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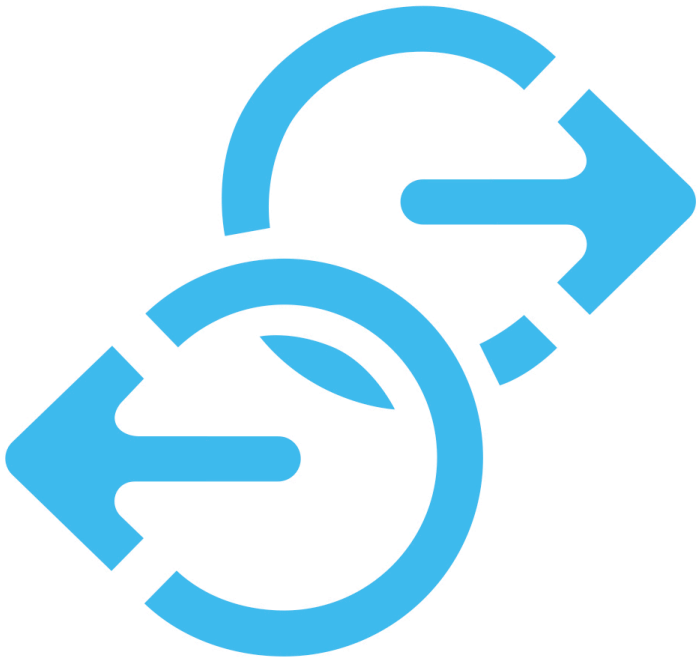

# Empowering retailers to compete offline with online insights

## Design research to design a digital multi-sided data analytics platform for the Dutch foodservice industry

Master thesis for the master Systems Engineering, Policy analysis & Management

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# Abstract


## Research problem

Currently suppliers in the Dutch foodservice industry, as well as hospitality entrepreneurs are facing increasing competition from new entrants to the foodservice market. A key problem for suppliers as well as entrepreneurs is lack of insight into what is going in the market and their enterprises. One of the main reasons for this is a highly fragmented Point of Sale system market, and lack of cooperation between parties in the foodservice supply chain.

A possible solution could lie in the development of a digital multi-sided platform by startup company Checkmetrix. Design of this platform is challenging because the current state of the art research mainly focuses on fully developed platforms (ex-post), and lacks knowledge on how platforms come into being and can be designed. Besides this Checkmetrix might not yet be in the position to negotiate with large foodservice suppliers because these might consider the solution to be too immature.

The main question this research tries to answer is the following. *Which design principles are useful for the design of a digital multi-sided platform for a start-up company, that enables market level data analytics and enables third party applications in the foodservice industry?*

## Methodology

In order to answer this question a literature review was conducted that lead to the extraction of 10 guidelines that can inform the design of a digital multi-sided platform. Utility of the guidelines was then tested using the case of Checkmetrix by developing a first version of a MSP for Checkmetrix.

Design science literature informed the methodology that allowed concretizing the steps needed to manage the designing process. More specifically the design cycle by Verschuren & Hartog (2005) was used to structure the design process. Using a combination of desk research, interviews and design science while executing one full design cycle an initial version of the Checkmetrix platform was developed and evaluated. Following this the knowledge extracted during the development of this first version was used to evaluate the utility of the principles extracted from literature.

## Results

Desk research on the foodservice industry shows that players in this industry need to invest in data analytics solutions, in order to deal with increasing competition from new entrants to the market. This part of the research also showed that there is currently no large-scale data analytics method that performs well in a fragmented market like the hospitality industry. Because of this it can be assumed that the foodservice industry is interested in a digital multi sided platform developed by Checkmetrix.

The knowledge extracted in the literature review, combined with the desk research on the foodservice industry informed a theory-ingrained artifact, or first hunch, on what the Checkmetrix platform should look like. However this first hunch was based on 13 assumptions regarding the interest in different aspects of the platform from the hospitality industry and foodservice suppliers.

To validate these assumptions interviews were conducted among hospitality entrepreneurs, as well as suppliers from the foodservice industry. These interviews lead to a twofold conclusion. Part one of the conclusion is that suppliers from the foodservice industry are currently not interested in the platform by Checkmetrix, because the concept has not yet proven itself. Suppliers did however express to be interested in joining the platform once it matures. Part two of the conclusion is that hospitality entrepreneurs are interested in analyses of the data generated in their enterprises by Checkmetrix.

This conclusion meant that Checkmetrix had to update its strategy from developing a digital multi-sided platform in one step, to a two-step process. First of all it will have to enter the

hospitality market with a data analytics solution for the hospitality, and later extend this to a multi-sided platform that also includes the foodservice industry suppliers.

This research initiated that strategy in the design of several dashboards based on hospitality data. The requirements for these dashboards, as well as the underlying application were elicited using the same interviews that were used to evaluate the assumptions underlying the first hunch. The dashboards will run on top of a set of modules that enable collection and analytics of the hospitality data, and that are easily extensible in a later stage.

Design of the dashboards was evaluated using 8 interviews with hospitality entrepreneurs and was twofold. First of all the interviews tested whether the requirements for a hospitality industry data analytics solution had been fulfilled. Secondly, the interviews tested if the designed artifact contributes to fulfilling the goals of problem owner, Checkmetrix. This lead to the conclusion that the dashboards indeed fulfill the goals of the problem owner, because hospitality entrepreneurs are willing to pay for the dashboards, would use them on a regular basis, and are also willing to share the data collected from their enterprises on a platform. This means that Checkmetrix can continue development of the hospitality data analytics solution, and use this solution as a basis for development of a digital multi-sided platform that includes hospitality suppliers as well.

## Scientific contribution

Applying platform design principles on the case of Checkmetrix allowed evaluating utility of those principles. This lead to three main contributions to theory; a set of principles that can inform the design of digital multi-sided platforms for start-ups; confirmation of the idea of Gawer & Cusumano, (2008) that start-ups are likely to have a harder time negotiating with large enterprise customers; and extension of the process model of MSP development. It is suggested that the process model of MSP development by Tan, Lu, Pan, & Huang, (2015) is extended with an extra stage, the inception or start-up phase. Evaluation of the design principles is displayed below.

