Medium	Branch	Urban		High	4	5	2	3	1	7	8	7	het moet draaiende gehouden worden, er moeten geen bug fixes komen. je moet het stapsgewijs opstarten. er moet een duidelijke installatie zijn en nazorg. voorbeeld van ESL implementatie, er was een krat aan ESL's die gewoon niet goed waren en al Idefect waren aan het begin. In deze wijk van de stad kijkt niemand toch naar de prijs	Loss and shrink	voor het bijvullen hebben we geen tijd om de vakken aan te vullen door de dag heen. We hebben te maken met een eprsoneelsbezettingsissue. de schappen van de populaire producten zijn al groot	kosten ten tijd. het perspectief van het hoofdkantoor is belangrijk. bijvoorbeeld, we hadden last van veel muggen/vliegen. we kregen hier een boete voor, en toen hebben we speciale lampen genomen. de boete was de aanleiding voor verandering/implementatie van tech. Dit hadden we als winkel ook al eerder gecommuniceerd. Misschien willen ze een trend zetten, dan zouden ze eerder voor zo'n sensor kiezen. De installatie tijd is ook een praktische obstakel. focus op nieuwe winkels. Ook voor diefstal zie ik dit werken als het geinstalleerd is werkt het gewoon lijkt me	dit zou je werk kunnen onderbreken tijdens andere taken, dit zou wel soepel moeten gaan, niet van hak op de tak, dan kan een werknemer een push melding negeren
36	Beauty & Health	Small	Branch	Urban		Medium	5	8	4	2	6	1	3	7	het moet niet moeilijker worden voor de werknemers, het moet matchen met de winkel. Er was al eens diefstal, eerst dacht ze dat deze persoon heel aardig was, maar verdacht en vertrouwde hem alsnog, maar achteraf bleek dit wel diefstal te zijn. ze wis thet niet van te voren toen ze iets verdachts zag	Loss and shrink	nu doen we dagelijks zelf controleren, dus dit kan tijd besparen. Maar zelf controleren betekent wel dat je producten ook nog netjes kan zetten	de melding moet achter de kassa op het systeem komen. Zebra is er wel, maar die heb je niet altijd vast. en kassa is dicht bij de uitgang	
37	Supermarket	Large	Franchise	Urban		High	1	5	2	7	3	4	6	8	voor personeel moet het geen extra werk zijn, oko niet als het niet werkt. We willen niet te hoeven bellen naar een service lijn, het moet gewoon plug en play zijn. er is al een personeelstekort, dan tel ik het zelf wel met de hand. fijn als het werkt met onze ESL's. alles gaat top down bij dit bedrijf, zelf als franchise moet je mee, we zijn een kleine franchise	Loss and shrink	er zijn voorraad verschillen door dervingj, bijvoorbeeld tandpasta en alcohol.	het invoeren ervan en ook het herindelen van de schappen (planogram change) wat gebeurt er dan? Wat zijn de hygienische aspecten van deze sensoren?Wat gebeurt er als ze vies worden? Komt er geen stof op? en wat gebeurt er bij verse schappen? kan het tegen viezigheid? bij zuivel bijvoorbeeld. Wie moeten we bellen ESL? devider's? Camera vision? het is niet realistisch voor de gehele winkel bij vragen?	het moet kloppen met de planogram, dus de sensor zou bijvoorbeeld kunnen samenwerken met de planogram, deze veranderen wekelijks, via wat gebeurt er bij verse schappen
38	Beauty & Health	Large	Branch	Urban	Premium	Medium	7	6	2	3	5	4	1	8	de signalen moeten betrouwbaar zijn en ze moeten kloppen. wat gebeurt er als mensen de producten verkeerd terug zetten? Wat doet het systeem dan? en wat zijn dan de gevolgen? stock counting is leidend	Loss and shrink	er is hier veel diefstal. we hebben zelf producten voor boven de 1000 euro. we zitten in het centrum van de staf	de kosten, het moet echt wat opleveren. we hebben al een systeem voor voorraad, wat zou het opleveren? Waarom zouden we dit doen? Daar moeten we van overtuigd worden en dat is een finaciele vraag	wat gebeurt er met de neerslag van alle parfum in de winkel? diefstal melding op een andere device met een diefstal melding. Op apparte deveces willen we de meldingen dan, anders die we nu gebruiken want dan gaat het interferen met het huidige systeem
39	Supermarket	Small	Branch	Urban	To Go	High	1	8	6	2	3	4	5	7	om een idee te hebben over kwantiteit, geen handmatige chacks meer. lavish (hoge alcohol mixdrankjes) wordt vaak gestolen. nu doen we number checking en hebben we een treshhold voor een aantal items en die bepaalt of we gaan bijvullen of niet	Loss and shrink	de dure kleine producten verdienen worden vaak gestolen, zou graag een medling willen hebben op een headset of mobile device	cost, de winkel moet worden overtuigd dat er winst gemaakt kan worden (hoofdkantoor bepaalt) waar kan het tegen? waterschade, temperatuur?	operations wijze, moet super smooth zijn. dat ebetekent weinig glitches of technische problemen
40	Supermarket	Small	Branch	Urban		High	8	7	1	2	6	5	4	3	de signale moeten snel zijn en kloppend zijn. het moet samen werken met de huidige technologie. bijvoorbeeld, als er een shift switch is, kunnen er weinig mensen zijn, alleen kassieres. Dan werden er 2 tassen met olijfolie en tonijn gestolen. tijdens het lossen was eens 300 euro aan vlees gestolen. hiervoor zal het een goede toepassing zijn. we hebben een budget om weg te tellen, maar niet oneindig.	Loss and shrink	we doen 0/1 metingen om te kijken hoeveel voorraad er is, maar ook om te kijken hoe het schap eruit ziet. is het netjes etc, staan er geen verkeerde producten. je hebt geen oog op elk vak	de support, er moeten duidelijke afspraken zijn, wie doet wat in elke situatie?	
41	Supermarket	Medium	Branch	Urban	Discount	Medium	7	6	2	3	5	1	8	4	soms hebben we restanten wel in het voorraadsysteem en niet in het schap. deze worden dan bijgevuld. dit koppelen we aan het systeem, van welke vakken leeg zijn. door deze extra voorraad kan je de sensor nog niet koppelen aan je bestelsysteem en niet door hoge omloopsnelheid. Daar is vast wel iets voor te verzinnen	Loss and shrink	tandpasta en babyvoeding zijn populair, een pop up op de kassa zou fijn zijn, dit is de trechter van de winkel.	het kostenplaatje, en de beginnnende fase, de prijs moet duidelijk zijn. en we hebben spijlen als schap (geen dichte platen) we gebruiken soms wel plastic platen voor een egale afwerking (voor balans van flessen bijvoorbeeld) maar dit is makkelijk schoon te maken. Producten gaan vaak kapot in de winkel	wat gebeurt er bij verkeerde producten op het schap? we hebben een bestelprincipe (commercieel minimum + veiligheids reserver + historie)

Store type

40 antwoorden

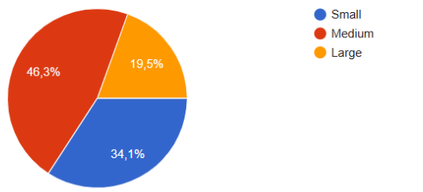
Diagram kopiëren



Size

41 antwoorden

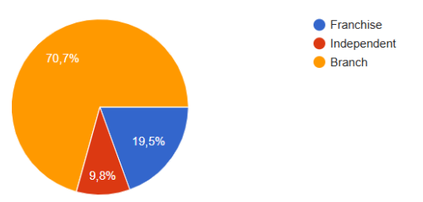
Diagram kopiëren



Governance

41 antwoorden

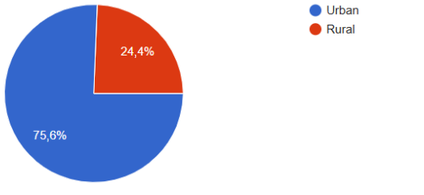
Diagram kopiëren



Location

41 antwoorden

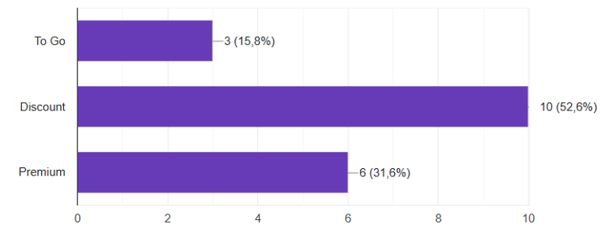
Diagram kopiëren



Specialty

19 antwoorden

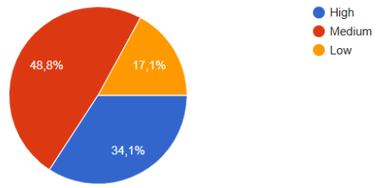
Diagram kopiëren



Tech level

41 antwoorden

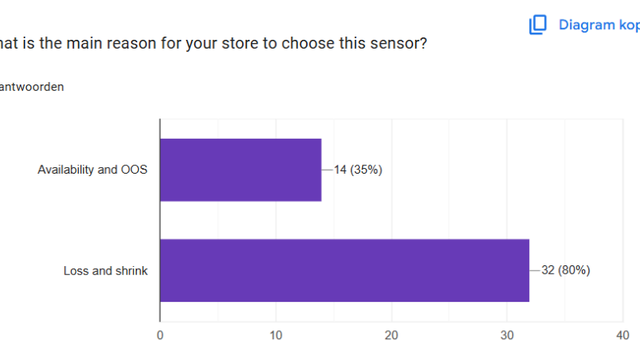
Diagram kopiëren



What is the main reason for your store to choose this sensor?

40 antwoorden

Diagram kopiëren



D. Expert Interview Research Material

D.1 Interview Protocol

Semi-Structured Interview Protocol – MOOS

1.Purpose and interviewer stance

Purpose

- Understand what makes shelf sensing actionable in practice, not just technically possible.
- Map the minimum chain of activities and dependencies needed to capture value at scale.
- Identify adoption gates and the conditions where deep integration wins versus light integration.
- Translate insights into positioning options for MOOS in the retail ecosystem.

Interviewer stance

1. I am not selling a product. I am learning how real rollout decisions are made and why scaling succeeds or fails.
2. I will ask for concrete examples from your experience.
3. I will challenge assumptions gently to understand trade-offs.
4. There are no right or wrong answers. I am interested in your logic and lived reality.

2.Checklist for start

- Confirm participant identity/role and allocate anonymised code (e.g., P1, P2, …).
- Confirm informed consent (incl. recording) is signed.
- Explain confidentiality and voluntary participation; confirm understanding.
- Test audio recording (and backup if available).
- Confirm duration and allow time for questions before starting.
- Note context variables (segment, format, governance, urban/rural) without identifying details.

3.Introductory script

Thank you for taking the time to participate. My name is Gijs and I am conducting interviews for my master thesis.

Before we start, did you have a chance to read the short pre-interview information document I sent?

If yes

Great, thank you. Then I will keep the context short.

If no

No problem. I will give a short neutral overview now so you know what to expect.

MOOS develops shelf-level sensing technology that can detect shelf events and turn them into signals and insights. The broader topic of this interview is not product evaluation. It is about what makes shelf information actionable at scale, and what this means for integration choices, adoption gates, and ecosystem positioning.

In this conversation I will focus on two operational domains where shelf sensing is often discussed. The first is on shelf availability and out-of-stock situations. The second is loss, shrink, and theft risk. I may also touch on related areas like inventory accuracy or planogram changes, depending on your experience.

I am especially interested in the trade-off between two integration approaches. One is deep integration with one or a few partners. The other is light integration with many partners using APIs and project-based integrations. I want to understand when each approach works best and why.

Everything you share will be treated confidentially. In my thesis I will not use your name or identifying details, and quotes will be anonymised. Your participation is voluntary. You can skip any question and you may stop at any time. There are no right or wrong answers. I am interested in your experience and concrete examples.

With your permission, I would like to audio record this conversation so I do not miss details. The recording will only be used for analysis. Is that okay?

4.Interview question guide

1. **To start, could you briefly describe your role and how you are involved in decisions about store technology, store execution, or partnerships?**
    - Which types of retailers or store formats are you most involved with? Grocery, convenience, health and beauty, or other.
    - What does success look like in your role?

1. **From your perspective, what are the most important shelf-related problems today, and why?**
    - Which problems create the most operational pain? Availability and out-of-stock, shrink and theft, inventory accuracy?
    - Which of these problems receive the most budget and attention? Which stays unsolved?

1. **When is shelf information actionable in day-to-day operations? What must be true for information to lead to action?**
    - Who needs to act, and within what time window?
    - What false-alarm rate is acceptable before people start ignoring alerts (alert fatigue)?
    - In practice, what is more valuable: high accuracy later, or 'good-enough' accuracy now?
    - What is the smallest unit of action that matters, shelf-level, section-level or item-level?

Before speaking with ecosystem stakeholders, I conducted a short field study with 41 store operators and store managers across different retail formats.

They were asked to rank eight potential adoption conditions for shelf-level sensing solutions.

Across formats, three attributes consistently ranked highest:

- *Reliable and trustworthy signals*
- *Fast enough to act upon*
- *No additional operational burden*

Attributes such as invisibility of hardware and clear ownership were ranked significantly lower.

1. **From your perspective in the broader retail ecosystem, how do you interpret these store-level priorities?**

    Recognition & alignment

    - Do these results match what you see in practice?
    - Where do you see alignment or misalignment between store-level priorities and head-office or IT-level priorities?

    Strategic tension

    - Are there attributes that store teams underestimate but that are critical for scaling?
    - Conversely, are there attributes that store teams overemphasize?

    Ecosystem implications

    - What would need to happen at system or partner level to truly deliver on reliability and actionability?
    - Which actor in the ecosystem is structurally responsible for guaranteeing reliability?
    - Does delivering on these top priorities push MOOS toward deeper integration, or can they be achieved through lighter integration?

    Governance reflection

    •If ownership was ranked low, does that reflect reality, or is ownership simply invisible until something breaks?

1. **Imagine this sensor which can detect a shelf event. What are the minimum steps that must happen next to create value at scale?**
    - What should happen operationally? Who does what?
    - What should happen technically? Which systems must receive the signal?
    - What should happen organizationally? Who owns the process and the outcome?
    - Separate the chain into installation, daily operation, and maintenance. Where does it usually break?

1. **Under what conditions is deep integration the best path, and under what conditions is light integration the best path?**
    - What deep integration means in practice in your context? Think about device management, dashboards, shared data model, embedded workflows.
    - What light integration means in practice in your context? Think about APIs, project based integrations, multiple partners, faster market coverage.
    - What is the tipping point? Store count, complexity, labor model, legacy stack, security requirements, partner leverage.
    - What is lost in each option? Speed, brand ownership, margin, flexibility, ability to scale.
    - Looking five years ahead, how do you expect shelf-level sensing to be integrated into the retail technology stack? (As part of camera systems, As part of shelf hardware, As part of retail data platforms, As a standalone infrastructure layer)

1. **Where do you most often see misalignment where the scaling of store technology fail?**
    - Technical alignment. Interfaces, reliability, network, device management.
    - Data alignment. Data ownership, definitions, source of truth, access rights.
    - Operational alignment. Workflows, task acceptance, store routines, training.
    - Incentive alignment. Who pays, who benefits, who carries workload.
    - Can you share one concrete example of a rollout that failed and why?

1. **What conditions determine whether a retailer says 'yes' or 'no' to this type of technology, and which preconditions are non-negotiable?**
    - Privacy and compliance. What is acceptable in store, what triggers a hard stop?

- Security and IT governance. Vendor risk, data residency, access control.
- Commercia. Procurement rules, payback thresholds, budget owner.
- Operational. Store workload, alert fatigue, maintenance burden.
- If you had to pick the top three conditions that decide go or no go, what are they?

1. **In the retail ecosystem, who actually determines what happens on the store floor, and who can realistically drive change?**
    - Within a retailer, who can truly drive adoption? Operations, IT, loss prevention, procurement, or category.
    - Outside the retailer, who shapes rollouts? Platform vendor, system integrator, ESL provider, camera platform, enterprise software provider.
    - If a company wants to scale a shelf sensing solution across hundreds or thousands of stores, which actor in the ecosystem ultimately controls that scaling? (Retail operations, IT architecture, Shelf hardware provider, Platform vendors (ESL, camera, analytics), System integrators)

1. **If you were advising MOOS on focus for the coming year, what would you prioritize? Why?**
    - •Would you focus on working deeply with one or two partners, or connect more lightly with several?
    - •If a startup like MOOS wanted to scale quickly, which type of partner would give them the strongest leverage? (Shelf infrastructure companies, ESL platforms, Camera / analytics platforms, System integrators, Retailers themselves)
    - •Which use case would be the most realistic entry point to scale this type of technology? (Shrink detection, On-shelf availability, Inventory accuracy, Store execution automation)
    - •What would you need to see before saying: “this can scale”?
    - •What would you consciously *not* focus on yet?