### Useful principles for start-ups

- Create clear vision and business model that balances pricing strategy, portfolio growth and user attraction, in order to deal with complex environments
- Components of digital platforms must be loosely coupled through standardized interfaces, in order to reduce system complexity.
- Layers must be coupled through standards and protocols shared by heterogeneous firms, in order to increase connectivity between platform participants.
- Build a coherent vision of what the platform and its ecosystem should look like, to help build a reputation as neutral industry broker
- Build strong partnerships with partners who share the platform vision, in order to reduce risk and increase power for the platform owner
- Create initial boundary resources in close cooperation with partners to prevent inefficient tuning of boundary resources
- Open the platform to a limited number of (partner) participants during the early stages, to reduce R&D costs and improve platform quality, whilst minimizing the need for extensive control arrangements
- Platform startups in markets where one side of the market is a large enterprise should focus on development of a value-creating product for a side of the market with small players, in order to reduce complexity, level the playing field with potential platform participants, and attain critical mass before connecting larger participants.

### Principles not useful for start-ups

- Solve chicken and egg problem before launching platform by subsidizing quality and price sensitive users, in order to quickly attain critical mass

- Nascent stage platforms should use coring and tipping strategies, in order to develop a hub & spoke MSP

### Probably useful principles (inconclusive results)

- Platforms must be generative and evolvable, in order to promote innovation on the platform by platform participants

The main recommendation for future work is to continue studying the Checkmetrix platform. Doing so will make it possible to really conclude if the design decision made in this stage of platform development will lead to a successful platform. It also becomes possible to further validate the design principles that turned out to be only moderately useful in this stage of development, but that are expected to contribute in a later stage of platform maturity.

Besides this the Checkmetrix case should be studied from an IS capabilities perspective to identify the IS capabilities that are relevant for the initiation stage of MSP development, and in that way complete extension of the process model of MSP development.

# Preface

This master thesis report is the results of five months of hard work and research on the topic of digital MSP development in an actual start-up environment for the master program Systems Engineering, Policy Analysis and Management. Although the design of a technical system in a complex environment of stakeholders is exactly what makes the research interesting, I did not expect it to be this challenging to come up with results that balance the need for academic rigor with business value. The report before you is proof that it is possible to make a scientifically relevant contribution while at the same time developing a platform for Checkmetrix and the foodservice industry, but I could not have done this on my own. Because of this there are several people to which I would like to express my gratitude.

First of all I would like to thank Mark de Reuver, my first supervisor. Mark, you always knew how to provide a new perspective on any problems I ran into. Besides this your always-swift comments helped to keep me on track in a tightly planned project. The detail of your comments was something I had not expected when I started out, but they were invaluable for improving the quality of this report and I probably could not have achieved writing it without you.

Second, I would like to thank Marijn Jansen, chair of the graduation committee. From courses during the master I already knew that you posses a huge amount of knowledge on IT architectures and governance research, and combined with a very critical view this proved very useful during the graduation process.

Third I would like to thank Martijn Warnier, second supervisor. Although I did not need to tap into the technical expertise that you possess as much as I would have liked, because Checkmetrix is still early stage, you were still able to provide very useful feedback on how to approach the design and research process. Thank you for that.

Besides my graduation committee this whole endeavor could not have been possible without the team at Tabster & Checkmetrix. I would like to especially thank Pieter van den Hoven for his day-to-day support and feedback from a business perspective. Pep, your sales and business experience often showed me a wonderful new perspective on all kinds of issues, and your continuous jokes made working at Checkmetrix a great experience.

I would also like to thank Frans van Hoogstraten & Sjoerd Rothweiler, founders of Tabster. Frans, Sjoerd when I joined you in the adventure of Tabster one and a half years ago I could not have foreseen how far it would come and I have not regretted joining the company for a moment. You gave me the opportunity and responsibility to not only design and develop the Tabster backend, but also do this for a large part while finishing my master. On top of that you made it possible to do my graduation project at Checkmetrix and for this I am very grateful.

Finally I would like to thank my parents. Marie-Rose, Frank, thank you for always encouraging me to choose my own path and make my own decisions, even when these might not always have been the most obvious ones. Your support is of course one of the main reasons that I am where I am today.

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# 1 Introduction

Currently retailers and suppliers in the Dutch foodservice industry are facing increasing competition from new entrants to the market, like supermarkets and delivery services. The use of big data by large new players means that small hospitality owners and their wholesalers have much less insight into the wishes of the consumer, and are simply not as well equipped when it comes to influencing customer interaction. Especially compared to large supermarkets that have already invested much in the use of big data and online delivery services, the traditional foodservice industry lags behind when it comes to analytics (GfK, 2015; Rabobank, 2016).

Tech companies and researchers have all spotted the need for offline retailers to compete with online retailers. Currently advances are being made in researching mobile payments (Dahlberg, Mallat, Ondrus, & Zmijewska, 2008), leveraging data analytics (Nedyalkov, 2013) and customer loyalty (Deng, Lu, Wei, & Zhang, 2010). Consequently many start-up companies and larger enterprises are trying to set-up businesses that try to help retailers by providing customer loyalty apps, offer mobile payment solutions or provide data insights to retailers (Vliet van der & Dam, 2014). Examples include Adyen, Bunq and Bitonic.

But all of these initiatives face a common problem. They need to somehow connect the consumer to the retailer through their mobile application. The logical place to do so is the retailer's Point of Sale (POS) system because it manages all transactions taking place in the retailer's store. Unfortunately for these application providers and data analysts the market of POS providers is extremely fragmented (Corporation, 2013). It constitutes for a large portion of expensive legacy system manufacturers who are unwilling, or incapable, of integrating mobile solutions into their systems, and a small portion of more modern, cloud-based POS providers. This means that it is very difficult, if not impossible for providers of mobile applications to integrate with a large amount of retailers, and very hard for SME retailers to freely choose between these mobile applications, and possibly offer multiple of them in their stores (larger chains usually have the required resources to develop custom solutions so they won't be considered for the rest of this research).

One start-up company that might hold a solution to this problem is the Dutch company Checkmetrix. As a spin-off from mobile payment solution start-up Tabster, that faced the same problems as described above, it has developed a device which can connect to any existing POS system. Because this device can connect to any existing POS system it has the potential to be easily integrated in the existing retail environment, and that way become a multi-sided platform for all kinds of mobile and data-analytics solutions.

## 1.1 Research problem

### 1.1.1 Stakeholder complexity

For years companies like AC Nielsen have provided reports on market share using data collected from large retailers. Large retailers themselves have also heavily invested in the collection and analysis of POS-level sales data with the purpose of gaining a competitive advantage through for example better pricing strategies (Banerjee & Banerjee, 2000). Collecting this data to gain insight into the market structure, and performance of the larger supermarket chains is relatively simple because the number of parties involved is limited to a few big players with enough resources to invest in expensive technological solutions.

This is however not the case for smaller retailers, especially in the hospitality industry. This sector is much more fragmented with the largest "chains" generally comprising of no more than 20 venues (bars or restaurants), and an average lifespan of venues of only three years (AB-InBev, 2012; HorecaDNA, 2015). The only larger players active in the market are the suppliers of the retailers. Here a few large chains dominate in a heavily regulated market. Because suppliers are often also investor in the retailers, the relationship between these parties can be somewhat twisted. On one hand both parties benefit from successful retail, but on the other hand both try to maximize their profit through the use of different strategic instruments (contracts, information hiding, strategic behavior). This combination of a fragmented market and unwillingness to

cooperate makes it hard to create a common solution that can be used for collection and analysis of the POS data.

Yet, initial interviews performed during this research with retailers from the hospitality sector and their suppliers (Heineken, AB InBev) express a clear need for more insight in POS-data. Although retailers still seem somewhat hesitant to share their data with competitors they are very interested in their performance compared to those same competitors. Suppliers especially showed interest in the POS data with the purpose of spotting product trends at an earlier stage. Besides this suppliers as well as retailers expressed interest in the creation of consumer facing apps to either provide better service, or get a direct communication channel to the consumer. However, at the same time all parties also perceive problems with relation to consumer privacy and data ownership. A key element for a successful solution is therefor that the values of all stakeholders involved are taken into account.

### 1.1.2 Digital multi-sided platforms

To be able to create a solution for the problems described in section 1.1.1 retailers' POS systems must be connected to data analysts, mobile application providers, suppliers and other third parties in such a way that retailers remain in control of their own data, without having to invest too many resources in new technology. One possibility of achieving this is a multi-sided platform. These platforms try to bring together different parties by enabling interaction between them. A key factor in this interaction is the presence of network effects, be it direct or indirect, and the purpose of the platform provider is to structure the platform in such a way that interaction cost between its participants is minimized (Hagiu, 2006; Rochet & Tirole, 2006). In case of direct network effects the platform's value is mainly increased if more users from one side join (e.g. only consumers), and in case of indirect network effects the platform's value depends on users in different groups (Katz & Shapiro, 1985). An example of indirect network effects can be found in mobile app stores. The app store (platform) becomes more valuable to consumers once more app developers join the platform.

For many years multi-sided platforms were studied from an economic perspective with researchers especially trying to describe the interaction between platform users, and market power of platform providers (T. Eisenmann, Parker, & Alstyne, 2006; Rochet & Tirole, 2006). In recent years scholars discovered that this approach is not sufficient for digital multi-sided platforms as they have very different characteristics (Yoo, Henfridsson, & Lyytinen, 2010). These characteristics are homogenization of data, reprogrammability, distributedness and editability (Reuver, Sorensen, & Basole, 2015). Besides this, the modular architecture of digital platforms allows for the creation of all kinds of new products and services by third party developers outside of the initially conceived platform applications. As a results of these characteristics digital multi-sided platforms typically have high development costs and low marginal costs (Staykova & Damsgaard, 2015). Besides this the field of service platform engineering generally takes a more holistic approach than traditional computer science. In order to successfully design a platform value must often be co-created by sharing information, technology and value propositions with stakeholders (Maglio & Spohrer, 2007). This means the design of a digital multi-sided platform must also incorporate the ecosystem and arrangements for platform governance.

A complication that arises when trying to design MSP's from the perspective of a start-up company is that little research has been conducted with regard to how platforms come into being. More precisely it is unknown if products and services accidently evolve into platforms, or if platforms can actually be designed and engineered. This means literature is also lacking in principles that can guide the design of platforms. Something which is a problem because a well developed set of principles can help to design platforms more efficiently (Reuver, Sorensen, & Basole, 2016). Besides these problems the strategies that are usually applied by large, successful platform sponsors to achieve platform leadership might not be applicable for early-stage start up platforms that target large enterprise customers (Gawer & Cusumano, 2008).

### 1.1.3 Problem statement

Different stakeholders from the hospitality industry are interested in market level data analytics, and the possibility to use third party (mobile) applications in bars en restaurants. However, these stakeholders also have opposing goals and values, which makes it hard for them to cooperate on the development of a uniform solution. The situation is further complicated by the technical difficulty of integrating different POS-systems.

A possible solution could lie in the development of a digital multi-sided platform by startup company Checkmetrix. Using the Checkmetrix Printerbox the challenge of integrating many POS systems can be tackled. By offering value to all sides of the party, and offering the opportunity for easier interaction when it comes to data analytics the platform can help to deal with opposing goals and values of stakeholders as well. Design of this platform is challenging because the current state of the art research mainly focuses on fully developed platforms (ex-post), and lacks knowledge on how platforms come into being. Besides this Checkmetrix might not yet be in the position to negotiate with large foodservice suppliers because these might consider the solution to be too immature.

## 1.2 Research contribution

### 1.2.1 Exaptation of platforms in foodservice industry

Gregor & Hevner, (2013) developed a framework for design science research contribution. They argue that design science research (DSR) should first of all be classified according to the type of contribution. The types of contribution depend on the maturity of the knowledge. Level 1 is a situated implementation of an artifact, level 2 is nascent design or knowledge as operational principles, and level 3 is well-developed design theory.

Secondly a DSR project should be categorized along two axis, being problem maturity and solution maturity. Depending on the maturity of these two project characteristics a project can either be routine design, an improvement, an invention or an exaptation.

In the case of this research the concepts relating to design of digital multi-sided platforms is applied to a new domain, that of data analytics in the foodservice industry. Because of this the research can be classified as exaptation research. The fact that an existing solution is being applied does not make the research less relevant. In fact, the new uncertain environment in which the solution is applied, allows for the development of new theoretical constructs. By reflection on the design process, and thorough evaluation of the artifact this knowledge might be transposed to different projects. This means that the expected level of the contributed knowledge is level 2. By designing and evaluating an artifact it should be possible to extract design principles that are transposable to different projects as well.

### 1.2.2 Contribute to early stage platform design knowledge

Very little knowledge is available on the design and development of platforms in its earliest stage. Nearly all research is performed on platforms after they come into being, and this research is highly prejudiced towards successful cases (Reuver, Sorensen, & Basole, 2016). One of the only works that studies a platform from inception (albeit ex-post) is the work from Tan, Lu, Pan, & Huang (2015). They develop a process model of MSP development, with corresponding strategies on how to attain critical mass for each stage of maturity. The strategies they add to the nascent stage of development are extracted from Gawer & Cusumano, (2008). In this article by Gawer & Cusumano, (2008) it is also suggested that those strategies might not be applicable when a start-up company applies them to attract large enterprise partners to a platform.