1. **What did I not ask that I should have asked to understand scaling and positioning correctly?**
    - Who else should I speak to, and why them specifically?
    - Can I follow up if I need to clarify details?

5.Checklist for closure

1. Explain next steps: transcription, thematic analysis, anonymised reporting; possible short follow-up for clarification.
2. Thank the participant, ask for the consent form and stop the recording.
3. Write immediate field notes/memos (non-identifying) right after the interview.

D.2 Interview Participants

Participant code	Name	Organisation	Context	Role
P1	Tom Wielheesen	Capgemini Invent	Senior consultant within Consumer Products & Retail, with expertise in data, IT and strategy	System integrator / strategic advisor
P2	Barbara Bodère-Hundhausen	Gondella	Business Development Manager for Germany, responsible for metal shelving and retail clients	Infrastructure provider, shelving / hardware
P3	Sander van der Laan	Douglas	Managing Director / Head of an international retail organisation with 2,000 stores across 22 countries, with previous experience at Gall & Gall and Albert Heijn	Retailer, decision-maker / HQ
P4	Romke de Jong	HL Display Nederland	Commercial Director, with final responsibility for P&L, focusing on presentation and shelving solutions	Infrastructure provider, hardware / display solutions
P5	Frenkel Tel	AS Watson	Store Innovation Lead within Group IT, involved in store innovation and technology validation for clients including Kruidvat and ICI PARIS XL	Retailer, IT & store innovation
P6	Linde Tangelder	Capgemini	Retail technology specialist, working on autonomous stores and loss prevention using computer vision	System integrator / supply chain advisor
P7	Dion Broeken	Trigo	Retail technology specialist, werkt aan autonomous stores en loss prevention via computer vision	Technology provider, platform / software
P8	John Southerington	HL Display	Senior Product Manager, responsible for identifying technology partnerships and market developments in the field of retail solutions	Infrastructure provider, hardware & partnerships

D.3 Interview consent forms

Interview 1

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☒	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☒	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☒	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☒	☐
6. I consent to audio recording of the interview.	☒	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☒	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☒	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☒
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☒	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☒	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

Signatures

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: Tom Wielheesen

Signature: Tom Wielheesen Digitally signed by Tom Wielheesen Date: 2026.03.13 15:28:30 +01'00' Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: 25 / 03 / 2026

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 2

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☐	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☐	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☐	☐
6. I consent to audio recording of the interview.	☐	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☐	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☐	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☐	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

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HUMAN RESEARCH ETHICS

Signatures

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: _____

Signature: _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: *25 / 03 / 2026*

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 3

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☒	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☒	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☒	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☒	☐
6. I consent to audio recording of the interview.	☒	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☒	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☒	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☒
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☒	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

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HUMAN RESEARCH ETHICS

Signatures

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: Sander van der Laan

Signature: _____ Date: 4 / 3 / 2026

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: Gijs de Meester Date: 25 / 3 / 2026

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 4

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☐	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☐	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☐	☐
6. I consent to audio recording of the interview.	☐	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☐	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☐	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☐	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

Signatures

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: _____

Signature: _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: *25* / *03* / *2026*

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 5

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☐	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☐	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☐	☐
6. I consent to audio recording of the interview.	☐	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☐	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☐	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☐	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

Signatures

I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: _____

Signature: _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: *25* / *03* / *2026*

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 6

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☐	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☐	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☐	☐
6. I consent to audio recording of the interview.	☐	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☐	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☐	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☐	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

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I, as legal representative, have witnessed the accurate reading of the consent form with the potential participant and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Participant name: _____

Signature: LT _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: Gijs de Meester _____ Date: 24 /03 /2026

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 7

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☐	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☐	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☐	☐
6. I consent to audio recording of the interview.	☐	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☐	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☐	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☐	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☐	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

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Participant name: _____

Signature: _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: *25* / *03* / *2026*

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Interview 8

Delft University of Technology

HUMAN RESEARCH ETHICS

Explicit Consent Points

Please tick Yes/No for each statement.

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICIPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the Participant Information above. I have been able to ask questions and my questions have been answered to my satisfaction.	☒	☐
2. I consent voluntarily to participate in this study. I understand I can refuse to answer questions and can withdraw at any time without giving a reason.	☒	☐
3. I understand that participation involves a semi-structured interview (max. 60 minutes) online or in person.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		
4. I understand that the main risk of participation is possible re-identification due to specialist roles or the nature of the topic, and that the researchers will mitigate this by de-identifying data and anonymising quotes.	☒	☐
5. I consent to the collection of the following administrative personal data: my name, email address, organisation and role (for scheduling and consent administration).	☒	☐
6. I consent to audio recording of the interview.	☒	☐
7. I understand that audio recordings will be deleted after transcription has been checked and the transcript de-identified, unless longer retention is required for verification.	☒	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
8. I understand that de-identified information I provide may be used in a Master's thesis and related academic outputs.	☒	☐
9. I agree that anonymous quotes from my interview may be used in research outputs (e.g., thesis, report).	☒	☐
10. OPTIONAL: I agree that my organisation/company name may be mentioned in research outputs.	☐	☐
PLEASE TICK THE APPROPRIATE BOXES	**Yes**	**No**
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
11. I understand that de-identified transcripts and analysis files may be retained for verification purposes in line with TU Delft/faculty policy, with access restricted to the research team.	☒	☐
I understand that my identifiable administrative data (contact details and signed consent form) will be stored separately and retained at least until the thesis is assessed and follow-up questions are concluded.	☒	☐

Delft University of Technology

HUMAN RESEARCH ETHICS

Signatures

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Participant name: _____

Signature: _____ Date: ____ / ____ / _____

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

Researcher name: *Gijs de Meester*

Signature: *Gijs de Meester* Date: *25* / *03* / *2026*

Note: For online interviews, a scanned signature or electronic signature is acceptable, if agreed with the researcher.

Appendix E. Data Analysis

E1. Data preparation process

Material	Raw input	Preparation decision	Use in analysis	Traceability output
Store visit ranking task	41 store visits with an eight-attribute ranking task.	Ranking columns were checked as ordinal ranks from 1 = most important to 8 = least important. Mean rank and top-three frequency were used only as descriptive indicators.	Used to identify store-level adoption priorities, especially reliability, speed of action, and low additional work.	Descriptive ranking summary in Chapter 5 and detailed interpretation note in Table E.4.
Store visit notes and open comments	Short contextual notes and comments from the store visits.	Comments were grouped into practical categories, such as trust in the signal, action speed, workload, visibility, and ownership.	Used to interpret the ranking results without treating short comments as full interview data.	Open response categorisation logic and store-level evidence notes.
Expert interviews	Eight semi-structured interviews with actors across the retail and retail technology ecosystem.	Transcripts and notes were cleaned, anonymised, and organised by participant code. Ambiguous transcript fragments were checked against the surrounding conversation where possible.	Used to identify activity chains, fragile links, actor positions, integration issues, governance gaps, and pathway differences between theft and OOS.	Codebook, theme overview, and framework-to-finding mapping in Tables E.5 and E.6.
NotebookLM notes	Structured notes generated from uploaded interview and store-visit material.	Used as retrieval and organisation support. Notes were not treated as autonomous analysis or as a replacement for researcher interpretation.	Helped compare passages and retrieve evidence during coding and writing.	AI-use boundary table in Table E.8.
Co-creation and design material	Workshop notes, pilot reflections, canvases, and clustered discussion points.	Grouped around future role, current anchor, route tensions, boundary decisions, and no-regret moves.	Used to translate the diagnosis into design criteria and positioning directions. It was not treated as proof that the roadmap would work.	Co-creation synthesis in Chapter 6 and Appendix reference to design input.
Conceptual framework	Framework from Chapter 3, refined through Chapter 5.	Used as a sensitising structure for organising codes around activities, links, alignment, risks, and internal readiness.	Helped connect empirical findings to design criteria and roadmap choices.	Framework-to-finding mapping in Table E.6.

E2. Data cleaning and handling rules

Area	Rule used	Reason	Effect on analysis
Anonymisation	Interview participants were referred to by participant codes rather than full names in the analysis tables.	This protects confidentiality while keeping the actor perspective visible.	Evidence could be compared by actor perspective without exposing identities unnecessarily.
Transcript cleaning	Speech repetitions, filler words, and transcription noise were removed when they did not affect meaning. Technical terms were kept where they mattered for interpretation.	The aim was readability without changing the substance of what participants said.	Quotes and coded fragments remained close to the original meaning.
Ambiguous fragments	Unclear or incomplete transcript passages were not used as primary evidence unless the meaning could be checked from context or notes.	This reduced the risk of over-interpreting uncertain material.	Weak fragments were used only as background, not as main evidence.
Translation and language	Dutch fragments were translated into English only when needed for the English report. The original meaning was kept as closely as possible.	The thesis is written in English, but several research interactions and notes were partly Dutch.	Translated quotes were used carefully and only when they supported a specific point.
Ranking data	Ranking values were treated as ordinal data. Lower mean ranks indicate higher perceived priority.	The task asked respondents to rank attributes from most to least important, not to give interval scores.	Mean rank was used as a descriptive pattern, not as statistical proof.
Co-creation material	Co-creation outputs were coded as design input and not as new evidence about market truth.	The sessions helped structure trade-offs, but the roadmap still had to follow from the earlier diagnosis.	The design process stayed research-led rather than workshop-led.
AI support	AI tools such as Notebook LM were used for organisation, retrieval, comparison, and summarisation support only.	AI can help handle large qualitative material, but it should not decide codes, themes, evidence, or design directions.	The researcher made final coding, interpretation, theme selection, and design decisions.