By studying a platform from the earliest stages this research aims to add knowledge on design principles that are useful for platform designers and owners who are just starting development of the platform. More specifically by performing this research on a platform that aims to attract enterprise customers the research tests the validity of the process model for MSP development in a setting where enterprise customers play an important role.

### 1.2.3 Design principles

Design principles are especially useful to guide the design of solutions for ill-structured or complex problems that cannot be formulated in explicit and quantitative terms. Their usefulness was first suggested by Cherns, (1976), and is extended with application to the design of socio-technical systems by Clegg, (2000). This section provides a short introduction on design principles, and the characteristics of well-formulated design principles.

Principles have been defined in several ways and a commonly accepted definition has yet to emerge (Stelzer, 2010). For example van Bommel, Hoppenbrouwers, Proper, & van Der Weide, (2006) define architectural principles as informal statements that serve the purpose of constraining design space. The Open Group defines architectural frameworks as “general rules

and guidelines, that are intended to be enduring and seldom amended, that inform and support the way in which an organization sets about fulfilling its mission" (TOGAF, 2004). According to Bharosa & Janssen, (2015) the common element to all definitions is that principles are normative or prescriptive in nature, and meant to give direction to the design of IS. Therefor they define principles as "Normative, reusable and directive guidelines, formulated towards taking action by the information system architects." According to them "principles capture prescriptive and directive guidelines that can be used to design systems within the framework of requirements and constraints".

There are five criteria that distinguish a good set of principles. First of all they must be understandable, so that violations are minimized. Secondly, they must be robust, in order to support consistent decision making in complex environments. Thirdly, they must be complete, so that every situation perceived is covered. Fourth, they must be consistent, so that adhering to a principle will not result in violation of another principle. And last they must be stable, so that they are enduring but able to accommodate changes (TOGAF, 2004; van Bommel et al., 2006).

### 1.2.4 Social relevance

Besides the academic contribution described in 2.1 and 2.2 development of the Checkmetrix platform also contributes to society. This contribution is threefold. First of all enabling the use of data analytics by SME retailers allows them to improve their competitive position. Secondly the platform also allows for all kinds of new services towards consumers, thereby possibly enriching and easing their shopping experience. Thirdly it offers the providers of in-store mobile applications a way to connect to existing POS-systems. An issue they have been struggling with for a long time.

## 1.3 Research questions

This section first presents the main research questions, followed by sub questions. The main research question is formulated as follows.

*Which design principles are useful for the design of a digital multi-sided platform for a start-up company, that enables market level data analytics and enables third party applications in the foodservice industry?*

Because platform design is challenging it is important to get an overview of the knowledge and best practices available on digital MSP's Because of this sub question 1 is added.

1. *What are relevant design principles from the field of digital multi-sided platforms?*

Design and development of a digital MSP can only be useful for Checkmetrix, as well as the foodservice industry when it is clear what the different stakeholders in the market are, how they interact, and why a platform might be a useful solution. From the point of view of Checkmetrix it is also important to attract sufficient users to become a successful company. Because of this sub question 2 is added.

2. *What is the need of a digital multi-sided platform for data analytics in the foodservice industry?*
    a. *Which stakeholders in the foodservice industry are interested in data analytics?*
    b. *What are barriers for cooperation between stakeholders?*
    c. *Under what conditions do stakeholders from all sides join the platform?*

Based on the extracted design guidelines and knowledge of the foodservice industry a first hunch of the platform can be created. Such a first hunch can be used to establish a baseline for the rest of the research. It is however expected there are several assumption underlying it. Sub question 3 is added to describe the different platform models possible and identify the assumptions underlying them.

3. *What does a theory ingrained digital multi-sided platform for the foodservice industry look like, and what are the assumptions underlying such a platform?*

Before panning out the first hunch into actual structural specifications it is important to evaluate which assumptions are actually true. This prevents development of unuseful or overly complex platform features. Question 4 deals with identifying the first hunch assumptions.

4. *How are the assumptions underlying a theory inspired digital multi-sided platform evaluated?*

To develop a platform that is truly valuable to all its users it is important to understand their requirements. Question 5 makes sure requirements are extracted.

5. *What are the requirements of the stakeholders involved?*

Design principles capture prescriptive and directive guidelines that can be used to design systems within the context of requirements and constraints (Bharosa & Janssen, 2015). Using the principles extracted under question 2, and the requirements and constraints collected under question 2, 3, 4 and 5 the Checkmetrix platform can be designed.

6. *How should the Checkmetrix platform be designed?*

Using the design created by answering question 6 the Checkmetrix platform can be built. This step involved development of the actual platform.

7. *How should the Checkmetrix platform be implemented?*

Design and implementation of the Checkmetrix platform must be evaluated. This is necessary to test if the platform meets the requirements set by the different stakeholders and contributes to achieving the goals of the problem owner. Besides this evaluation is necessary to infer whether or not the design principles extracted under question 1 are actually useful for the design of digital multi-sided platforms in the foodservice industry. Because of this question 8 is the final sub question added to this research.

8. *How is the Checkmetrix platform evaluated?*

## 1.4 Research method

According to Verschuren & Hartog, (2005) design has been recognized for a long time as both an art and a science. But in order to continuously move the field of Information Systems (IS) forward it is important to take a systematic and scientific approach to research in this field. Because of this scholars have for some time now worked on the development of design science research (DSR) methodologies. The design-science paradigm has its roots in engineering and is fundamentally a problem-solving paradigm. By creating and evaluating IT artifacts intended to solve organizational problems DSR tries to extract knowledge that aids in the productive application of information technology to human organizations and their management. The results of DSR include not only artifacts but also knowledge on how to design other artifacts in the same class of problems. This knowledge is often referred to as design principles (Hevner, March, Park, & Ram, 2004; Vaishnavi & Kuechler, 2004).

### 1.4.1 General research approach

When looking at the research questions specified in section 1.3 it seems the structure is very similar to the steps of the design cycle by Verschuren & Hartog, (2005). Their approach to Design Science Research (DSR) specifies a design cycle consisting of six steps. Although the process is represented linearly it should be noted that the actual design is often incremental, and especially evaluation should take place during all steps of the design cycle. The different steps are displayed below.

1. First hunch
2. Requirements and assumptions
3. Structural specifications
4. Prototype
5. Implementation
6. Evaluation

This approach is especially suitable for the problem at hand because it pays a lot of attention to the requirements of the different stakeholders involved. Combined with the continuous

evaluation of the different design steps this will help to create an artifact that meets the expectations of all parties involved, because the validity and soundness of the design is continuously tested. Continuous evaluation during the entire process also helps to keep track of all design decisions, so that these might be extracted into more general scientific knowledge (design principles) during the final evaluation.