E3. Codebook

	Final code	*Expo code / origin*	*Code type*	*Definition*	*Supporting interviews*	*Representative quote 1*	*Analytic note*
Theme 1. Fast-moving retail blindness and focal value proposition	Retail Blindness & Phantom Inventory	Retailer Blindness; Phantom Inventory	Hybrid	The systemic gap between physical shelf reality and retailer system assumptions, especially when enterprise stock or replenishment logic assumes stock is present while the shelf is already empty.	P3, P4, P7, P8	"Eén van de allerbelangrijkste problemen die in retailer heeft, is dat die blind is wat er in zijn winkel gebeurt. Hij weet alleen maar wat de omzet is aan het eind van de dag."	This code captures the basic data gap that makes actionable shelf insight necessary in the first place.
Theme 1. Fast-moving retail blindness and focal value proposition	System-Distorting Theft	System-Distorting Theft	Inductive	Organised, multi-item theft events that bypass checkout, create direct loss, and simultaneously corrupt digital stock records.	P3, P4, P5, P7, P8	"Er zijn er gewoon gangs die door Nederland gaan. Mobiele eh mobiele gangs en die starten gewoon in eh in Limburg ergens en die swipen gewoon dat hele vakop."	Useful because it shows that theft is not only a security problem but also an inventory distortion problem.
Theme 1. Fast-moving retail blindness and focal value proposition	OSA Revenue Opportunity	OSA Revenue Opportunity	Hybrid	The commercial value of reducing out-of-stocks by preventing lost sales, customer frustration, and delayed replenishment.	P4, P7, P8	"Daar komt altijd zo 2 3% meer omzet dat je kunt maken op het moment dat je eh je producten eh niet autostok op je schap hebt staan en dat je weet wat er aan de hand is."	Important because it makes the OOS case financially legible beyond the shelf itself.
Theme 1. Fast-moving retail blindness and focal value proposition	Labor Shortage Catalyst	Labor Shortage Catalyst	Inductive	The structural shortage of store labour that makes manual monitoring, manual checking, and manual correction increasingly unrealistic.	P4, P5, P7, P8	"De labor market is op dit moment heel eh heel thaai. Lastig om mensen te vinden en mensen zijn duur. Dus we moeten gewoon eh ja, weet je, op het moment dat je efficiëntie kan vinden door middel van technologie... die besparing wordt steeds groter."	Acts as a background driver that increases the value of automation in both theft and availability contexts.
Theme 2. Chaos theory of store execution	Human Execution & Workload Vulnerability	Human Execution Vulnerability; Peak-Hour Overload	Inductive	Failure risk created when the system depends on busy store staff to maintain, update, check, or execute tasks consistently in a chaotic retail environment.	P4, P8	"I think unfortunately humans are sometimes the weakest link in this... The more complicated it is, the more problematic it can be."	Moves the analysis from generic execution risk to the specific vulnerability of human-dependent systems in stores.
Theme 2. Chaos theory of store execution	Planogram Recalibration Burden	Planogram Recalibration Burden	Inductive	The operational burden created when sensors have to be manually recalibrated or reconfigured every time shelf layouts or product positions change.	P4, P8	"Ik denk de grootste uitdaging in het wisselen van de planogrammen hè, want in één keer gaat dat product naar een ander plekje en dat gebeurt natuurlijk heel veel. Dat moet dan wel allemaal weer opnieuw ingeregeld worden."	Highly relevant for shelf-level hardware because it shows how quickly data quality can drift in normal store operations.
Theme 2. Chaos theory of store execution	Alert Fatigue	Alert Fatigue	Hybrid	The breakdown of actionability when too many false or low-value alerts cause staff to ignore the system.	P5, P7, P8	"In a busy store after a week of that beep beep beeping, if somebody's been trying to steal stuff, there's a good chance that store staff are going to ignore it or it just gets lost in the background..."	Shows why detection accuracy and routing quality are inseparable from actual behaviour on the shop floor.
Theme 2. Chaos theory of store execution	Staff Capability & Safety Limits	Staff Capability & Safety Limits	Inductive	The practical, legal, and organisational limits of expecting young or low-authority store staff to interpret complex signals or confront suspected thieves.	P3, P6, P7	"Die zal nooit gaan zeggen tegen een juffrouw van 16. Daar komt nu een klant aan die diefstal pleegt. Ga maar stoppen."	Important because it redefines actionability as a role and authority issue, not just a speed issue.
Theme 3. Integration paradox	Demand for API Modularity	API-First Modularity	Inductive	Preference for light, decoupled, reusable API-based connections that keep options open and reduce bespoke development.	P4, P5	"Als dat iets anders gaat worden in de toekomst, ja, dan haal je gewoon de software eruit... precies een soort legoblokjes. Om maar gewoon die onafhankelijkheid te behouden."	Captures the strong ecosystem preference for modularity in fragmented technology markets.
Theme 3. Integration paradox	Lock-in & Market Exclusion	Lock-in & Market Exclusion	Inductive	The risk that deep or exclusive integration with one dominant ecosystem actor reduces future market access because rival retailers or partners avoid the solution.	P5, P6, P8	"Walmart bought a 10% stake in Fusion... So then what happened was the second, third, fourth... biggest players in North America didn't roll out Fusion. They rolled out other people's ESLs because they didn't want to buy from any company that was kind of in bed with Walmart."	Important because it turns integration into a strategic exposure question rather than just a technical one.
Theme 3. Integration paradox	End-to-End ROI Proof (Deep Integration)	End-to-End ROI Proof	Hybrid	The need to embed sensor data deeply enough into enterprise systems, such as ERP or replenishment environments, to prove measurable business value.	P7	"...dan praat ik dus over diepe integratie als ik dus kan samen met een partner kan aantonen van ik trigger dit en je kan in SAP zien: Mijn performance van mijn sensoren zorgt ervoor dat mijn availability met 1-2% omhoog gegaan is."	Makes clear that some value cases cannot be proven from a side system alone.
Theme 3. Integration paradox	Integration by Use Case	Integration by Use Case	Inductive	The structural split in which theft tends to work through lighter trigger routing, while OOS requires deeper system closure and backend integration.	P7	"Ik denk in de out of stock wereld om de schalen denk ik dat je bijna niet ontkomt om te kijken van welke partijen in de markt kan ik een volle propositie maken.	One of the strongest bridge codes from empirical diagnosis to positioning logic.
Theme 3. Integration paradox	Physical vs. Software Integration	Physical vs. Software Integration	Inductive	The distinction between embedding the hardware deeply into shelf infrastructure while keeping software and data routing comparatively open and modular.	P3, P8	"Dus als wij een schapleverancier hebben die schappen met matten aan ons verkoopt... dan hoef ik niet een mattenleverancier te hebben, maar heb ik een smartschappenleverancier."	Useful because it turns 'integration' into a layered design variable instead of one binary choice.
Theme 4. Fragmented buying centre and adoption gatekeepers	The Upfront ROI Gate	Upfront ROI Gate	Hybrid	The corporate requirement for an explicit financial business case and payback logic before testing, adoption, or rollout.	P3, P4, P5, P8	"Denk de grootste hurdel. Is. Eigenlijk. Van tevoren... Dat je eigenlijk van tevoren met de retailers... eigenlijk alles al in een model heb moeten kunnen gieten. Je ROI moet hebben berekend... voordat we een stap maken van joh, we gaan gewoon eens testen In de winkel."	Important because it shows why startup learning logic and enterprise buying logic can clash very early.
Theme 4. Fragmented buying centre and adoption gatekeepers	IT Resource Bottleneck	IT Resource Bottleneck	Hybrid	The chronic shortage of integration capacity, migration bandwidth, and architectural attention inside central retail IT environments.	P1, P2, P5, P7	"Er is een prioriteitenlijst... daar staan 100 dingen op en waar is er altijd tekort aan is aan IT resources... Het heeft een jaar geduurd voordat de directie gewoon de prioriteit ertoe gekend: OK beste IT. Jullie moeten nu die integraties maken."	Very strong support across interviews; one of the main reasons why promising pilots stall after initial interest.
Theme 4. Fragmented buying centre and adoption gatekeepers	Commercial Veto (Sales vs. Security)	Commercial Veto (Sales vs. Security)	Inductive	The power of sales, marketing, or customer-experience actors to block otherwise attractive loss-prevention solutions if they make the store feel hostile or commercially damaging.	P5, P7	"Maar Sales is degene die zegt: 'Ja, maar jij gaat mijn klanten mogelijk lastig vallen met hem aanspreken.' En Als je dat fout doet, komt hij bij mij niet meer terug. Want dan gaat hij dus bij een omzet naar beneden."	Analytically valuable because it shows that a technically effective solution may still be rejected for shopper-facing reasons.
Theme 4. Fragmented buying centre and adoption gatekeepers	HQ-Store Priority Misalignment	HQ vs. Store Misalignment	Hybrid	The difference between what headquarters optimises for, such as architecture, ROI, and repeatability, and what store teams optimise for, such as speed, trust, and low burden.	P6, P8	"Prioriteiten van de winkel is eigenlijk gewoon zo efficiënt mogelijk de winkel runnen. En. Prioriteiten van het hoofdkantoor zou het meer kosten gedreven... performance van winkels."	Key bridge code from raw findings to ecosystem interpretation.
Theme 4. Fragmented buying centre and adoption gatekeepers	Enterprise SLA & Field Support Gate	Maintenance & SLA Gate; Field Support Burden	Inductive	The requirement that support, maintenance, and fault recovery must be credible and scalable across dispersed store networks.	P3, P5, P8	"Grote klanten zijn gewoon puur puur op zoek naar zekerheid... Wat gebeurt er als er een centrum kapot gaat? Hoe hoe snel kan die dan worden worden vervangen?"	Makes service design and operational support part of the positioning problem, not an afterthought.
Theme 4. Fragmented buying centre and adoption gatekeepers	Master Data Dependency	Master Data Dependency	Inductive	The vulnerability that sensor logic can fail because upstream product or reference data, such as product weights or item definitions, are poor or poorly maintained.	P3	"Het gaat ook heel vaak vaak fout op productmasterdata hè. Dat is dat een andere iemand anders in zo'n groot bedrijf die product master data moet verzamelen. Anders werken die matten niet."	Evidence is concentrated in a smaller number of interviews, but the code is analytically strong because it reveals a hidden system failure point.
Theme 5. Ecosystem piggybacking to scale	Hardware Infrastructure Piggybacking	ESL Piggybacking; Shelf Infrastructure Integration	Inductive	Scaling by embedding sensors into infrastructure or store upgrades that retailers are already buying, such as ESL rollouts, shelf refits, or smart-shelf hardware.	P2, P3, P4, P8	"If a retailer's already rolling out ESL into that store and you can then almost piggyback Moose into that, like they're getting so much extra value, but from that one visit, from that one installation."	A concrete scale route that reduces installation friction and makes hardware adoption more realistic.
Theme 5. Ecosystem piggybacking to scale	Software & IT Ecosystem Routing	Partner as Door Opener; System Integrator & Full Proposition; Camera & Analytics Integration	Inductive	Scaling by routing the proposition through established enterprise actors, such as system integrators, security platforms, or other trusted software ecosystems that can open doors and carry credibility.	P1, P2, P6, P7, P8	"I would not focus on the retailers themselves because it's a niche... it could be a nice to have for the partner that is already working with the customer. It could be a door opener for you."	Important because it reframes scaling as ecosystem attachment rather than stand-alone sales.
Theme 5. Ecosystem piggybacking to scale	Partner Dependency & Resource Drain	Partner Dependency & Resource Drain	Inductive	The risk that a startup becomes over-dependent on one large partner or retailer and exhausts its engineering, support, and commercial capacity.	P8	"If you've got 100 leads, which ones do you decide to prioritise? ... if you're not careful, does Tesco take up so much of the resource that well actually these other medium fish.. . how do you keep that momentum?"	Acts as the main counter-weight to the optimism of partner-led scaling.
Theme 5. Ecosystem piggybacking to scale	Hardware Infrastructure Piggybacking	ESL Piggybacking	Inductive	Scaling by installing the technology alongside a planned Electronic Shelf Label (ESL) rollout to utilize existing installation budgets and minimize store disruption.	P3, P8	"If a retailer's already rolling out ESL into that store and you can then almost piggyback Moose into that, like they're getting so much extra value, but from that one visit, from that one installation."	Exploratory stage note: this code fed into Hardware Infrastructure Piggybacking
Theme 5. Ecosystem piggybacking to scale	Hardware Infrastructure Piggybacking	Shelf Infrastructure Integration	Inductive	Embedding the sensor directly into the physical metal shelving units or displays provided by established shelf manufacturers to ensure robustness and utilize their distribution channels.	P2, P3, P4, P8	"Als wij een schapleverancier hebben die schappen met matten aan ons verkoopt... dan hoef ik niet een mattenleverancier te hebben, maar heb ik een smart schappenleverancier."	Exploratory stage note: this code fed into Hardware Infrastructure Piggybacking
Theme 5. Ecosystem piggybacking to scale	Software & IT Ecosystem Routing	Partner as Door Opener	Inductive	Leveraging the trust and existing vendor relationships of larger platforms to bypass the retailer's strict IT and procurement gatekeepers (indirect sales).	P1, P2	"I would not focus on the retailers themselves because it's a niche... it could be a nice to have for the partner that is already working with the customer. It could be a door opener for you."	Exploratory stage note: this code fed into Software & IT Ecosystem Routing
Theme 5. Ecosystem piggybacking to scale	Software & IT Ecosystem Routing	System Integrator & Full Proposition	Inductive	Allying with IT integrators and consultants to build a complete, end-to-end data proposition that connects the sensor to enterprise ERP systems (like SAP).	P6, P7	"Ik denk in de out of stock wereld om te schalen denk ik dat je bijna niet ontkomt om te kijken van welke partijen in de markt kan ik een volle propositie maken."	Exploratory stage note: this code fed into Software & IT Ecosystem Routing
Theme 5. Ecosystem piggybacking to scale	Software & IT Ecosystem Routing	Camera & Analytics Integration	Inductive	Combining shelf sensors with existing security camera platforms to validate theft triggers with video evidence and enhance the loss-prevention ecosystem.	P6, P8	"Ik zou dan zeggen nou ik moet matchen met de security camera's bijvoorbeeld, dat je goede case kan bouwen van oké, we hebben op meerdere punten gezien dat je iets gestolen hebt."	Exploratory stage note: this code fed into Software & IT Ecosystem Routing
Theme 5. Ecosystem piggybacking to scale	Flagged outlier scaling variant	FMCG Brand Financing	Inductive	Overcoming retailer budget constraints by having external consumer brands (FMCG) pay for the installation in exchange for actionable shelf data for their merchandisers.	P4, P8	"Supermarkten zijn heel gretig als ze het zelf niet hoeven te betalen. Wij zien dat ook heel vaak dat dus de toeleveranciers de de Mars, de Coca-Cola's, de Unilever dat die het installeren voor de supermarkten."	Exploratory stage note: this code fed into Flagged outlier scaling variant
Theme 5. Ecosystem piggybacking to scale	Partner Dependency & Resource Drain	Partner Dependency & Resource Drain	Inductive	The severe operational risk that leveraging massive partners or landing a giant retail client (the "big fish") will completely drain the startup's limited engineering and support resources.	P8	"If you've got 100 leads, which ones do you decide to prioritise? ... if you're not careful, does Tesco take up so much of the resource that well actually these other medium fish.. . how do you keep that momentum?"	Exploratory stage note: this code fed into Partner Dependency & Resource Drain
Theme 4. Fragmented buying centre and adoption gatekeepers	The Upfront ROI Gate	Upfront ROI Gate	Hybrid	The strict corporate requirement for a fully calculated financial business case and proven Return on Investment (ROI) before initiating agile pilots or scaling.	P3, P4, P5, P8	"Denk de grootste hurdel. Is. Eigenlijk. Van tevoren... Dat je eigenlijk van tevoren met de retailers... eigenlijk alles al in een model heb moeten kunnen gieten. Je ROI moet hebben berekend... voordat we een stap maken van joh, we gaan gewoon eens testen In de winkel."	Exploratory stage note: this code fed into The Upfront ROI Gate
Theme 4. Fragmented buying centre and adoption gatekeepers	IT Resource Bottleneck	IT Resource Bottleneck	Hybrid	The delay or blockage of technology adoption due to a chronic lack of integration capacity and competing legacy transformations within the retailer's central IT department.	P1, P2, P5, P7	"Er is een prioriteitenlijst... daar staan 100 dingen op en waar is er altijd tekort aan is aan IT resources... Het heeft een jaar geduurd voordat de directie gewoon de prioriteit ertoe gekend: OK beste IT. Jullie moeten nu die integraties maken."	Exploratory stage note: this code fed into IT Resource Bottleneck
Theme 4. Fragmented buying centre and adoption gatekeepers	Commercial Veto (Sales vs. Security)	Commercial Veto (Sales vs. Security)	Inductive	The power of the Sales and Marketing departments to block loss-prevention initiatives if the technology negatively impacts the shopper experience and threatens revenue.	P5, P7	"Maar Sales is degene die zegt: 'Ja, maar jij gaat mijn klanten mogelijk lastig vallen met hem aanspreken.' En Als je dat fout doet, komt hij bij mij niet meer terug. Want dan gaat hij dus bij een omzet naar beneden."	Exploratory stage note: this code fed into Commercial Veto (Sales vs. Security)
Theme 4. Fragmented buying centre and adoption gatekeepers	HQ-Store Priority Misalignment	HQ vs. Store Misalignment	Hybrid	The discrepancy in priorities where store staff focus on daily workflow ease, while headquarters focus on macro-logistics and tactical KPIs, meaning a solution loved by the store floor can still be rejected by HQ.	P6, P8	"Prioriteiten van de winkel is eigenlijk gewoon zo efficiënt mogelijk de winkel runnen. En. Prioriteiten van het hoofdkantoor zou het meer kosten gedreven... performance van winkels."	Exploratory stage note: this code fed into HQ-Store Priority Misalignment
Theme 4. Fragmented buying centre and adoption gatekeepers	Enterprise SLA & Field Support Gate	Maintenance & SLA Gate	Inductive	The strict enterprise requirement for guaranteed Service Level Agreements (SLAs) and remote support infrastructure to handle hardware or network failures at scale.	P3, P5, P8	"Grote klanten zijn gewoon puur puur op zoek naar zekerheid... Wat gebeurt er als er een centrum kapot gaat? Hoe hoe snel kan die dan worden worden vervangen?"	Exploratory stage note: this code fed into Enterprise SLA & Field Support Gate
Theme 4. Fragmented buying centre and adoption gatekeepers	Master Data Dependency	Master Data Dependency	Inductive	The structural vulnerability that sensor accuracy relies entirely on foundational product data (like precise weights) maintained by uninvested departments (like Procurement).	P3	"Het gaat ook heel vaak vaak fout op productmasterdata hè. Dat is dat een andere iemand anders in zo'n groot bedrijf die product master data moet verzamelen. Anders werken die matten niet."	Exploratory stage note: this code fed into Master Data Dependency
Theme 3. Integration paradox	Demand for API Modularity	API-First Modularity	Inductive	The strong preference for decoupled, API-based software integrations that function as interchangeable building blocks to maintain flexibility.	P4, P5	"Als dat iets anders gaat worden in de toekomst, ja, dan haal je gewoon de software eruit... precies een soort legoblokjes. Om maar gewoon die onafhankelijkheid te behouden."	Exploratory stage note: this code fed into Demand for API Modularity
Theme 3. Integration paradox	Lock-in & Market Exclusion	Lock-in & Market Exclusion	Inductive	The commercial risk that deep, exclusive integration with a single partner shrink the total addressable market, as competing retailers will actively boycott the solution.	P5, P6, P8	"Walmart bought a 10% stake in Fusion... So then what happened was the second, third, fourth... biggest players in North America didn't roll out Fusion. They rolled out other people's ESLs because they didn't want to buy from any company that was kind of in bed with Walmart."	Exploratory stage note: this code fed into Lock-in & Market Exclusion
Theme 3. Integration paradox	End-to-End ROI Proof (Deep Integration)	End-to-End ROI Proof	Hybrid	The necessity of deeply embedding the technology into a retailer's core enterprise systems (e.g., SAP, ERP) to automatically trigger systemic actions and prove financial value.	P7	"...dan praat ik dus over diepe integratie als ik dus kan samen met een partner kan aantonen van ik trigger dit en je kan in SAP zien: Mijn performance van mijn sensoren zorgt ervoor dat mijn availability met 1-2% omhoog gegaan is."	Exploratory stage note: this code fed into End-to-End ROI Proof (Deep Integration)
Theme 3. Integration paradox	Integration by Use Case	Integration by Use Case	Inductive	The logic that the required depth of integration depends entirely on the operational problem: Out-of-Stock requires deep ERP integration, while Loss Prevention (theft) functions on light API integration.	P7	"Ik denk in de out of stock wereld om de schalen denk ik dat je bijna niet ontkomt om te kijken van welke partijen in de markt kan ik een volle propositie maken.	Exploratory stage note: this code fed into Integration by Use Case
Theme 3. Integration paradox	Physical vs. Software Integration	Physical vs. Software Integration	Inductive	The distinction that hardware can (and should) be deeply embedded (e.g., built into shelves, sharing ESL power), while the software layer must remain independent and light.	P3, P8	"Dus als wij een schapleverancier hebben die schappen met matten aan ons verkoopt... dan hoef ik niet een mattenleverancier te hebben, maar heb ik een smartschappenleverancier."	Exploratory stage note: this code fed into Physical vs. Software Integration
Theme 3. Integration paradox	Dropped / weak single-respondent rule	Integration by Market Share	Inductive	The strategic decision to pursue deep integration only when there is an undisputed market leader, while relying on light integration for highly fragmented markets.	P6	"Ik denk dat diepe integratie de beste keuze is als het heel erg duidelijk is voor de complementaire technologische oplossingen wie de marktleider is... Als er heel veel dezelfde soort bedrijven zijn... dan is het veel logischer dat je een lichte integratie doet."	Exploratory stage note: this code fed into Dropped / weak single-respondent rule
Theme 3. Integration paradox	Flagged minority case / contradictory	The Exclusivity Myth	Inductive	The outlier view that exclusive, deep partnerships do not alienate competitors, as large retailers frequently adopt the same standard enterprise partners without caring about exclusivity.	P3	"Zo werkt het met SAP niet... Albert Heijn zal zich er niet druk om maken dat Jumbo ook met SAP werkt... Als Jumbo met die matten op het schap gaat werken... dan zou het maar zo kunnen dat Albert Heijn zegt, Jezus... Ik moet ook die matten van Jumbo op mijn schap hebben."	Exploratory stage note: this code fed into Flagged minority case / contradictory
Theme 2. Chaos theory of store execution	Human Execution & Workload Vulnerability	Human Execution Vulnerability	Inductive	System failures caused by human unpredictability (e.g., sickness, forgetting tasks), which breaks the synchronization between physical shelves and digital records.	P8	"I think unfortunately humans are sometimes the weakest link in this... The more complicated it is, the more problematic it can be."	Exploratory stage note: this code fed into Human Execution & Workload Vulnerability
Theme 2. Chaos theory of store execution	Planogram Recalibration Burden	Planogram Recalibration Burden	Inductive	The operational friction and scaling barrier caused by requiring store staff to manually remeasure or reset sensors whenever shelf layouts (planograms) change.	P4, P8	"Ik denk de grootste uitdaging in het wisselen van de planogrammen hè, want in één keer gaat dat product naar een ander plekje en dat gebeurt natuurlijk heel veel. Dat moet dan wel allemaal weer opnieuw ingeregeld worden."	Exploratory stage note: this code fed into Planogram Recalibration Burden
Theme 2. Chaos theory of store execution	Human Execution & Workload Vulnerability	Peak-Hour Overload	Inductive	The failure of manual technological tasks because staff are overwhelmed during busy periods and must prioritize core operations over tech maintenance.	P4, P8	"...because on a Saturday afternoon when it's crazy busy, if it takes an extra 5, 10 seconds to do it and it's not done... there's a good chance that it doesn't get done properly."	Exploratory stage note: this code fed into Human Execution & Workload Vulnerability
Theme 2. Chaos theory of store execution	Alert Fatigue	Alert Fatigue	Hybrid	Store staff actively ignoring system notifications due to a high volume of false positives or constant, disruptive alerts.	P5, P7, P8	"In a busy store after a week of that beep beep beeping, if somebody's been trying to steal stuff, there's a good chance that store staff are going to ignore it or it just gets lost in the background..."	Exploratory stage note: this code fed into Alert Fatigue
Theme 2. Chaos theory of store execution	Staff Capability & Safety Limits	Staff Capability & Safety Limits	Inductive	The operational and legal unreasonableness of expecting young, untrained retail staff (e.g., 16-year-olds) to interpret complex data dashboards or act as security guards.	P3, P6, P7	"Die zal nooit gaan zeggen tegen een juffrouw van 16. Daar komt nu een klant aan die diefstal pleegt. Ga maar stoppen."	Exploratory stage note: this code fed into Staff Capability & Safety Limits
Theme 2. Chaos theory of store execution	Enterprise SLA & Field Support Gate	Field Support Burden	Inductive	The logistical nightmare and high cost of requiring physical technicians to travel to dispersed store locations to fix broken hardware or connectivity issues.	P3, P5, P8	"Because if you have to physically send somebody there, I mean, very quickly, that's like, there's the travel time... now I've got a six hour drive to the next bloody store..."	Exploratory stage note: this code fed into Enterprise SLA & Field Support Gate
Theme 1. Fast-moving retail blindness and focal value proposition	Retail Blindness & Phantom Inventory	Retailer Blindness	Hybrid	The structural inability of retailers to see real-time physical shelf conditions between warehouse delivery and POS checkout.	P3, P7	"Eén van de allerbelangrijkste problemen die in retailer heeft, is dat die blind is wat er in zijn winkel gebeurt. Hij weet alleen maar wat de omzet is aan het eind van de dag."	Exploratory stage note: this code fed into Retail Blindness & Phantom Inventory
Theme 1. Fast-moving retail blindness and focal value proposition	Retail Blindness & Phantom Inventory	Phantom Inventory	Hybrid	The discrepancy between what the IT/replenishment system records as available stock and the actual physically empty shelf, which paralyzes automated ordering.	P3, P4, P7, P8	"Op het moment dat het systeem denkt dat er nog voorraad is en op en op het schap op die mat staat niks, dan krijgt die winkel in principe geen nieuwe leveringen op dat artikel... Dus dat is waardeverlies, want je verkoopt niks."	Exploratory stage note: this code fed into Retail Blindness & Phantom Inventory
Theme 1. Fast-moving retail blindness and focal value proposition	System-Distorting Theft	System-Distorting Theft	Inductive	Organized theft (like "sweeps") that bypasses the checkout, causing acute financial loss while simultaneously corrupting the store's digital inventory data.	P3, P4, P5, P7, P8	"Er zijn er gewoon gangs die door Nederland gaan. Mobiele eh mobiele gangs en die starten gewoon in eh in Limburg ergens en die swipen gewoon dat hele vakop."	Exploratory stage note: this code fed into System-Distorting Theft
Theme 1. Fast-moving retail blindness and focal value proposition	OSA Revenue Opportunity	OSA Revenue Opportunity	Hybrid	The invisible financial loss and missed sales opportunities caused by out-of-stock (OOS) situations on the shelf.	P4, P7, P8	"Daar komt altijd zo 2 3% meer omzet dat je kunt maken op het moment dat je eh je producten eh niet autostok op je schap hebt staan en dat je weet wat er aan de hand is."	Exploratory stage note: this code fed into OSA Revenue Opportunity
Theme 1. Fast-moving retail blindness and focal value proposition	Labor Shortage Catalyst	Labor Shortage Catalyst	Inductive	The structural lack of available and affordable store staff that forces retailers to seek technological automation for shelf-monitoring.	P4, P5, P7, P8	"De labor market is op dit moment heel eh heel thaai. Lastig om mensen te vinden en mensen zijn duur. Dus we moeten gewoon eh ja, weet je, op het moment dat je efficiëntie kan vinden door middel van technologie... die besparing wordt steeds groter."	Exploratory stage note: this code fed into Labor Shortage Catalyst
Theme 1. Fast-moving retail blindness and focal value proposition	Dropped / scope note	Premium Retail Irrelevance	Inductive	The boundary condition where shelf-sensing adds no value due to extremely low turnover rates and high staff-to-customer ratios.	P3	"Ik verkoop er maar één in de vier maanden. Dus en dan heb ik ook nog vijf medewerkers die de hele dag door langs die schappen patrouilleren... in mijn geval heeft het onvoldoende toegevoegde waarde om die investering in die matsen te doen."	Exploratory stage note: this code fed into Dropped / scope note

E4. Interview x codes

Interview code	*Respondent role*	*Evidence fragment*	*First-cycle code*	*Main theme*	*Use-case*	*Why this fragment matters*
P1	Senior consultant in strategy and transformation projects	"Ik denk dat je ... moet waken dat je alles custom made gaat maken ... dat je uiteindelijk wat meer richting modulair werk moet gaan, anders maak je het heel moeilijk schaalbaar."	Avoid bespoke development	Theme 3. Integration paradox	Cross-case / ecosystem	Shows a consultant perspective that scaling is blocked when each client requires bespoke development work.
P1	Senior consultant in strategy and transformation projects	"Als je diep integreert met partner één, betekent dat misschien dat je met partner twee en drie niet meer kan samenwerken, waardoor je je markt verkleint."	Exclusive partner risk	Theme 3. Integration paradox	Cross-case / ecosystem	Shows how deep integration can narrow the addressable market before the startup has established a repeatable position.
P1	Senior consultant in strategy and transformation projects	"Ik denk veel tijdsbesparing ... hoe kunnen we in minder uren eigenlijk dezelfde servicekwaliteit of betere servicekwaliteit bieden?"	Time-saving budget logic	Theme 1. Fast-moving retail blindness and focal value proposition	OOS / availability	Connects the value proposition to labour efficiency and management-level value rather than only shelf-level detection.
P1	Senior consultant in strategy and transformation projects	"Samenwerken met Capgemini ... dat we op die manier bij de klant komen ... is zeker een oplossing."	Integrator as access route	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Shows that indirect market access through trusted integrators is seen as a realistic route into enterprise retail environments.
P2	Business development / retail account management professional	"If the ESL changes to another product, then you don't have to manually recalibrate the sensor."	ESL-driven recalibration relief	Theme 5. Ecosystem piggybacking to scale	OOS / availability	Shows how piggybacking on ESL infrastructure can reduce one of the core human-maintenance risks in store execution.
P2	Business development / retail account management professional	"There could be more value if it can integrate with other technologies ... ESLs ... computer vision."	Sensor as complement, not stand-alone	Theme 3. Integration paradox	Cross-case / ecosystem	Shows that value is expected to emerge through complementarity with surrounding systems rather than through stand-alone sensing alone.
P2	Business development / retail account management professional	"I would not focus on the retailers themselves because it's a niche ... it could be a nice to have for the partner that is already working with the customer."	Do not sell standalone to retailers	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Shows an explicit ecosystem sales logic in which the sensor is attached to a broader partner proposition.
P2	Business development / retail account management professional	"I would not focus on the retailers themselves because it's a niche... it could be a nice to have for the partner that is already working with the customer. It could be a door opener for you."	Partner as Door Opener	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Leveraging the trust and existing vendor relationships of larger platforms to bypass the retailer's strict IT and procurement gatekeepers (indirect sales).
P2	Business development / retail account management professional	"It could be a door opener for you."	Partner credibility	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Captures the borrowing of trust and installed relationships as a scale mechanism.
P3	General director / end responsible for an international retail organisation	"Ik verkoop er maar één in de vier maanden. Dus en dan heb ik ook nog vijf medewerkers die de hele dag door langs die schappen patrouilleren... in mijn geval heeft het onvoldoende toegevoegde waarde om die investering in die matsen te doen."	Premium Retail Irrelevance	Theme 1. Fast-moving retail blindness and focal value proposition	Cross-case / ecosystem	The boundary condition where shelf-sensing adds no value due to extremely low turnover rates and high staff-to-customer ratios.
P3	General director / end responsible for an international retail organisation	"Zo werkt het met SAP niet... Albert Heijn zal zich er niet druk om maken dat Jumbo ook met SAP werkt... Als Jumbo met die matten op het schap gaat werken... dan zou het maar zo kunnen dat Albert Heijn zegt, Jezus... Ik moet ook die matten van Jumbo op mijn schap hebben."	The Exclusivity Myth	Theme 3. Integration paradox	Cross-case / ecosystem	The outlier view that exclusive, deep partnerships do not alienate competitors, as large retailers frequently adopt the same standard enterprise partners without caring about exclusivity.
P3	General director / end responsible for an international retail organisation	"Als wij een schapleverancier hebben die schappen met matten aan ons verkoopt... dan hoef ik niet een mattenleverancier te hebben, maar heb ik een smart schappenleverancier."	Shelf Infrastructure Integration	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Embedding the sensor directly into the physical metal shelving units or displays provided by established shelf manufacturers to ensure robustness and utilize their distribution channels.
P3	General director / end responsible for an international retail organisation	"Het gaat ook heel vaak vaak fout op productmasterdata hè. Dat is dat een andere iemand anders in zo'n groot bedrijf die product master data moet verzamelen. Anders werken die matten niet."	Master Data Dependency	Theme 4. Fragmented buying centre and adoption gatekeepers	OOS / availability	The structural vulnerability that sensor accuracy relies entirely on foundational product data (like precise weights) maintained by uninvested departments (like Procurement).
P3	General director / end responsible for an international retail organisation	"Dus als wij een schapleverancier hebben die schappen met matten aan ons verkoopt... dan hoef ik niet een mattenleverancier te hebben, maar heb ik een smartschappenleverancier."	Physical vs. Software Integration	Theme 3. Integration paradox	Cross-case / ecosystem	The distinction that hardware can (and should) be deeply embedded (e.g., built into shelves, sharing ESL power), while the software layer must remain independent and light.
P3	General director / end responsible for an international retail organisation	"Op het moment dat het systeem denkt dat er nog voorraad is en op en op het schap op die mat staat niks, dan krijgt die winkel in principe geen nieuwe leveringen op dat artikel... Dus dat is waardeverlies, want je verkoopt niks."	Phantom Inventory	Theme 1. Fast-moving retail blindness and focal value proposition	OOS / availability	The discrepancy between what the IT/replenishment system records as available stock and the actual physically empty shelf, which paralyzes automated ordering.
P4	Commercial professional in retail / display solutions in the Benelux	"Supermarkten zijn heel gretig als ze het zelf niet hoeven te betalen ... Mars, Coca Cola, Unilever installeren het voor de supermarkten."	External funding route	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Introduces an alternative commercial architecture in which external brands finance deployment in exchange for operational value.
P4	Commercial professional in retail / display solutions in the Benelux	"Supermarkten zijn heel gretig als ze het zelf niet hoeven te betalen. Wij zien dat ook heel vaak dat dus de toeleveranciers de de Mars, de Coca-Cola's, de Unilever dat die het installeren voor de supermarkten."	FMCG Brand Financing	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Overcoming retailer budget constraints by having external consumer brands (FMCG) pay for the installation in exchange for actionable shelf data for their merchandisers.
P4	Commercial professional in retail / display solutions in the Benelux	"Als wij een schapleverancier hebben die schappen met matten aan ons verkoopt ... dan heb ik een smart schappenleverancier."	Smart shelf route	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Shows a concrete physical embedment route in which MOOS becomes part of a broader shelf offering rather than a separate product.
P4	Commercial professional in retail / display solutions in the Benelux	"We verkopen daar maar één per week. Dus als daar twee uit het schap gehaald worden, willen we eigenlijk al een melding hebben."	Category-specific trigger logic	Theme 3. Integration paradox	Theft / loss prevention	Shows that trigger thresholds and response models depend on category economics and use-case context.
P4	Commercial professional in retail / display solutions in the Benelux	"Ik denk de grootste uitdaging in het wisselen van de planogrammen hè, want in één keer gaat dat product naar een ander plekje en dat gebeurt natuurlijk heel veel. Dat moet dan wel allemaal weer opnieuw ingeregeld worden."	Planogram Recalibration Burden	Theme 2. Chaos theory of store execution	OOS / availability	The operational friction and scaling barrier caused by requiring store staff to manually remeasure or reset sensors whenever shelf layouts (planograms) change.
P4	Commercial professional in retail / display solutions in the Benelux	"Het mag niet de dagelijkse operatie in de weg zitten ... hun planogrammen willen ze beslist niet kwijt."	Store disruption from hardware changes	Theme 2. Chaos theory of store execution	OOS / availability	Shows how shelf-level hardware can fail if it disrupts the planogram logic retailers already rely on.
P5	Lead in store innovation and product / design development	"Als dat iets anders gaat worden in de toekomst, ja, dan haal je gewoon de software eruit... precies een soort legoblokjes. Om maar gewoon die onafhankelijkheid te behouden."	API-First Modularity	Theme 3. Integration paradox	Cross-case / ecosystem	The strong preference for decoupled, API-based software integrations that function as interchangeable building blocks to maintain flexibility.
P5	Lead in store innovation and product / design development	"Grote klanten zijn gewoon puur puur op zoek naar zekerheid... Wat gebeurt er als er een centrum kapot gaat? Hoe hoe snel kan die dan worden worden vervangen?"	Maintenance & SLA Gate	Theme 4. Fragmented buying centre and adoption gatekeepers	Cross-case / ecosystem	The strict enterprise requirement for guaranteed Service Level Agreements (SLAs) and remote support infrastructure to handle hardware or network failures at scale.
P5	Lead in store innovation and product / design development	"Prioriteiten van de winkel is eigenlijk gewoon zo efficiënt mogelijk de winkel runnen. En. Prioriteiten van het hoofdkantoor zou het meer kosten gedreven... performance van winkels."	HQ vs. Store Misalignment	Theme 4. Fragmented buying centre and adoption gatekeepers	Cross-case / ecosystem	The discrepancy in priorities where store staff focus on daily workflow ease, while headquarters focus on macro-logistics and tactical KPIs, meaning a solution loved by the store floor can still be rejected by HQ.
P5	Lead in store innovation and product / design development	"De labor market is op dit moment heel eh heel thaai. Lastig om mensen te vinden en mensen zijn duur. Dus we moeten gewoon eh ja, weet je, op het moment dat je efficiëntie kan vinden door middel van technologie... die besparing wordt steeds groter."	Labor Shortage Catalyst	Theme 1. Fast-moving retail blindness and focal value proposition	Cross-case / ecosystem	The structural lack of available and affordable store staff that forces retailers to seek technological automation for shelf-monitoring.
P5	Lead in store innovation and product / design development	"Er zijn er gewoon gangs die door Nederland gaan. Mobiele eh mobiele gangs en die starten gewoon in eh in Limburg ergens en die swipen gewoon dat hele vakop."	System-Distorting Theft	Theme 1. Fast-moving retail blindness and focal value proposition	Theft / loss prevention	Organized theft (like "sweeps") that bypasses the checkout, causing acute financial loss while simultaneously corrupting the store's digital inventory data.
P5	Lead in store innovation and product / design development	"Denk de grootste hurdel. Is. Eigenlijk. Van tevoren... Dat je eigenlijk van tevoren met de retailers... eigenlijk alles al in een model heb moeten kunnen gieten. Je ROI moet hebben berekend... voordat we een stap maken van joh, we gaan gewoon eens testen In de winkel."	Upfront ROI Gate	Theme 4. Fragmented buying centre and adoption gatekeepers	Cross-case / ecosystem	The strict corporate requirement for a fully calculated financial business case and proven Return on Investment (ROI) before initiating agile pilots or scaling.
P6	Senior consultant in supply chain strategy and transformation	"Ook weer met die security camera's ... als de helft van de markt hetzelfde aanbiedt, dan is het logischer dat je licht integreert."	Fragmented complement market	Theme 3. Integration paradox	Theft / loss prevention	Supports the logic that modularity is strategically preferable when no single complement ecosystem clearly dominates.
P6	Senior consultant in supply chain strategy and transformation	"Ik denk dat diepe integratie de beste keuze is als het heel erg duidelijk is voor de complementaire technologische oplossingen wie de marktleider is... Als er heel veel dezelfde soort bedrijven zijn... dan is het veel logischer dat je een lichte integratie doet."	Integration by Market Share	Theme 3. Integration paradox	Cross-case / ecosystem	The strategic decision to pursue deep integration only when there is an undisputed market leader, while relying on light integration for highly fragmented markets.
P6	Senior consultant in supply chain strategy and transformation	"Ik denk dat diepe integratie de beste keuze is als het heel erg duidelijk is ... wie de marktleider is ... als er heel veel dezelfde soort bedrijven zijn ... dan is het logischer dat je een lichte integratie doet."	Integration depth depends on market structure	Theme 3. Integration paradox	Cross-case / ecosystem	Useful as an exploratory decision rule, but the notebook analysis treated it as too weak to keep as a final main code.
P6	Senior consultant in supply chain strategy and transformation	"Allemaal verschillende soorten integratie mogelijk ... deep integration ... maar ook light integration."	Integration options are layered	Theme 3. Integration paradox	Cross-case / ecosystem	Shows that integration is better understood as a design space with layers and options than as one single choice.
P6	Senior consultant in supply chain strategy and transformation	"Ik zou dan zeggen nou ik moet matchen met de security camera's bijvoorbeeld, dat je goede case kan bouwen van oké, we hebben op meerdere punten gezien dat je iets gestolen hebt."	Camera & Analytics Integration	Theme 5. Ecosystem piggybacking to scale	Theft / loss prevention	Combining shelf sensors with existing security camera platforms to validate theft triggers with video evidence and enhance the loss-prevention ecosystem.
P6	Senior consultant in supply chain strategy and transformation	"Ik zou voornamelijk focussen op de service die je eromheen hebt ... hoe ziet je dashboarding eruit ... hoe zorg je ervoor dat zij het direct kunnen omvertalen in performance management?"	Service layer around data	Theme 5. Ecosystem piggybacking to scale	OOS / availability	Shows that scaling depends not only on sensing, but also on the surrounding service and dashboard layer that makes data useful for management.
P7	Commercial specialist in retail technology / autonomous store solutions	"Maar Sales is degene die zegt: 'Ja, maar jij gaat mijn klanten mogelijk lastig vallen met hem aanspreken.' En Als je dat fout doet, komt hij bij mij niet meer terug. Want dan gaat hij dus bij een omzet naar beneden."	Commercial Veto (Sales vs. Security)	Theme 4. Fragmented buying centre and adoption gatekeepers	Theft / loss prevention	The power of the Sales and Marketing departments to block loss-prevention initiatives if the technology negatively impacts the shopper experience and threatens revenue.
P7	Commercial specialist in retail technology / autonomous store solutions	"...dan praat ik dus over diepe integratie als ik dus kan samen met een partner kan aantonen van ik trigger dit en je kan in SAP zien: Mijn performance van mijn sensoren zorgt ervoor dat mijn availability met 1-2% omhoog gegaan is."	End-to-End ROI Proof	Theme 3. Integration paradox	OOS / availability	The necessity of deeply embedding the technology into a retailer's core enterprise systems (e.g., SAP, ERP) to automatically trigger systemic actions and prove financial value.
P7	Commercial specialist in retail technology / autonomous store solutions	"Er is een prioriteitenlijst... daar staan 100 dingen op en waar is er altijd tekort aan is aan IT resources... Het heeft een jaar geduurd voordat de directie gewoon de prioriteit ertoe gekend: OK beste IT. Jullie moeten nu die integraties maken."	IT Resource Bottleneck	Theme 4. Fragmented buying centre and adoption gatekeepers	Cross-case / ecosystem	The delay or blockage of technology adoption due to a chronic lack of integration capacity and competing legacy transformations within the retailer's central IT department.
P7	Commercial specialist in retail technology / autonomous store solutions	"Ik denk in de out of stock wereld om de schalen denk ik dat je bijna niet ontkomt om te kijken van welke partijen in de markt kan ik een volle propositie maken.	Integration by Use Case	Theme 3. Integration paradox	Cross-case / ecosystem	The logic that the required depth of integration depends entirely on the operational problem: Out-of-Stock requires deep ERP integration, while Loss Prevention (theft) functions on light API integration.
P7	Commercial specialist in retail technology / autonomous store solutions	"Daar komt altijd zo 2 3% meer omzet dat je kunt maken op het moment dat je eh je producten eh niet autostok op je schap hebt staan en dat je weet wat er aan de hand is."	OSA Revenue Opportunity	Theme 1. Fast-moving retail blindness and focal value proposition	OOS / availability	The invisible financial loss and missed sales opportunities caused by out-of-stock (OOS) situations on the shelf.
P7	Commercial specialist in retail technology / autonomous store solutions	"Eén van de allerbelangrijkste problemen die in retailer heeft, is dat die blind is wat er in zijn winkel gebeurt. Hij weet alleen maar wat de omzet is aan het eind van de dag."	Retailer Blindness	Theme 1. Fast-moving retail blindness and focal value proposition	OOS / availability	The structural inability of retailers to see real-time physical shelf conditions between warehouse delivery and POS checkout.
P7	Commercial specialist in retail technology / autonomous store solutions	"Ik denk in de out of stock wereld om te schalen denk ik dat je bijna niet ontkomt om te kijken van welke partijen in de markt kan ik een volle propositie maken."	System Integrator & Full Proposition	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Allying with IT integrators and consultants to build a complete, end-to-end data proposition that connects the sensor to enterprise ERP systems (like SAP).
P7	Commercial specialist in retail technology / autonomous store solutions	"Die zal nooit gaan zeggen tegen een juffrouw van 16. Daar komt nu een klant aan die diefstal pleegt. Ga maar stoppen."	Staff Capability & Safety Limits	Theme 2. Chaos theory of store execution	Theft / loss prevention	The operational and legal unreasonableness of expecting young, untrained retail staff (e.g., 16-year-olds) to interpret complex data dashboards or act as security guards.
P8	International leader in projects and supply chain / commercial operations	"In a busy store after a week of that beep beep beeping, if somebody's been trying to steal stuff, there's a good chance that store staff are going to ignore it or it just gets lost in the background..."	Alert Fatigue	Theme 2. Chaos theory of store execution	Theft / loss prevention	Store staff actively ignoring system notifications due to a high volume of false positives or constant, disruptive alerts.
P8	International leader in projects and supply chain / commercial operations	"Because if you have to physically send somebody there, I mean, very quickly, that's like, there's the travel time... now I've got a six hour drive to the next bloody store..."	Field Support Burden	Theme 2. Chaos theory of store execution	Cross-case / ecosystem	The logistical nightmare and high cost of requiring physical technicians to travel to dispersed store locations to fix broken hardware or connectivity issues.
P8	International leader in projects and supply chain / commercial operations	"If a retailer's already rolling out ESL into that store and you can then almost piggyback Moose into that, like they're getting so much extra value, but from that one visit, from that one installation."	ESL Piggybacking	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	Scaling by installing the technology alongside a planned Electronic Shelf Label (ESL) rollout to utilize existing installation budgets and minimize store disruption.
P8	International leader in projects and supply chain / commercial operations	"I think unfortunately humans are sometimes the weakest link in this... The more complicated it is, the more problematic it can be."	Human Execution Vulnerability	Theme 2. Chaos theory of store execution	Cross-case / ecosystem	System failures caused by human unpredictability (e.g., sickness, forgetting tasks), which breaks the synchronization between physical shelves and digital records.
P8	International leader in projects and supply chain / commercial operations	"...because on a Saturday afternoon when it's crazy busy, if it takes an extra 5, 10 seconds to do it and it's not done... there's a good chance that it doesn't get done properly."	Peak-Hour Overload	Theme 2. Chaos theory of store execution	Cross-case / ecosystem	The failure of manual technological tasks because staff are overwhelmed during busy periods and must prioritize core operations over tech maintenance.
P8	International leader in projects and supply chain / commercial operations	"Walmart bought a 10% stake in Fusion... So then what happened was the second, third, fourth... biggest players in North America didn't roll out Fusion. They rolled out other people's ESLs because they didn't want to buy from any company that was kind of in bed with Walmart."	Lock-in & Market Exclusion	Theme 3. Integration paradox	Cross-case / ecosystem	The commercial risk that deep, exclusive integration with a single partner shrinks the total addressable market, as competing retailers will actively boycott the solution.
P8	International leader in projects and supply chain / commercial operations	"If you've got 100 leads, which ones do you decide to prioritise? ... if you're not careful, does Tesco take up so much of the resource that well actually these other medium fish... how do you keep that momentum?"	Partner Dependency & Resource Drain	Theme 5. Ecosystem piggybacking to scale	Cross-case / ecosystem	The severe operational risk that leveraging massive partners or landing a giant retail client (the "big fish") will completely drain the startup's limited engineering and support resources.