When looking at the possible strategies for design science by Iivari (2015) the major problem addressed is a general problem inspired by practice, combined with uncertainty about the solution concept to this class of problems. This means the problem context is much more like the context of the earlier DSR approaches in which the contribution is constructed first and possibly instantiated later. And not so much like the newer DSR approach in which artifacts are constructed first from a client-specific context (e.g. Action Design Research). This is another reason why the design cycle by Verschuren & Hartog (2005) is a good fit to solve the problem.

### 1.4.2 Methods per research question

This section gives a more detailed explanation of the different methods needed for answering each of the research questions. An overview of all the questions with their method, as well as the chapter of this thesis that covers it is displayed in Table 1 - Research questions related to methodology.

1. *What are relevant design guidelines from the field of digital multi-sided platforms?*
   Answering this question will require a literature review on the topic of digital multi-sided platform design.

2. *What is the need for a digital multi-sided platform for data analytics in the foodservice industry?*
   Answering this question will require a combination of desk research and interviews. Using desk research an overview of the current state of data analytics in the foodservice and hospitality industry can be created, as well as insight into the main stakeholders in these markets. Plain desk research on this topic will not be sufficient to answer this question and all of its sub questions. To get better insight into barriers for cooperation between stakeholders, and the conditions under which stakeholders from all sides join the platform interviews with stakeholders must be conducted. Several parties from the foodservice industry will be interviewed, as well as hospitality entrepreneurs.

3. *What does a theory ingrained digital multi-sided platform for the foodservice industry look like, and what are the assumptions underlying such a platform?*
   Using the data collected to answer the previous questions a theory ingrained first hunch can be created. This will entail a brief conceptual design of a digital multi-sided platform that fits the case of Checkmetrix. It is expected that such a first hunch depends on several assumptions, and those must be extracted using desk research

4. *How are the assumptions underlying a theory inspired digital multi-sided platform evaluated?*
   To validate any assumptions extracted from the first hunch in research question 3 interviews must be conducted with suppliers from the foodservice industry and with hospitality entrepreneurs. These interviews can be used to validate if the assumptions hold, and if platform development is indeed viable for Checkmetrix.

5. *What are the requirements of the stakeholders involved?*
   Answering this question will require input from the stakeholders selected in question 1. Extracting these requirements can be combined with the interviews needed to evaluate the assumptions extracted while answering research question 3.

6. *How should the Checkmetrix platform be designed?*
   By working in close cooperation with Checkmetrix the platform can be designed. The researcher will work as one of the main architects of the platform, together with other developers of Checkmetrix. Evaluating the design should be done through interviews with stakeholders and users of the platform.

7. *How should the Checkmetrix platform be implemented?*

After the platform has been designed it must be build and implemented. To do so the researcher will work together with developers from Checkmetrix to create a prototype of the platform. This prototype should once again be validated, by interviewing stakeholders. After the prototype has been build it should be implemented by actually connecting stakeholders to the platform.

8. *How should the Checkmetrix platform be evaluated?*

When the platform has been designed and implemented its utility and effectiveness must be evaluated. In order to do so interviews will be conducted with potential users of the platform.

| **Sub question** | | **Method** | **Phase of design cycle** | **Chapter** |
|---|---|---|---|---|
| 1 | Relevant guidelines | Literature review | First hunch | 2 |
| 2 | Platform need | Desk research | First hunch | 3 |
| 3 | First hunch | | First hunch | 4 |
| 4 | Assumptions | Interviews | Assumptions | 5 |
| 5 | Requirements | Interviews | Requirements | 5 |
| 6 & 7 | Design & implementation | | Structural specifications & prototype | 6 |
| 8 | Evaluation | Interviews | Evaluation | 7 |

**Table 1 - Research questions related to methodology**

## 4.4 Drawbacks

Different stakeholders move at different speeds, and with different resources. To successfully create a prototype of the platform it is important to align at (at least part of) the stakeholders. For starters it is important to be able to access them timely for requirements analysis, but this is the least tricky part because this process has already been set in motion. To evaluate the implementation of the platform at least one party must also be connected to the platform and use it. Although initial conversations seem promising it could be challenging to fully implement the platform with a partner stakeholder within the timespan of five months.

Besides this evaluation of the platform and its design relies heavily on interviews. Although this will be helpful in extracting a rich body of information on the design of the platform this might no be sufficient to test whether enough participants are interested in joining the platform. To get a decisive answer on the validity of the Checkmetrix business case, and the applicability of any extracted scientific theory it might be necessary to also incorporate a more quantitative approach as well.

# 1.5 Structure

The rest of this research is structured as follows. First of all, chapter 2 presents a literature review of digital-multi-sided platforms. This literature review will inform the design of the Checkmetrix platform by extraction of guidelines on the design of digital multi-sided platforms.

To understand why a digital multi-sided platform for data analytics is relevant to the foodservice industry it is important to understand the different stakeholders in the foodservice industry, as well as their relationships in a context of data analysis. This context is presented in chapter 3 - Domain. From this chapter it becomes clear that the main parties that need to be on board for development of the Checkmetrix platform are suppliers in the foodservice industry and hospitality entrepreneurs, and that both of these parties are interested in the development a data analytics solutions.

Combining the developed guidelines with domain knowledge enables to create a first vision, or hunch of the Checkmetrix platform. Because the application of platform theory on data analytics in the foodservice industry has not been done before this first hunch is based on several assumptions. The first hunch, together with its underlying assumptions are presented in chapter 4 - First hunch.

Before actual design and development of the platform can begin the assumptions underlying platform development, developed in chapter 4 must be validated. Using 8 interviews with entrepreneurs from the hospitality industry and analysis of 5 meetings with suppliers from the foodservice industry it is tested if the assumptions hold true. It turns out that not all of the assumptions hold as a result of insufficient applicability of platform design guidelines. Because of this the rest of the research will focus on development of a data analysis product for hospitality entrepreneurs that can later be extended to a platform. The purpose of this is to test whether platform literature can be extended with knowledge on strategies for nascent stage platform development. Besides this chapter 5 is also used to elicit requirements that hospitality entrepreneurs have of a data analytics platform.

The requirements extracted in chapter 5, together with the guidelines from chapter 2 are the main inspiration for actual design of the platform. This design is presented in chapter 6 - Structural specification. The design of the platform consists of the technical architecture, the ecosystem and mock-ups of the dashboards that hospitality entrepreneurs will use for analyzing their data.