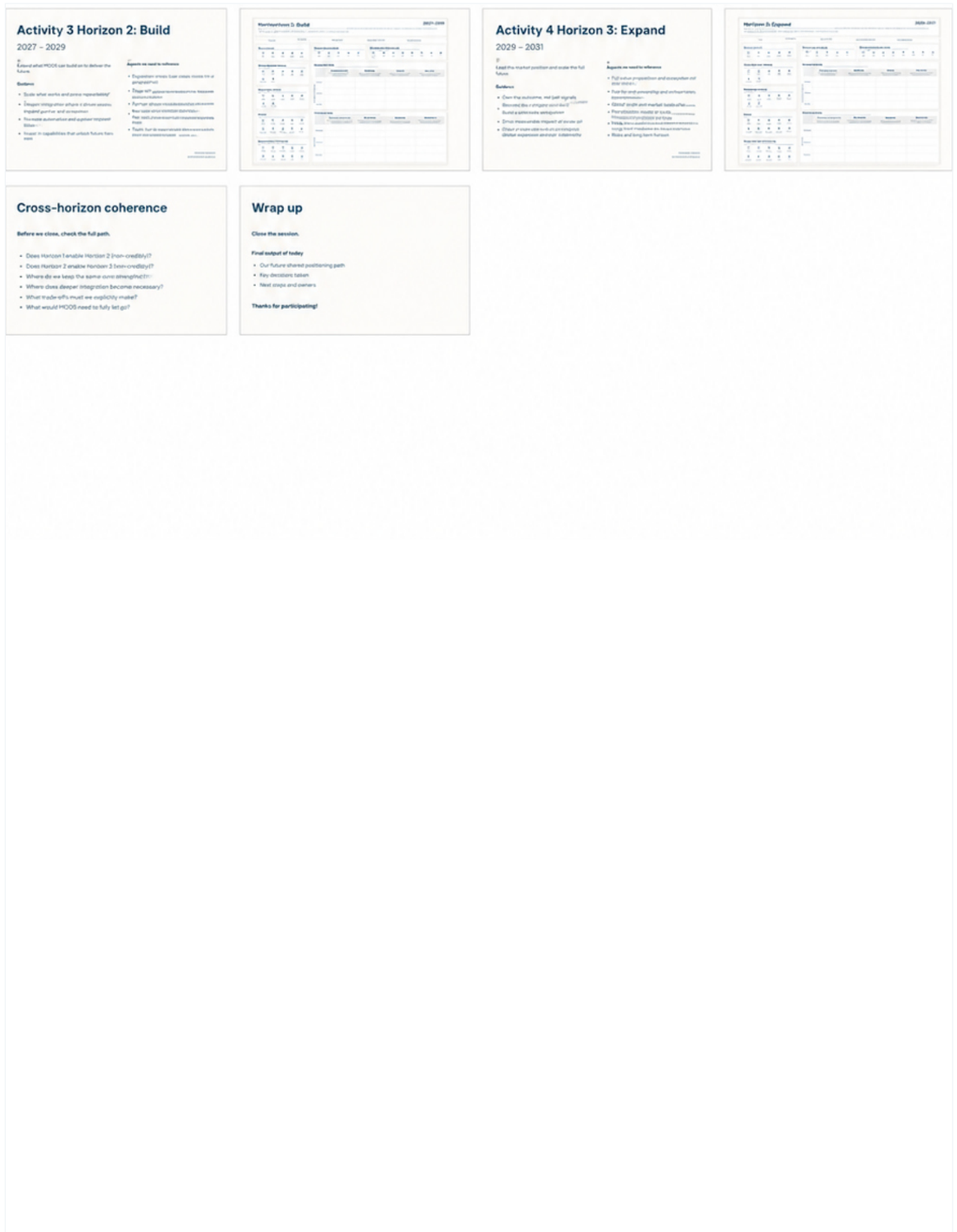
E5. Themes

Theme	*Central meaning*	*Included final codes*	*Main supporting interviews*	*Negative case / tension*	*Key actor logic*	*Part 1 link*	*Cross-dataset / synthesis implication*	*Framework refinement*	*Why it matters for the thesis*	*Key quote 1*	*Key quote 2*	*Key quote 3*
Theme 1. Fast-moving retail blindness and focal value proposition	Retailers remain structurally blind to what happens on the shelf between delivery and checkout. Shelf sensing matters because it corrects the gap between digital assumptions and physical shelf reality, not because it is merely another sensor.	Retail Blindness & Phantom Inventory; System-Distorting Theft; OSA Revenue Opportunity; Labor Shortage Catalyst	P3, P4, P7, P8	Low-turnover premium retail and slow-moving environments weaken the urgency of the proposition, because human service can still compensate for the data gap.	OOS makes supply chain, category management, and ERP logic central. Theft makes store operations, LP, and security response central.	Connects to the store-level hierarchy in which theft is the most visible local trigger, while OOS appears as a second but still relevant operational pain point.	Supports the synthesis argument that theft and OOS share the umbrella of actionable shelf insight, but diverge once the signal has to travel through real organisations.	Refines the focal value proposition by making the shelf-to-system reality gap more explicit and by separating the two use-case pathways after the shared visibility problem.	It grounds the whole thesis in a concrete problem logic: MOOS is not selling a sensor in isolation, but a way to reduce retail blindness and make shelf reality actionable.	"Eén van de allerbelangrijkste problemen ... is dat die blind is wat er in zijn winkel gebeurt. Hij weet alleen maar wat de omzet is aan het eind van de dag."	"Op het moment dat het systeem denkt dat er nog voorraad is ... en op het schap staat niks, dan krijgt die winkel in principe geen nieuwe leveringen."	"There is a huge customer penalty if it's out of stock .. . they go 150 metres up the road to your competitor."
Theme 2. Chaos theory of store execution	Shelf sensing fails when success depends on flawless execution by busy store staff. Human variability breaks the chain both before action, by poor upkeep and reconfiguration, and after action, by alert fatigue or unsafe response expectations.	Human Execution & Workload Vulnerability; Planogram Recalibration Burden; Alert Fatigue; Staff Capability & Safety Limits	P4, P5, P7, P8	Some respondents accepted a limited false-positive rate for theft if enough alerts still lead to catches, which complicates a simplistic 'zero false alerts' rule.	The store floor is the weakest synchronisation point in the chain, especially when the system requires manual upkeep or repeated human response under time pressure.	Directly explains the store-level insistence on reliable signals, fast enough action, and no extra work.	Shows that simple store demands, such as trust and low workload, depend on many hidden conditions around maintenance, filtering, routing, and responder design.	Sharpens the activity chain by identifying where fragility sits after detection, especially at configuration, routing, response, and feedback points.	It stops the analysis from treating store execution as a neutral implementation step. Execution itself is a structural bottleneck.	"I think unfortunately humans are sometimes the weakest link in this ... the more complicated it is, the more problematic it can be."	"If you buy a car, you assume it is reliable ... why would you still walk the eleventh time?"	"No one is going to say to a 16 year old girl: a customer is now committing theft, go and stop them."
Theme 3. Integration paradox	Retail ecosystems prefer open, modular, API-first connections, yet some use cases only become financially meaningful when the sensor is deeply embedded into core systems. MOOS therefore faces a real integration paradox rather than a simple technical choice.	Demand for API Modularity; Lock-in & Market Exclusion; End-to-End ROI Proof (Deep Integration); Integration by Use Case; Physical vs. Software Integration	P3, P5, P6, P7, P8	A minority view suggested that exclusivity can also create fear of missing out, not only lock-out. This remained analytically interesting but weaker than the broader anti-lock-in pattern.	Theft tends to work through light routing into existing tools, while OOS depends more on backend closure through ERP, replenishment, and proof inside enterprise systems.	Builds on the store wish that the solution should work with existing tools and should not create separate app-based work.	Explains why the same store demand for 'works with existing technology' hides very different burdens depending on the use case and system layer.	Refines the original framework by turning integration from one generic alignment issue into a layered variable with physical and software dimensions.	This theme narrows the design space directly. It shows that MOOS cannot pursue one single integration logic across all pathways.	"Dan trek je gewoon de software eruit ... precies een soort legoblokjes."	"Als ik ... in SAP kan zien dat de performance van mijn sensoren de availability met 1 à 2 procent verhoogt ... dan praat ik over diepe integratie."	"Walmart bought a 10% stake in Vusion ... the next biggest players chose other ESL ecosystems."
Theme 4. Fragmented buying centre and adoption gatekeepers	A good local pilot does not scale automatically because adoption is split across finance, IT, operations, procurement, sales, and support. The real problem is not one missing owner but a fragmented sequence of gatekeepers with different criteria.	The Upfront ROI Gate; IT Resource Bottleneck; Commercial Veto (Sales vs. Security); HQ-Store Priority Misalignment; Enterprise SLA & Field Support Gate; Master Data Dependency	P1, P3, P5, P7, P8	Some respondents framed business ownership as primary and IT as following; others treated IT as the real bottleneck. The data suggests a sequential rather than singular ownership structure.	Store teams feel the pain, but HQ, IT, procurement, LP, sales, and service actors decide whether the proposition can be integrated, funded, supported, and scaled.	Explains why clear ownership ranked low in store visits: it is not unimportant, but largely outside the end user's direct field of control until something breaks.	Supports the split-user adoption trap and shows that store-level usefulness and organisational rollout feasibility are different evaluation logics.	Makes ownership, gatekeeping, and hidden alignment failures more explicit in the framework, especially after pilot and during scale.	This theme gives the strongest structural explanation for why promising shelf-sensing propositions stall between pilot and rollout.	"Je ROI moet hebben berekend ... voordat we een stap maken van: we gaan gewoon eens testen in de winkel."	"Er is een prioriteitenlijst ... daar staan 100 dingen op en waar is er altijd te weinig van? IT-capaciteit."	"If you have to physically send somebody there ... now I've got a six hour drive to the next store."
Theme 5. Ecosystem piggybacking to scale	A stand-alone shelf sensor is too small and too friction-heavy to scale directly. The realistic path is to piggyback on installed infrastructure, existing vendor trust, and broader propositions. That path creates access, but it also creates dependency risk.	Hardware Infrastructure Piggybacking; Software & IT Ecosystem Routing; Partner Dependency & Resource Drain	P1, P2, P3, P4, P7, P8	The same partner route that opens the market can absorb the startup's cash, support capacity, and strategic freedom. Fast access can therefore create long-term vulnerability.	Physical routes run through ESLs, shelves, and store refits. Software routes run through integrators, security ecosystems, and trusted enterprise platforms.	Matches the store requirement that the solution should fit existing technology and should not add visible burden or disruption.	Shows that reducing store friction often depends on attaching the proposition to actors outside the store, which shifts the problem from usability to dependency design.	Adds a more explicit scale-route logic to the framework by linking leverage points to infrastructure hosts, system integrators, and dependency exposure.	This theme directly informs positioning: MOOS is more likely to scale as a bounded component within larger routes than as a stand-alone retail system.	"If a retailer's already rolling out ESL ... you can almost piggyback ... from that one visit, from that one installation."	"It could be a door opener for you."	"If you've got 100 leads ... does Tesco take up so much of the resource that the medium fish lose momentum?"