Evaluation of the designed artifact is performed using another 8 interviews with hospitality entrepreneurs. The results of this are presented in chapter 7 - Evaluation.

To conclude the main findings of this research as well as ideas for future work are presented in chapter 8 - Discussion & conclusion. A complete overview of the structure of this thesis is depicted in Figure 1 - Thesis outline.

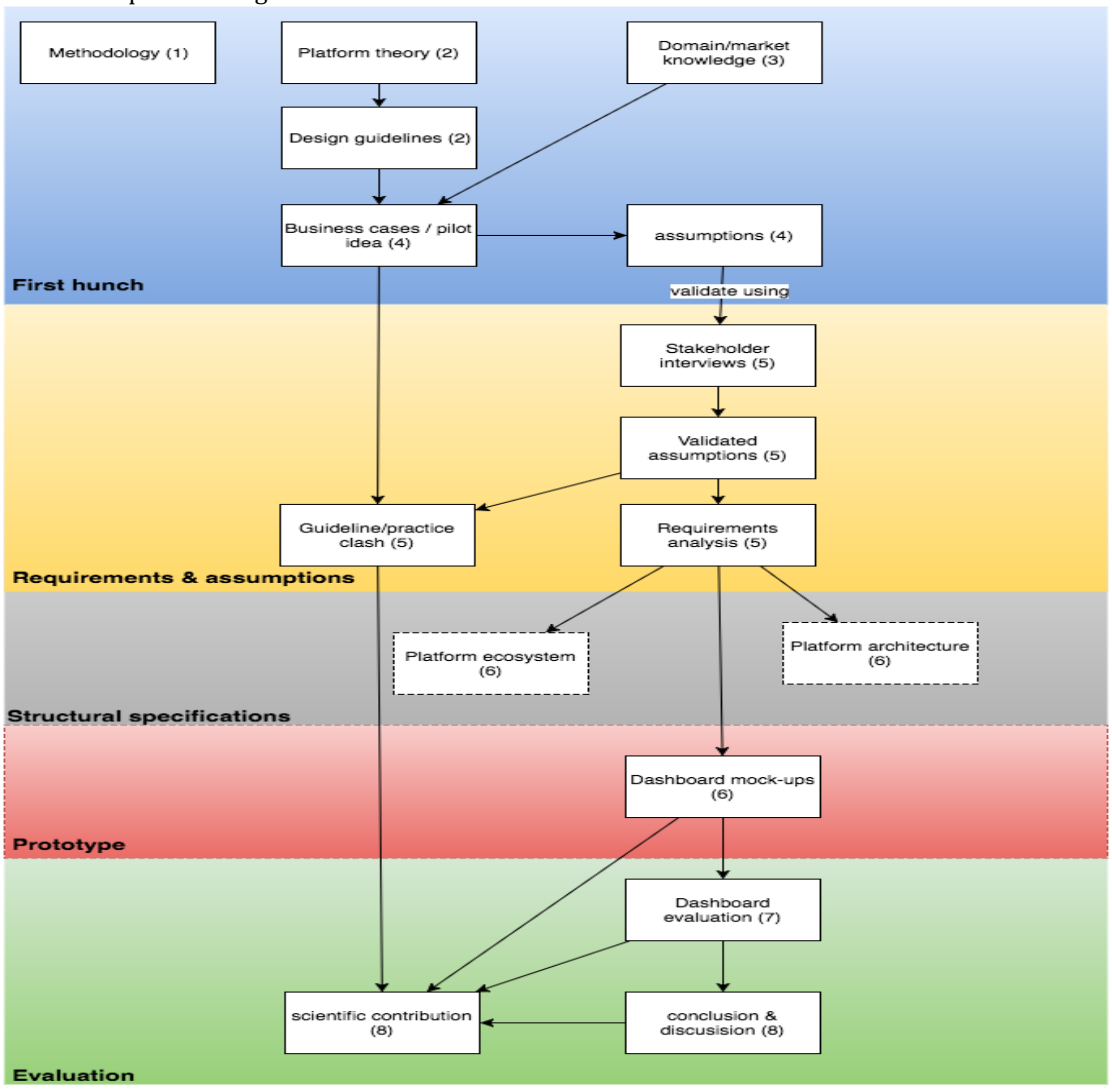



**Figure 1 - Thesis outline**

This image relates the different stages of the design cycle by Verschuren & Hartog, (2005) to the different steps performed in the research. The numbers between brackets indicate the number of the chapter that deals with the respective topic.

# 2 Platform theory

Multi-sided platforms seem to be omnipresent in today's society. Recent notable examples from the digital world include Uber, AirBnb or the Apple app store, but platforms are not necessarily Internet related. Carmakers and energy companies linking drivers to refueling stations can be thought of as non-digital platforms. The ubiquity of platforms is the reason that they have been the topic of study in academic literature for many years. Scholars from the fields of economics, business strategy, and innovation management, and in more recent years Information Systems (IS), have all given attention to multi-sided platforms from their own perspective.

The purpose of this chapter is to inform design of the Checkmetrix platform using state of the art literature from the different scientific fields concerned with platforms. In order to do so design guidelines are extracted from the literature. Each of the developed guidelines describes the mean to achieve a certain goal.

The rest of this chapter is structured in the following manner. To start of a definition of digital MSP's will be presented in section 2.1. Following research from the field of economics will be discussed in section 2.2. This is followed with the digital perspective on platforms in section 2.3. A discussion of platform ecosystems and governance mechanisms is presented in section 2.4. Finally the different stages of a platform life cycle, focusing on the initial stage are discussed in section 2.5, before finishing the chapter with a conclusion in section 2.6.

## 2.1 Definition

Throughout the different streams of research on multi-sided platforms different definitions of what constitutes a platform exist. One of the first appearances of the word platform seems to originate from the literature on product development. Here platforms are viewed as a set of reusable elements that can be used to meet the needs of different customers by simply adding, modifying or subtracting features. These platforms have later been relabeled by Gawer & Cusumano, (2014) as internal platforms. Because these platforms are not used inter-organizationally they are out-of scope for the rest of this research.

From an economical perspective the main idea behind multi-sided platforms is that they enable interaction between multiple groups of users (Rochet & Tirole, 2006). One of the main ideas of the economic perspective is that the platform becomes increasingly more valuable as more users join because of network effects. Different thoughts exist as to what the main purpose of a platform should be. According to (T. Eisenmann et al., 2006) it is to provide the rules and infrastructure that enable interaction between the different user groups. Boudreau & Hagiu, (2009) on the other hand argue that a platform owner tries to reduce search costs and/or transaction costs among all sides of the platform. The transactions are facilitated in such a way that members of one side are more likely to get on board than members on a different side of the platform. A more in depth overview of the economical line of though is presented in section 2.2 - economical perspective.