Appendix F. Co-creation

F.1 Co-creation session 1 slides





F.2 Co-creation session 2 slides

MOOS Roadmap Session

From Future Vision to Horizon 1, 2, 3, 4?

Goal today: define a coherent roadmap across three horizons.

Were we left off

- Future vision was largely sharpened
- Horizons were not finished
- Today we use the future vision as a starting point
- Main focus = H1, H2, H3

How we work this session

We will work in these steps

- Confirm future vision
- Horizon 1
- Horizon 2
- Horizon 3
- Cross-horizon check
- Final wrap-up

Future Vision

*MOOS should become a **shelf intelligence** and **trigger layer** for **store operations**, known for **sensing without supervision** and **actionable shelf insight**, owning the **core sensing, event, trigger** and **diagnostics logic**, while not trying to **own** the retailer's **full operating system**.*

- More than a sensor
- Not the full operating system
- Partner-ready from H1

Guiding Principles

These principles matter because this is a high changing market. They guide and help MOOS make consistent choices under uncertainty.

- Follow urgent store pain
- Reliability before scale
- Build on proven proof points
- Prove repeatability before widening
- Own the core intelligence layer
- Stay partner-ready and modular
- Go deeper only when value is clear and profitable

Horizon 1: Prove & Repeat

2026 - 2027

From pilot proof to repeatable rollout

Goal

- Prove a clear first use case in theft / loss prevention
- Show that MOOS works with low burden in daily store operations
- Move from one-off pilots to a repeatable rollout logic

What this horizon must prove

- The use case is retail pain enough to trust
- Store staff can scale actions in a simple way
- Installation and support can be repeated across multiple stores

- *Where should we stay intentionally light in this phase?*
- *What would make this still feel like 'pilot mode' instead of a real first horizon?*
- *Which part of H1 should MOOS own itself, and where can partners already help?*

Miro material:
[A3 Horizon Canvas 1]

Horizon 2: Build

2027 - 2029

From local proof to partner-ready scaling

Goal

- Expand from a first wave into stronger operational value
- Make MOOS more repeatable, more useful, and less replaceable
- Build the first retailer / partner-enabled scaling logic, which is partner-ready

What this horizon must prove

- MOOS can scale with selected partners, not only by doing everything itself
- Diagnostics and selective OOS value make the offer stronger
- Workflow and system links become structured enough to support broader rollout

- *What exactly becomes deeper in H2?*
- *What should H2 add that H1 cannot yet support?*
- *What kind of partner logic is needed here to make scaling credible?*
- *What should MOOS still not own in this phase?*

Miro material:
[A3 Horizon Canvas 2]

Horizon 2: Expand

2029 - 2031

From partner-ready solution to system-embedded scale

Goal

- Grow into a broader shelf intelligence role at chain level
- Enter larger, more complex retail environments (grocery/convenience)
- Create value that depends on deeper workflow and system integration

What this horizon must prove

- MOOS can support chain-level operational value, not only local actions
- The model works in more complex retail contexts such as supermarket / convenience
- Partner and system dependencies are strong enough to scale, but still manageable

- *What only becomes realistic in H3, and why not earlier?*
- *Where is deeper integration truly worth it?*
- *Which actors control success in this horizon?*
- *What would need to be true internally for MOOS to support this horizon?*

Miro material:
[A3 Horizon Canvas 3]

Activity 3 H2: Build

2027 - 2029

Goal

Define what MOOS must build next after the first horizon.

Discuss

- If Horizon 1 works, what should MOOS build next?
- What has to become deeper or more embedded now?
- Which new actions become relevant in this phase?
- What should Horizon 2 add that Horizon 1 could not yet support?
- What must already be prepared in Horizon 1 for this to work?

Based on existing information

- **Route:** diagnostics + selective OOS expansion built on top of the first wedge
- **Segments:** health & beauty / drugstore first, then selected adjacent categories
- **Need:** stronger partner and system links, more repeatable operation, more attachable diagnostics
- **Goal:** become more valuable and less replaceable by moving from local alerts toward broader operational and system value
- **Shift:** from mainly workflow-led value to a mix of workflow + selected system/data value

Miro material:
[A3 Horizon Canvas 2]

Activity 4 H3: Expand

2029 - 2031

Goal

Define what MOOS could grow into over time after H1 & H2.

Discuss

- Which becomes realistic only later?
- Which larger market or sector should MOOS focus on then?
- Where is deeper embedding justified?
- Which actors would control success at that point?
- What does MOOS need internally to support this horizon?
- What are the biggest risks to scale and reliability?

Based on existing information

- **Route:** broader OOS / replenishment value and wider shelf intelligence role
- **Segment:** grocery / convenience, then broader multi-category retail
- **Challenge:** deeper embedding, local workflow variation, scaling needs, performance, stronger partner dependence
- **Need:** heavier system/data integration, stronger service model, stronger internal scaling capability
- **Strategic logic:** MOOS expands from a clear first wedge into a broader, more embedded role only once earlier proof points and capabilities are in place.

Miro material:
[A3 Horizon Canvas 3]

Wrap up

Capture the outcome

Final output of today

- one future vision
- one three-phased positioning path
- one first roadmap logic

Thanks for participating!

F.3 Co-creation canvas

Future Vision Canvas

IN 5 YEARS

Define the long-term position MOOS should move toward. Use the options to clarify what MOOS should be known for, what it should own, what it should not own, and what role it should play in the ecosystem. Add a post-it when an important idea does not fit the options.

What should MOOS be known for?

Choose the value MOOS should become recognised for in the market. Focus on what should make MOOS distinctive and credible over time.

- Real-time shelf insight
- Actionable shelf insight
  - Theft, OSA, Engagement
- Reliable shelf-event detection
- Trigger-based store operations
- Shelf transaction intelligence
- A critical component in the retail tech ecosystem
- Easy-to-embed shelf sensing
- A partner-ready building block for store operations
  - Partnership accmomplished
- Other:
  - Sensing without supervision
  - Turn shelf events in store action
  - From blind operations to reality driven operation
  - Stores with MOOS should outperform stores without MOOS

What should MOOS own?

Choose the parts of the proposition that MOOS should control itself. Focus on the capabilities, logic, or assets that are most strategic to keep in-house.

Own the truth layer between shelf event and action

Own the translation from shelf event to trigger, not the full workflow

- Core sensing technology
- AI / signal processing
- Shelf-event logic
- Alert / trigger logic
- Diagnostics logic
- Insight generation & interface
- Integration recipes
- Data layer for shelf transactions
- Embedded shelf solution know-how
  - Only where strategically critical
- Other:
  - shelf transaction intelligence

What role should MOOS play in the ecosystem?

Choose the role MOOS should play relative to other actors, systems, and partners. Focus on whether MOOS should remain specialised, become embedded, or grow into a broader layer over time.

- **Specialised sensing component** focused on detecting shelf events
  - Critical digital layer
- Missing layer between shelf reality and store action
- **Data-enrichment complement** Strengthening other systems such as ESL, camera, POS, voice
- **Trigger/insight layer** Turning shelf events into action
  - Signal to action (not from ERP to everything)
- **Broader shelf intelligence layer** Connecting multiple use cases and systems over time
- **Embedded shelf infrastructure component** Physically integrated into shelving systems

What should MOOS not own?

Choose the parts that should remain outside MOOS. Focus on what is better left to partners, customers, or the wider ecosystem.

- POS system
- ERP/ BI
- Generic workflow software
- Full Camera platform
- Full shelf manufacturing
- Full systems integration project
- Retail operations programme delivery
- Enterprise master data ownership
- Other:
  - Do not become RELEX/SAP

Vision statement

Summarise the preferred future position of MOOS in one clear sentence. Use the choices above to describe what MOOS should become, what it should be known for, and where it should create value.

MOOS should become a partner ready shelf intelligence and trigger layer for store operations that is **known** for sensing without supervision and actionable shelf insight ,

owns the core sensing, event and trigger logic , and does **not** try to **own** the retailers full operating system .

Horizon Canvas 1: Entry

Start operating form 1 pilot to 50 rollout | Avolta as current anchor | prove a first real route | alerts + earpiece + shelf events | partly manual | not full store integration

2026-2027

Use this canvas to define one coherent horizon that moves MOOS closer to the future vision. Use the options to make clear choices about focus, market, stakeholders, integration, and internal priorities. Add a post-it when something important is missing, conditional, or needs explanation.

This horizon is about: **Focus**:theft/los prevention **Main segment**: duty free / travel **Main partner logic**: selected partners help with access and install **Dominant integration depth:** light **Main internal priority:** reliability + repeatable installation

1) Strategic Focus

Highlight the main value logic of this horizon. Choose what MOOS is primarily trying to achieve in this phase.

Fast Entry | Easy to prove

- (●) Theft / loss prevention
- ( ) OOS / availability
- (●) Shelf diagnostic
- ( ) Trigger based replenishment
- ( ) Perfect shelf/ shelf compliance
- Engage-ment

2) Market/Segment Focus

Mark the segment where this horizon is most credible. Focus on where this phase creates the strongest fit between value, urgency, and feasibility.

duty free / travel first | current proof sits here

Short near term fit for loss prevention and actionability

- (●) Duty-free /Travel
- ( ) Health &beauty
- ( ) Drugstore
- ( ) DIY
- ( ) Other:

3) Category/Application Focus

Select the product categories or shelf applications that best match this horizon. Use this to make the phase concrete and commercially relevant.

high-value shelves

- (●) Spirits/ Alcohol
- (●) Fragrence/ Cosmetics
- (●) Personal Care
- ( ) Coffee
- ( ) Meat/ Fish
- ( ) Soft drinks/ Juices
- ( ) Baby/ Kids
- ( ) Other:

High value shelves

4) Key Stakeholders to align

Highlight the actors that need to align for this horizon to work. Focus on who must support, enable, approve, or operate this phase.

- (●) Retailer
- (●) Store Operations
- (●) Shelf Layer
- ( ) Store Systems
- (●) RTM partner/ Deployment
- ( ) Enterprise/ System owner
- ( ) Other: Security / LP

5) Integration Matrix

Indicate how deep each integration type needs to be in this horizon. Mark the minimum depth required to make this phase work credibly.

Integration Depth	Physical infrastructure *How MOOS connects to the physical shelf setup*	Edge/device *How MOOS connects to local devices and communication components*	Workflow *How MOOS turns shelf events into action in daily operations*	System / Data *How MOOS connects to business systems and data environments*
Light	retrofit on existing shelf (v)	basic gateway and local connection (v)	Alert to headset / PDA / app; alert to staff; operational attention logic	light API / simple dashboard; dashboard / export / basic view
Medium	simplify install steps; prepare partner-installable setup; keep retrofit stable before adding complexity	easier gateway replacement / support; clearer device workflow	test how alerts can support theft / engagement; reduce manual tuning and exception handling	explore POS as next meaningful step; camera as later add-on; improve config / monitoring before deeper integrations
Deep	[PLACE POST-ITS]	[PLACE POST-ITS]	[PLACE POST-ITS]	[PLACE POST-ITS]

6) Strategic Proof Point

Choose what this horizon must prove before MOOS can move forward. This is the main signal that this phase is successful enough to build on.

reliable first use case | strong store actionability | proof that alerts can change behaviour

- (●) Reliable first use case
- (●) Strong Store actionability
- ( ) Low operational burden
- (●) Repeatable Installation
- ( ) First partner-enabled roullout
- ( ) First system Integration
- ( ) Stronger enterprise value case

Reliable first use-case

7) Risks

Highlight the biggest risks or bottlenecks in this horizon. Focus on what could slow down, block, or weaken this phase.

overreading Avolta as proof for everything | too much manual work behind the scenes | unclear response logic in store | building richer features too early | optimizing scale on too little evidence

- ( ) Too much operational burden in store
- (●) Weak reliability/ false alerts
- ( ) Too much partner dependence
- ( ) Too much custom work
- ( ) Slow installation / rollout friction
- ( ) Interface ownership unclear
- ( ) Support load too high
- ( ) Deep integration too early
- ( ) Staying too standalone for too long
- (●) Other: Unclear response logic

8) Operation Matrix

Use post-its to describe what must work in practice for installation, daily use, and support. Keep it concrete and close to real store operations.

Phase	What is must work in practice ? *How this horizon works in real operations from installation to daily use and support*	Who carries it? *How this horizon works in real operations from installation to daily use and support*	Depends on? *Who is primarily responsible for making this work in practice*	Enables/blocks? What this makes possible next or what it blocks if it fails
Installation	Install in hours (v); identify what a partner could already take over	MOOS / shelf/deployment partner (v)	shelf type, power, store access (v)	Enables repeatable rollout (v); Blocks scale if every store is custom (v)
Daily Use	Alert must be trusted and easy to act on (v); reduce need for manual monitoring; learn which events create real theft / engagement value	store manager/ staff (v)	signal quality, rules, low noise (v)	Enables proof of actionability (v); Blocks trust if alerts are noisy (v)
Support	Fast remote check o.. simple handling to do on location (by storestaff) (v); identify what can move to partner or workflow	MOOS (v)	diagnostics, spare parts, clear owner (v)	Enables low burden (v); Blocks next rollout if support stays manual (v)

9) What MOOS must do internally

Mark what MOOS must strengthen internally to make this horizon possible. Focus on the capabilities, structure, or readiness this phase depends on.