Another take on platforms is presented in Gawer, (2011). According to her "*industry platforms are products, services or technologies that are developed by one or several firms, and that serve as foundations upon which other firms can build complementary products, services or technologies.*" These industry platforms are not unlike internal platforms in that they provide a set of reusable elements with which new products and services can be created, but they differ because they are open for others to create these goods and services (Gawer & Cusumano, 2014).

Researchers from the field of IS are using different terms and definitions to refer to platforms. Tilson, Lyytinen, & Sørensen, (2010) refer to platforms as 'digital infrastructures'. They define these infrastructures as "*the basic information technologies and organizational structures, along with the related services and facilities necessary for an enterprise or industry to function.*' Tiwana, (2013) uses the term 'software platform' and defines it as "*The extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it and the interfaces through which they operate".*

The common element in all definitions of platforms across the different streams of research is that they have modular architectures. This results in platforms with a stable core and

variable periphery (C. Y. Baldwin & Woodard, 2008; Nikayin, 2014). This modularity allows new products and services to be added on top of the platform, that way mediating between different participants of the platform's network.

The variety of definitions and different streams on multi-sided platforms can be confusing. As is pointed out by Reuver, Sorensen, & Basole, (2016) the lack of conceptual rigor is one of the main inhibitors for moving the field of IS research forward. They advise scholars to clearly define the digital platform concept, as well as the unit of analysis.

This research specifically looks to create value by enabling interaction between different stakeholders in the foodservice industry through the use of a software system. Because of this the definition use in this research is formulated in the following manner.

*A digital multi-sided platform is the modular, extensible codebase of a software-based system along with the organizational structures and interfaces, that creates value by mediating between different participants of the platform's network*

## 2.2 Economical perspective

Either way, a key factor in the interaction between user groups is the presence of direct, or indirect network effects. Network effects, or externalities imply that that value of a platform increases as its user base grows. In case of direct network effects this means the platform's value is mainly influenced by users from a single group, and in the case of indirect network effects the value depends on users in a different group (Katz & Shapiro, 1985). An example of direct network effects can be found in telephone services. As more people join the network it becomes more valuable. A commonly used example of indirect network effects is the video game console market. As more users join it becomes increasingly attractive for game developers to join the platform, and vice versa. Indirect network effects are not necessarily positive. This can for example be seen in search engines. These platforms connect users to advertisers, but when too many advertisers join the platform, the value for users might actually decrease.

The presence of network effects means that platforms can grow extremely fast. As more users join the attraction towards other users, in the same or other groups, is increased even further. A challenge that platform providers face before this happens is the critical mass constraint. For a platform to become attractive to the masses it must first secure enough participants on all sides of the platform. It is suggested that for platforms to survive at all they must solve this so called 'chicken and egg' problem before the platform is launched (Evans & Schmalensee, 2010).

Most of the economic scholars agree that the main challenge multi-sided platform providers need to get right in order to create a profitable platform is their pricing strategy. Although it should be possible to monetize on all sides of the platform it is usually smart to subsidize a specific side. This can even go as far as giving away products for free to one side, in order to attract more users from the other side. The main factors influencing pricing strategy should be the ability to capture cross-side (indirect) network effects, user sensitivity to price and quality, same-side (direct) network effects and users' brand valuation. When appropriately analyzing these factors it should be possible to find the 'marquee' user. This so-called marquee user has an exceptional influence compared to the rest of the players in the market, and it can be profitable to subsidize this player. It could for example be a good idea to give a discount to the biggest shop in the shopping mall to attract other, smaller shops (Bakos & Katsamakas, 2008; T. Eisenmann et al., 2006; G. G. Parker & Van Alstyne, 2005; Rochet & Tirole, 2006). According to these authors applying pricing strategies in the correct manner will lead to winner-takes all behavior. The main ingredients for successfully taking control of a multi-sided market are at the least cost or differentiation advantages (T. Eisenmann et al., 2006).

Some of the more recent literature on multi-sided platforms suggests this winner-take all approach might not be as unconditional as presented in the previous works. CennamO & Santalo, (2013) and Holzer & Ondrus, (2011) show that if multiple platform providers leverage aggressive pricing strategies to grow their user base on all sides it not only diminishes the effect of the strategy, but it is even detrimental to platform performance. They find that it is often possible for platforms to successfully capture a niche market by using distinctive positioning. Instead it is suggested in their work that companies should have a clear vision and business model which tries to balance the nuanced trade-off between pricing strategy, portfolio growth

and user attraction. This idea is supported in Hagiu, (2006) and Boudreau & Hagiu, (2009). Both of these studies show that platform providers have much more strategic instruments available to them besides pricing strategies. Using empirical research Boudreau & Hagiu, (2009) show that instruments used by platform providers include investments, technology rules, information dissemination, and contracting choices besides price differentiation. According to them this means that platform providers are not just regular market players, but almost 'regulators' of that market. These ideas mean that the environment in which multi-side platform providers operate, and their behavior are subject to much more complex behavior than originally expected More importantly, this behavior is dynamic as well, which means that platform providers will only be successful if they act on these dynamics, and adept over time (Hagiu, 2006). From the above the following main guidelines can be extracted that should inspire designers of digital multi-sided platforms.

1. **Solve chicken and egg problem before launching platform by subsidizing quality and price sensitive users, in order to quickly attain critical mass**

2. **Create clear vision and business model that balances pricing strategy, portfolio growth and user attraction, in order to deal with complex environments**

## 2.3 Digital perspective

Although innovation management and economic research on platforms has been relatively successful in analyzing platforms from their respective perspectives this approach is not sufficient for digital multi-sided platforms. Digital platforms in IS research are set apart from their economical and innovative counterparts because they have different characteristics. First of all Yoo, Henfridsson, & Lyytinen, (2010) describe reprogrammability, homogenization of data and the self referential nature of digital technology as the main items that set digital platforms apart. Kallinikos, Aaltonen, & Marton, (2013) add to this editability, composability, distributedness and openness as defining characteristics of digital platforms.

Reprogrammability of data means that functional logic is separated from the device on which it is executed resulting in the ability of a single device to perform multiple functions (e.g. browsing the internet and listening to music). Homogenization of data in turn separates the content from the medium because all data can be accessed using the same devices and networks. Combining these two characteristics with the self-referential nature ultimately results in the democratization of innovation. The fact that digital innovation requires digital devices causes the creation of positive network effects that further increase the development of digital devices and content. These network effects help to continuously lower barriers of entry and learning costs, making digital technology, and its development available to almost anyone (Yoo et al., 2010).