- (●) Improve Reliability
- (●) Build repeatable installation logic
- (●) Strengthen partner management
- (●) Build service & support model
- ( ) Develop integration capability
- ( ) Build stronger enterprise sales case
- ( ) Build POS connectio
- ( ) Improve diagnostics/ analytics
- (●) Prepare for scale
- ( ) Other: make one clear install manual

improve reliability | gather more reps | learn from more than one live company | improve configurator | improve threshold automation | clarify install workflow | add change log / history

Horizon Canvas 2: Build

From partner-ready solution to system-embedded scale

move beyond current alert-only setup

deepen proposition

deepen scalability

2027-2029

Use this canvas to define one coherent horizon that moves MOOS closer to the future vision. Use the options to make clear choices about focus, market, stakeholders, integration, and internal priorities. Add a post-it when something important is missing, conditional, or needs explanation.

theft / diagnostics / richer value cases

without supervision / deployability / automation

still stay close enough to learn from reality

H&B / drugstore + adjacent high-value retail

repeatable trained + H&B contexts before grocery

partner role becomes more explicit

user-case partners become more important

install / hardware / deployment partners become more important

deeper than H1, but not full deep everywhere

medium in system / workflow

medium in physical / edge / operational process

choose next step based on pull, not on guesswork

build meaningful capabilities

make solution less manual and less MOOS-dependent

This horizon is about: **Focus**: theft/OOS/diagnostics **Main segment**: H&B + drugstores **Main partner logic**: MOOS becomes truly partner ready and starts scaling trough selected partners **Dominant integration depth**: medium **Main internal priority**: reliability + repeatable installation

1) Strategic Focus

Highlight the main value logic of this horizon. Choose what MOOS is primarily trying to achieve in this phase.

builds next phase

creates stronger system logic

H2 is where the route choice becomes real

H2 should not yet pretend everything is solved

expand what MOOS can do

move from simple alerts to richer cases

move toward without supervision

make current system easier to deploy and operate

- Theft / loss prevention
- OOS / availability
- Shelf diagnostic
- Trigger based replenishment
- Perfect shelf/ shelf compliance
- Engage-ment

2) Market/Segment Focus

Mark the segment where this horizon is most credible. Focus on where this phase creates the strongest fit between value, urgency, and feasibility.

market pull may decide what comes first

segment choice depends on what route is prioritized

H&B / drugstore

same high-value / shrink-sensitive logic

stay in environments where repetition is still manageable

do not jump to hardest grocery context too early

better place to test system and workflow links before going to grocery

- Duty-free /Travel
- Health &beauty
- Drugstore
- DIY
- Other:

3) Category/Application Focus

Select the product categories or shelf applications that best match this horizon. Use this to make the phase concrete and commercially relevant.

high-value + high-shrink + specific preference products

categories where theft and OSA both create value

personal care / skincare type logic

categories where setup can be standardized earlier

more stable shelves help scaling route

High value shelves

- Spirits/ Alcohol
- Fragrence/ Cosmetics
- Personal Care
- Coffee
- Meat/ Fish
- Soft drinks/ Juices
- Baby/ Kids
- Other: high shrink

4) Key Stakeholders to align

Highlight the actors that need to align for this horizon to work. Focus on who must support, enable, approve, or [illegible] this phase.

store systems

POS partner

camera partner

workflow / task partner

hardware / production partner

deployment / installer partner

support / service partner

workflow software partner

- Retailer (V)
- Store Operations (V)
- Shelf Layer
- Store Systems
- RTM partner/ Deployment
- Enterprise/ System owner (V)
- Other:
- Security / LP

5) Integration Matrix

Indicate how deep each integration type needs to be in this horizon. Mark the minimum depth required to make this phase work credibly.

Integration Depth →	Physical infrastructure *How MOOS connects to the physical shelf setup*	Edge/device *How MOOS connects to local devices and communication components*	Workflow *How MOOS turns shelf events into action in daily operations*	System / Data *How MOOS connects to business systems and data environments*
Light	works on standard H&B/drugstore shelves keep retrofit workable	stable gateway with remote updates	Alert to headset / PDA / app	light API / simple dashboard
Medium	Install playbook for partner rollout add only what specific use cases need installation playbook partner-ready hardware flow clearer assembly / cabling process	fleet management + diagnostics tools enrich inputs where use case needs it more structured device logic for richer outputs shared with partner (where needed) easier gateway swap / support / remote status fleet management becomes relevant	task routing into staff workflow tools MOOS events influence task priority logic move from alerts to better theft / OSA handling task-relevant logic starts to matter simplify config and operational workflows make customer / partner operation less dependent on MOOS	ESL / POS / planogram / masterdata link for context POS becomes key for deeper theft camera enriches diagnostics ordering / workflow system becomes key for OSA customer-adjustable parameters where possible changelog / history / config governance only deepen data integrations where pull is clear
Deep	embedded only for selected partners (if possible) embedded route can start as option, not default	fleet management becodevices should become easier to deploy by third partiesmes relevant	full task management is not yet default	elected workflow / ERP / handheld links if use case demands it

6) Strategic Proof Point

Choose what this horizon must prove before MOOS can move forward. This is the main signal that this phase is successful enough to build on.

proof that MOOS can unlock a richer proposition

proof that next integrations create meaningful extra value

proof that deployment burden can go down

proof that partners can take part of setup / support

H2 should prove a credible next step, not a final model

- Reliable first use case
- Strong Store actionability
- Low operational burden
- Repeatable Installation
- First partner-enabled roullout
- First system Integration
- Stronger enterprise value case

7) Risks

Highlight the biggest risks or bottlenecks in this horizon. Focus on what could slow down, block, or weaken this phase.

too much feature building without scalable delivery

overfitting to one customer stack

integrating too deep too early

automating around an unstable proposition

scaling before product / use case is stable enough

too few live reps to optimize hard

market may pull in a different direction than planned

- Too much operational burden in store
- Weak reliability/ false alerts
- Too much partner dependence
- Too much custom work
- Slow installation / rollout friction
- Interface ownership unclear
- Support load too high
- Deep integration too early
- Staying too standalone for too long
- Other: product becomes too broad too fast

8) Operation Matrix

Use post-its to describe what must work in practice for installation, daily use, and support. Keep it concrete and close to real store operations.

Phase	What is must work in practice ? *How this horizon works in real operations from installation to daily use and support*	Who carries it? *How this horizon works in real operations from installation to daily use and support*	Depends on? *Who is primarily responsible for making this work in practice*	Enables/blocks? What this makes possible next or what it blocks if it fails
Installation	Partner can install with a standard method setup must support richer use-case inputs install becomes more standard and trainable	Partner + MOOS QA MOOS + selected technical partners partner + MOOS QA	training, install kit, fixture specs integration requirements per use case training, install kit, fixture specs	enables proposition depth enables multi-store rollout blocks progress if every new case stays custom
Daily Use	Alerts + diagnostics fit daily store routine richer outputs must still be usable in practice less manual adjustment in daily operation theft / OSA logic must fit store routines clearer rules and less MOOS handholding	store ops + workflow partner (V)	role logic, alert quality role logic + signal quality + system links simpler config + good support model	enables stronger enterprise case enables real repeatability Blocks if store use stays inconsistent (V)
Support	Partner handles first line, MOOS handles deeper issues support richer integrations without chaos move first-line work away from MOOS where possible	Partner, Moos MOOS + specialist partners partner L1 + MOOS L2	diagnostics, clear escalation clearer ownership per integration diagnostics + escalation + history	enables deeper proposition enables scaling capacity Blocks growth if support load stays with MOOS only (V)

9) What MOOS must do internally

define what is must-have vs add-on

clarify decision rules for next capability step

Mark what MOOS must strengthen internally to make this horizon possible. Focus on the capabilities, structure, or readiness this phase depends on.

- Improve Reliability
- Build repeatable installation logic
- Strengthen partner management
- Build service & support model
- Develop integration capability
- Build stronger enterprise sales case
- Build POS connectio
- Improve diagnostics/ analytics
- Prepare for scale
- Other: define partner package and interface rules

build transaction logic

build POS integration

explore camera / diagnostics

build first useful workflow / OSA links

improve installability

improve configurability

add changelog / rollback

define partner operating model

reduce cost-to-serve

Horizon Canvas 3: Expand

become partner-scaled and system-embedded

broader, more mature MOOS role

deeper store operations value

industrialized and scalable delivery model

likely convergence of both routes

2029-2031

Use this canvas to define one coherent horizon that moves MOOS closer to the future vision. Use the options to make clear choices about focus, market, stakeholders, integration, and internal priorities. Add a post-it when something important is missing, conditional, or needs explanation.

OSA / tasking / broader store operations

scalable deployment / lower cost-to-serve / partner-led rollout

without supervision becomes much more important here

broader retail only when earlier steps are proven

grocery / convenience becomes more credible here

larger multi-store rollouts become more credible here

MOOS cannot do everything itself at this stage

deeper system and workflow partners

hardware / install / industrialization partners

selective depth, not depth everywhere

medium to deep in workflow / systems

medium to deep in physical / edge / deployment model

protect strategic focus while broadening reach

deeper proposition and stronger operational relevance

industrialization and repeatable scaling

This horizon is about: **Focus**:OOS/Availability **Main segment**: Groecery/conveinience **Main partner logic**: partner scaled, system embeded **Dominant integration depth:** medium / deep **Main internal priority:** scale architecture

builds on earlier proof

highest long term market value

H3 is not just more of the same

H3 depends on what was learned and proven earlier

broader store operations logic

tasks and execution matter more

deployment and support must scale without MOOS touching everything

1) Strategic Focus

Highlight the main value logic of this horizon. Choose what MOOS is primarily trying to achieve in this phase.

- Theft / loss prevention
- OOS / availability
- Shelf diagnostic
- Trigger based replenishment
- Perfect shelf/ shelf compliance

segment expansion depends on automation and stability

not every category or store deserves the same depth

grocery / convenience becomes realistic only later

dynamic environments require deeper capability

bigger rollouts become possible if cost-to-serve drops

2) Market/Segment Focus

Mark the segment where this horizon is most credible. Focus on where this phase creates the strongest fit between value, urgency, and feasibility.

- largest market opportunity
- Duty-free /Travel
- Health &beauty
- Drugstore
- DIY
- Other: grocery/ convinience

move from only price-1 shelves toward broader shelf coverage

lower-priority categories open only when economics improve

categories where OSA and workflow value are high

faster-moving shelves if systems are linked

only broader coverage if hardware / support costs come down

3) Category/Application Focus

Select the product categories or shelf applications that best match this horizon. Use this to make the phase concrete and commercially relevant.

- Spirits/ Alcohol
- Fragrence/ Cosmetics
- Personal Care
- Coffee
- Meat/ Fish
- Soft drinks/ Juices
- Baby/ Kids
- Other: irregular replenishment shelves

High value shelves

workflow / task / ERP / ordering partners

handheld / execution system partners

camera partner

workflow / task partner

4) Key Stakeholders to align

Highlight the actors that need to align for this horizon to work. Focus on who must support, enable, approve, or operate this phase.

- V Retailer
- Store Operations
- Shelf Layer
- Store Systems
- RTM partner/ Deployment
- V Enterprise/ System owner
- Other: Security / LP

hardware production partner

installer / deployment partner

ERP/ replenishment partner

partner ecosystem becomes central

service / support partner

5) Integration Matrix

Indicate how deep each integration type needs to be in this horizon. Mark the minimum depth required to make this phase work credibly.

Integration Depth →	V **Physical infrastructure** *How MOOS connects to the physical shelf setup* (physical model should not stay MOOS-heavy forever)	**Edge/device** *How MOOS connects to local device and communication components* (edge becomes operationally mature)	**Workflow** *How MOOS turns shelf events into action in daily operations* (alerts alone are not enough at this stage)	**System / Data** *How MOOS connects to business systems and data environments* (deeper systems role only if earlier cases justify it)
Light	[PLACE POST-ITS]	[PLACE POST-ITS]	[PLACE POST-ITS]	[PLACE POST-ITS]
Medium	Standard shelf; physical setup supports broader applications	Managed device fleet across many stores; edge supports richer operational logic	Task routing into store tools, PDA, voice, dashboards; partner / client can manage more of operational setup	POS, planogram, master data, analytics context; governance, history, customer-side control
Deep	Semi-embedded route with shelf / ESL infrastructure; industrialized hardware route; partner-assembled / partner-installed; embedded shelf possible where justified	Full remote diagnostics and control at network level; strong fleet management / remote support; device handling largely outside MOOS day-to-day	MOOS events become part of normal store ops logic; move toward task distribution / execution; shelf events feed real store processes	ERP / replenishment / POS integration; workflow, ordering, ERP, handheld links; planogram becomes much more important; only deepen data stack where stable and valuable

6) Strategic Proof Point

Choose what this horizon must prove before MOOS can move forward. This is the main signal that this phase is successful enough to build on.

- Reliable first use case
- Strong Store actionability
- Low operational burden
- Repeatable Installation
- First partner-enabled roullout
- First system Integration
- Stronger enterprise value case

proof that MOOS creates broader store operations value

proof that OSA / tasking can work in deeper environments

proof that MOOS can scale without founder-heavy delivery

proof that cost-to-serve can come down

proof that MOOS can broaden without losing focus

becoming too dependent on deep integrations

entering grocery before prerequisites are solved

industrializing the wrong version

locking design too early

complexity grows faster than capability

partner dependence may increase

governance and change control become critical

7) Risks

Highlight the biggest risks or bottlenecks in this horizon. Focus on what could slow down, block, or weaken this phase.

- Too much operational burden in store
- Weak reliability/ false alerts
- Too much partner dependence
- Too much custom work
- Slow installation / rollout friction
- Interface ownership unclear
- Support load too high
- Deep integration too early
- Staying too standalone for too long
- Other: local workflow variation across chains

define strategic boundaries

decide what MOOS owns and what partners own

keep learning while standardizing

9) What MOOS must do internally

Mark what MOOS must strengthen internally to make this horizon possible. Focus on the capabilities, structure, or readiness this phase depends on.

- Improve Reliability
- Build repeatable installation logic
- Strengthen partner management
- Build service & support model
- Develop integration capability
- Build stronger enterprise sales case
- Build POS connectio
- Improve diagnostics/ analytics
- Prepare for scale
- Other: create clear product boundaries for what MOOS owns vs not owns

build stronger propcosition depth

build deeper integration capability

validate which deep use cases truly matter

industrialize only stable parts

reduce cost-to-serve

build scalable support and deployment model

build customer / partner-safe configurability

8) Operation Matrix

Use post-its to describe what must work in practice for installation, daily use, and support. Keep it concrete and close to real store operations.

Phase	**What is must work in practice ?** *How this horizon works in real operations from installation to daily use and support*	**Who carries it?** *How this horizon works in real operations from installation to daily use and support*	**Depends on?** *Who is primarily responsible for making this work in practice*	**Enables/blocks?** What this makes possible next or what it blocks if it fails
Installation	Third parties can install fast with low effort; installation supports deeper integrations; third parties can do most of the deployment	Certified partners + retailer tech team; MOOS + systems / integration partners; certified partners + retailer tech teams	Standards, rollout planning, shelf infra fit; stable interfaces and system logic; industrialized hardware + clear workflows	enables broader proposition; enables chain-scale rollout; blocks scale if deployment remains bespoke
Daily Use	events are part of normal store operations and replenishment flow; events become part of real store execution; tasks / replenishment / theft handling fit store routines; customer / partner can manage more themselves	Retailer ops + workflow/system partners; V	Clear ownership, KPI logic, system links; workflow and system integration; governance, permissions, stability	enables chain-level operational value; enables broader adoption; blocks growth if MOOS remains bottleneck
Support	Multi-level support works across many stores and countries; support deeper data / workflow dependencies; multi-level support model; issues traceable and reversible	Partner + retailer ops/IT + MOOS platform team; MOOS + technical ecosystem partners; partner L1 + retailer IT / ops + MOOS platform team	diagnostics, governance, data quality; diagnostics, changelog, ownership rules	enables reliable deeper value; enables network rollout; blocks trust if support is slow or unclear

Appendix G. Design Development

G.1 SCAMPER

SCAMPER	*Interpretation for MOOS*	*Positioning ideas generated*	*Design implication*
Substitute	What weak activity or missing link could MOOS partly replace?	Substitute manual shelf checks with shelf-event triggers. Substitute delayed shelf visibility with direct shelf sensing. Substitute retrospective theft review with earlier alerts.	MOOS should not replace the full store system, but it can reduce current store blindness around shelf events.
Combine	What could MOOS connect with to make shelf signals more actionable?	Combine MOOS with point of sale data for theft interpretation. Combine MOOS with camera layers for incident review. Combine MOOS with electronic shelf labels or shelf-edge infrastructure for stronger shelf fit. Combine shelf signals with workflow tools for on-shelf availability.	Partner connections are relevant, but not every connection should become deep at the same time.
Adapt	Which current proof points can be moved into adjacent contexts?	Adapt the current Travel and Duty Free logic to comparable settings. Adapt theft-sensitive trigger logic to Health and Beauty. Explore drugstore contexts after earlier adjacent proof.	Market expansion should start near the current proof base before moving into heavier grocery settings.
Modify	What should be made stronger, narrower, or easier?	Make theft alerts more specific. Add event filtering and prioritisation. Improve installation and configuration. Reduce support dependence on MOOS.	Proposition depth and repeatability both matter, but they should not be developed at the same speed.
Put to another use	Where else could shelf-event data create value?	Use shelf sensing for shelf compliance, brand execution, display quality, or engagement-related learning.	These ideas remain adjacent options. They should not lead the initial roadmap unless they support the main trigger-layer role.
Eliminate	What should MOOS avoid owning or doing?	Avoid becoming a full retailer platform. Avoid full workflow ownership. Avoid solving theft, on-shelf availability, engagement, and general store operations at the same time. Avoid unnecessary custom deployment.	The position should stay bounded. MOOS should own sensing, interpretation, and trigger logic, not the full operating system.
Rearrange	What development sequence would reduce risk?	Start with trusted alerting and theft logic before deeper on-shelf availability. Improve repeatability before heavier integration. Prepare point of sale and workflow links before making them central.	The roadmap should be staged. Some work can start early, but should only become central after enough proof and readiness.

G.2 Morphological Chart

Design variable	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Market sequence	Travel and Duty Free first	Health and Beauty adjacent	Drugstore after Health and Beauty proof	Grocery later and selected	Convenience as later test	
Primary use case entry	Trusted alerting	Theft prevention	Richer theft diagnostics	Basic on-shelf availability	Workflow-linked availability	Shelf compliance
Action route	Headset or staff alert	Dashboard alert	Point of sale supported trigger	Workflow or task trigger	Partner-routed action	
Integration depth	Standalone sensing	Light routing connection	Selected system connection	Deep link only where justified		
Partner connection	Fixture partner	Electronic shelf label or shelf-edge partner	Camera analytics partner	Point of sale partner	Workflow or task system partner	Retail technology integrator
MOOS role	Shelf sensing component	Trusted alert provider	Shelf intelligence layer	Trigger layer for store action	Selected diagnostic layer	
Proof logic	Stabilise current proof	Repeat comparable travel retail cases	Validate Health and Beauty fit	Pilot drugstore	Explore selected grocery	
Deployment logic	MOOS-led setup	Guided setup	Repeatable install package	Partner-assisted rollout	Remote support model	
Ownership boundary	Own sensing	Own event logic	Own trigger logic	Connect to workflow owner	Leave enterprise system ownership outside MOOS	
Support model	Direct MOOS support	Split first-line and second-line support	Partner first-line support	Remote quality assurance		

G.3 Positioning Option Development

Initial positioning element	Strategic logic	Main category	Role in convergence
Trusted alerting in Travel and Duty Free	Build from the current proof base, where shelf events can already be routed into store action.	Market focus and use case focus	Core starting point
Theft-first trigger logic	Start with loss prevention because it can begin through lighter alert routing and clearer immediate value.	Use case focus	Core starting point
Richer theft diagnostics	Move beyond basic alerts by interpreting theft-related shelf events more deeply over time.	Use case focus and proposition depth	Staged deepening
Point of sale supported theft logic	Link shelf events to transaction data where this improves theft interpretation.	Integration logic and proposition depth	Staged deepening
Camera-assisted incident review	Use camera layers selectively to enrich interpretation of high-risk shelf events.	Partner logic and diagnostics	Staged or partner-based option
Basic on-shelf availability support	Add simple availability signals where this can be done without heavy workflow or planning integration.	Use case focus	Later supporting route
Workflow-linked on-shelf availability	Connect shelf signals to store tasks or routines when on-shelf availability requires structured action.	Integration logic	Later staged route
Electronic shelf label or shelf-edge collaboration	Explore collaboration with shelf-edge infrastructure actors where this improves deployment, shelf fit, or data connection.	Partner logic and integration logic	Selective partner connection
Partner-ready deployment logic	Make installation, configuration, support, and role division easier to repeat across sites.	Route to scale	Core enabling condition
Selective workflow or task system connection	Connect to workflow systems only where the use case clearly needs it.	Integration logic	Selective connection
Stronger physical shelf embedding	Improve the fit between MOOS sensing, fixtures, and shelf infrastructure where this reduces reliability or deployment problems.	Integration logic and partner logic	Selective embedding
Shelf compliance or brand execution support	Use shelf sensing to support visibility around display quality, product presence, or execution.	Adjacent opportunity	Background option
Engagement or display-quality signals	Explore whether product interaction or display signals could become useful later.	Adjacent opportunity	Background option
Grocery-first on-shelf availability route	Enter grocery early through availability logic and planning links.	Market focus and integration logic	Deprioritised for the initial roadmap
Sensor-only positioning	Stay close to the sensing component and avoid deeper role development.	Role definition	Too narrow as main direction
Full platform ownership	Move toward broad workflow, enterprise, or store operating system ownership.	Role definition	Excluded as main direction

G.4 Clustering of positioning themes

Clustering of initial positioning elements into design themes

Positioning theme	Ideas included	Main question	Role in the design direction
Market sequencing	Travel and Duty Free, Health and Beauty fit validation, drugstore exploration, later grocery entry.	Where should MOOS build proof first, and which segments should come later?	Starts from the current proof base and avoids entering heavier contexts too early.
Use case sequencing	Trusted alerting, theft-first trigger logic, richer theft diagnostics, basic on-shelf availability, workflow-linked on-shelf availability.	Which use cases are most feasible early, and which need more system maturity?	Places trusted alerting and theft earlier, while treating on-shelf availability as a staged pathway.
Selective partner connection	Electronic shelf labels, camera layers, workflow systems, point of sale systems, fixture partners.	Which partner links strengthen actionability, and where would they add too much dependency?	Makes partner connection part of the direction, but only where it supports the use case or repeated deployment.
Repeatable deployment	Partner-ready deployment logic, configuration templates, support roles, rollback logic, installation rules.	How can MOOS move from pilot logic to repeated use across sites?	Becomes an early condition for moving beyond the first proof cases.
Role definition	Shelf sensing component, alert provider, trigger layer, diagnostic layer, connector to wider systems.	What should MOOS own, and what should remain outside its role?	Leads to the preferred role of a bounded, partner-ready shelf intelligence and trigger layer.
Adjacent option space	Shelf compliance, brand execution, engagement, display-quality related signals.	Which ideas may become useful later without driving the main route now?	Keeps future options visible, while preventing the strategy from becoming too broad.

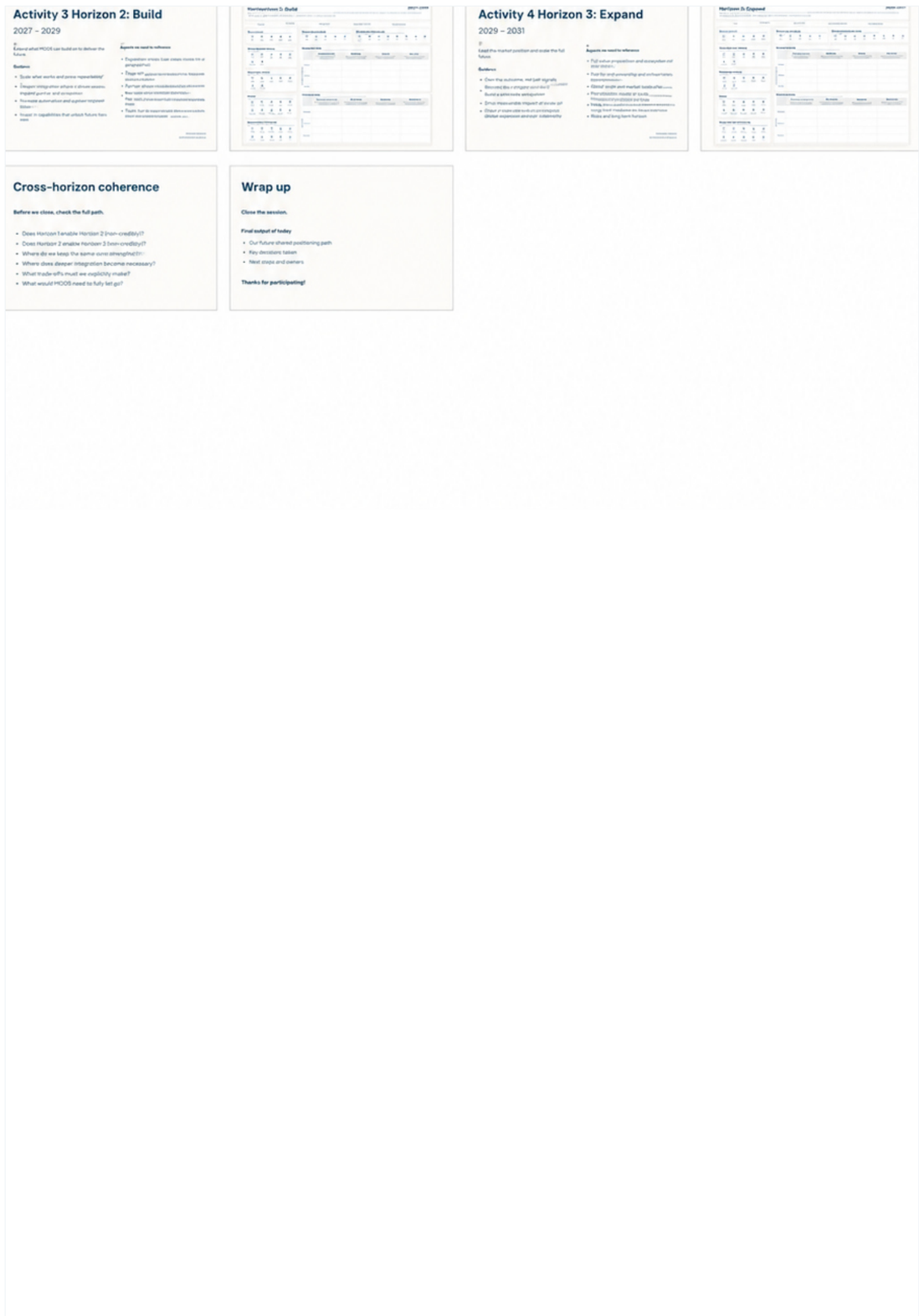
Composition of the preferred positioning direction from the strongest themes

Theme used in the preferred direction	*Element kept in the preferred direction*	*How it appears in Chapter 6*	*Trade-off accepted*
Market sequencing	Start from Travel and Duty Free, then test Health and Beauty and drugstore before selected grocery entry.	The strategic roadmap begins from the current proof base and moves into adjacent settings before heavier contexts.	Grocery is not ignored, but it is not treated as an early broad route.
Use case sequencing	Keep trusted alerting and theft-first trigger logic as the early base. Add richer theft diagnostics and selected on-shelf availability later.	The roadmap separates the faster theft pathway from the slower on-shelf availability pathway.	MOOS does not try to solve all shelf problems at the same time.
Selective partner connection	Work with electronic shelf label, camera, point of sale, workflow, or fixture partners only where the use case justifies it.	Partner and integration rows in the tactical roadmap are staged rather than immediate.	Some value opportunities are delayed to avoid early dependency overload.
Repeatable deployment	Treat reliability, configuration, rollback, support, and partner readiness as early priorities.	Tactical roadmap workstreams start with deployability and support conditions.	Proposition depth is not the only early priority.
Role definition	Position MOOS as a bounded, partner-ready shelf intelligence and trigger layer.	This becomes the preferred positioning direction.	MOOS does not become a full retailer platform or workflow owner.
Adjacent option space	Keep engagement, display quality, and brand execution as possible later uses.	These ideas remain visible, but do not lead the initial roadmap.	The initial direction stays narrower than the full opportunity space.

Appendix H. Validation

H1. Validation Slides





H2. Validation Matrix + Roadmap Revision

Feedback point	*Feedback type*	*Interpretation*	*Design response*	*Roadmap revision*
The roadmap direction was understandable, but the visual contained too much text	Clarification needed	The core logic was not rejected, but the visual asked too much from the reader	Reduce text density and improve hierarchy	Revised roadmap uses fewer words, larger labels, and clearer stage logic
The roadmap could not rely on long verbal explanation	Revision needed	The roadmap must be understandable for people who were not part of the design process	Make the visual and captions more self-explanatory	Add direct figure explanation and clearer stage labels
The preferred positioning direction remained relevant	Confirmation	MOOS' bounded trigger-layer role was broadly accepted as the right direction	Keep the preferred direction as the basis for the revised roadmap	Future ambition remains a bounded shelf intelligence layer
The starting point needed to be more proof-based	Revision needed	The roadmap needed to start from current traction instead of broad ambition	Anchor the roadmap in the current proof point	Add Avolta traction case as current proof point
Avolta should be treated as current proof, not as proof of broad scalability	Revision needed	Current traction is valuable, but still needs to be understood before replication	Separate proof point from scalability claim	Current proof point becomes separate stage before Now
The first step should be to understand why the current traction works	Revision needed	MOOS needs to identify the repeatable conditions behind the current case	Reframe Now around learning and repeatability	Now becomes identify and replicate the repeatable traction pattern
The horizon logic was too time-led	Revision needed	Calendar years gave a false sense of certainty	Replace fixed timing with maturity stages	Strategic roadmap uses current proof point, Now, Next, Later, future ambition
The horizon logic was too segment-led	Revision needed	Segment sequence could push MOOS toward broad expansion too early	Make conditions more important than segment names	Add lookalike conditions as guiding logic
Duty free logic may apply elsewhere if similar conditions exist	Revision needed	Similar shelf-action patterns may exist across sectors	Use criteria instead of fixed segment order	Add lookalike conditions such as high theft, high value, fixed context, clear staff action
Segment labels are still useful as examples	Clarification needed	Segments can help readers understand the logic, but should not drive the roadmap	Keep examples secondary	Segment examples remain contextual, not structural
Theft should remain earlier than OSA in the roadmap	Revision needed	Theft has a more direct action route and stronger urgency	Sequence theft-related trigger logic before OSA workflow logic	Theft trigger route appears in Now and Next, OSA workflow moves to Later
OSA needs more backend closure than theft	Revision needed	OSA depends on planning, replenishment, ordering, stock correction, or workflow systems	Treat OSA as a more integration-heavy path	OSA light signal can be explored earlier, OSA workflow is placed later
Theft is shaped by urgency, response risk, and timing	Confirmation	Theft cases depend on quick and safe action after a shelf event	Keep theft trigger logic close to current proof	Theft trigger is shown as an earlier use-case pathway
OSA is shaped by integration and ownership dependencies	Revision needed	OSA cannot be treated as the same scaling path as theft	Separate OSA from theft in tactical roadmap	OSA receives separate bars and later decision gates
Partner logic was too generic	Revision needed	The roadmap named partnerships but did not always show their purpose	Define partner role by function and stage	Add more specific partner role logic in tactical roadmap
"With whom do we do what, and when?" needed clearer answers	Revision needed	Partnership logic had to become actionable rather than descriptive	Link partner types to roadmap stages and decision gates	Tactical roadmap separates partner needs by stage
Client-facing partners and MOOS readiness partners should not be mixed	Revision needed	Some partners improve the retailer proposition, while others improve delivery capacity	Split partner logic into two categories	Add separate rows for client-facing integrations and MOOS readiness integrations
Client-facing value means improving the retailer proposition	Clarification needed	The roadmap needed clearer wording around what creates value for the customer	Define client-facing value in the roadmap explanation	Client-facing integration row includes headset route, POS support, camera review, workflow link, ordering link
MOOS readiness means improving delivery, support, and repeatability	Clarification needed	Some work matters mainly because it helps MOOS deliver and repeat the solution	Define MOOS readiness separately	MOOS readiness row includes partner install, fixture embedding, remote support, quality gates, support split
The integration logic was too simple if described as light versus deep	Revision needed	Integration complexity depends on breadth, depth, and dependency load	Replace simple light/deep framing	Use single-component trigger connection versus multi-system integration
One integration component is different from many system dependencies	Revision needed	A headset route is not the same as POS, camera, task, workflow, and ordering links together	Show integration breadth across stages	Tactical roadmap separates headset route from later POS, camera, workflow, and ordering links
Deeper integration should only happen where proof and readiness justify it	Revision needed	Integration can create value, but also adds dependency load	Add decision gates before deeper embedding	Later stage asks whether deeper embedding is worth it
The roadmap should help MOOS choose, not only show options	Revision needed	The roadmap must function as a filter for opportunities	Add explicit use logic and decision options	Add decision options: do now, do later, do with partner, do not do, learn more first
The roadmap should prevent premature expansion	Revision needed	Broad expansion before repeatability could create strategic distraction	Make maturity and proof the main progression logic	Revised roadmap moves from proof point to repeatability, then adjacent propositions, then selective embedding
Grocery or supermarket contexts appeared too early	Revision needed	Grocery environments may require heavier workflow and system dependencies	Move grocery-like contexts to Later unless proof supports earlier entry	Complex store contexts and OSA workflow are placed later
The future vision should remain bounded	Confirmation	MOOS should not become the full retailer operating system	Keep the future ambition narrow enough	Future ambition becomes bounded shelf intelligence layer
The roadmap should not become a rollout plan	Limitation	The validation only tested roadmap logic, not implementation certainty	State scope clearly in Chapter 7	Revised roadmap is presented as decision-support logic, not rollout plan
The validation did not test market demand	Limitation	Internal validation cannot prove retailer acceptance	State validation limitation	Add limitation on validation status
The validation did not test technical feasibility	Limitation	Integration logic was assessed strategically, not technically proven	Avoid technical proof claims	Chapter 7 states that technical validation is outside scope
The validation did not test partner willingness	Limitation	Partner roles were assessed as plausible strategic routes, not confirmed agreements	Avoid claiming partner commitment	Chapter 7 states that partner willingness remains outside validation scope
Structured notes were used instead of a verbatim transcript	Limitation	Evidence is traceable but does not include direct quotes	Explain method clearly	Appendix H provides structured validation matrix instead of quotations