In their paper Yoo et al., (2010) present the layered modular architecture as a means to design digital product platforms that enable to creation of multi-sided markets and their corresponding ecosystems. The reprogrammability characteristic means that device and service are separated, and homogenization of data causes the separation of network and contents. This results in the following layered architecture.

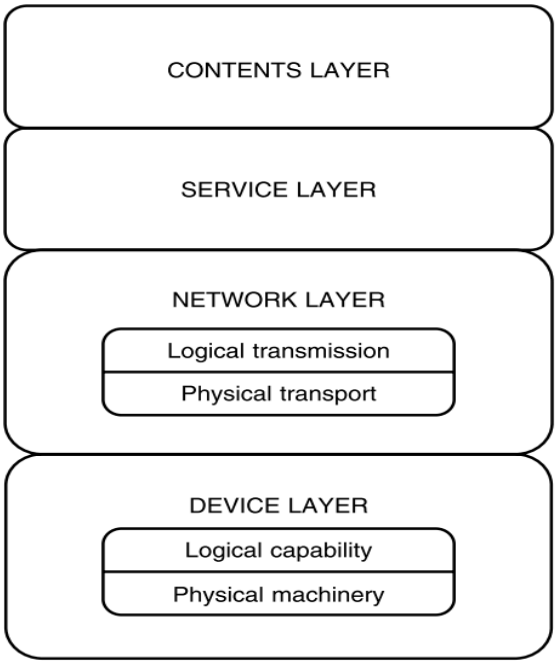



**Figure 2 - layered architecture** (Yoo et al., 2010)

Because the layers represent different design hierarchies design decisions for components in each of the respective layers can be made without considering the structure and design of any of the other layers. This gives designers flexibility in the creation of the final product by combining components from different layers. The layered architecture can be combined with a modular architecture. Modularity is a general characteristic of complex systems and refers to the degree to which a product can be decomposed into products that can be recombined (Schilling, 2000). The main advantages of a modular architecture are increased flexibility and reduced complexity. Besides this modularity encourages innovation by decentralizing decision making on hidden modules, and creates the option for third parties to innovate on a module (C. Baldwin & Clark, 2000). When combining the modular architecture with a layered architecture the so-called layered modular architecture can be derived. In this architecture there is no fixed product boundary, which means little knowledge of the final product is required to design a component. Because components can be designed freely and bound together through loosely coupled layers new unforeseen innovations can be created by complementary providers, something which is called generativity (Tilson et al., 2010; Yoo et al., 2010). From this the following design guidelines can be distilled.

3. **Components of digital platforms must be loosely coupled through standardized interfaces, in order to reduce system complexity.**

4. **Layers must be coupled through standards and protocols shared by heterogeneous firms, in order to increase connectivity between platform participants.**

5. **Platforms must be generative and evolvable, in order to promote innovation on the platform by platform participants**

## 2.4 Ecosystems & governance

As can be seen in the previous paragraphs all streams of literature incorporate the concept of interaction between multiple groups of stakeholders, either through network effects, or in the digital perspective through distributed innovation thanks to layered modular architectures. It can even be said that platforms do not have a single core owner (Henfridsson, Mathiassen, & Svahn, 2014). This means a discussion of digital multi-sided platforms should also include a discussion of their ecosystems, and how to deal with the governance challenges that

come with a complex environment of stakeholders (Reuver et al., 2016). The concept of biological ecosystems as a comparison to business ecosystems is particularly useful because the fate of each of the members in the business network is tied to the fate of the other participants, as is the case in a biological ecosystem. The complex interdependencies among companies in a network cause the network as a whole to become more innovative and productive. At the same time the moves a company makes will impact the health of the business network, which ultimately reflects on the businesses' own health (Iansiti & Levien, 2004).

The work of Iansiti & Levien, (2004) focuses on how a company can become a keystone actor within an ecosystem by first, creating value within the ecosystem, and secondly, sharing this value with the rest of the ecosystem. Keystone organizations are crucial members in a business ecosystem that try to improve the overall health of the ecosystem so that they can in turn benefit from this as well. Examples of keystone organizations are Microsoft and eBay. A similar approach is taken by Gawer & Cusumano, (2014). In this work the authors provide guidelines on how to obtain, or maintain platform leadership. According to them one of the main challenges for platform providers is to take coherent business, technology and design decisions, in order to successfully navigate the complex strategic landscape where competition and collaboration occur between different actors. To become a platform leader an organization must first build a vision of how their product, technology or service can become part of a larger ecosystem, and then build a coalition around "the right technical architecture". By sharing risks with complementors and creating benefits for partners in the ecosystem the organization can build up a reputation as a neutral industry broker. This way a sustainable ecosystem with the organization at its core can be created in the long term.

6. **Build a coherent vision of what the platform and its ecosystem should look like, to help build a reputation as neutral industry broker**

7. **Build strong partnerships with partners who share the platform vision, in order to reduce risk and increase power for the platform owner**

### 2.4.1 Governance

Managing a vibrant ecosystem comes with challenges of its own. According to Tiwana, (2013) *governing platforms requires a delicate balance of control by a platform owner and autonomy among independent developers, a*nd hence*, call for examining the formal and informal mechanisms implemented by a platform owner to encourage desirable behaviors by module developers.* Finding the right combination of governance mechanisms is a costly process, and the optimal governance structure is the simplest one that achieves the goals of a platform at the least cost to both app developers and the platform owner. The main governance mechanisms available to a platform owner are gatekeeping, process control, metrics and relational control. The right combination of control mechanisms for a specific platform is dependent on the platform architecture, stage of its lifecycle and its business model.

Two concepts that are closely related to the governance of digital platforms are the paradox of change and control. The paradox of change is a result of the opposing forces of flexibility and stability. Because how can a platform on one hand be stable, so that new artifacts processes and actors can be connected to and build on top of it, while at the same time remaining flexible to support unbounded growth? The paradox of control considers the opposing logic of centralization vs. decentralization. The key issue here is how to set control points in such a way that they are acceptable to others in the ecosystem, yet provide platforms that are sufficiently generative (Tilson et al., 2010). In that sense the paradox of control can be closely related to boundary resources (see next section for a discussion of boundary resources) and their process of distributed tuning because both theories acknowledge that a platform owner needs to find the right balance between exerting its own power and incorporating the will and need of the ecosystem to its own advantage.

### 2.4.2 Boundary resources

Ghazawneh & Henfridsson, (2013) on the other hand suggest that the focus should not be on the platform owner, but on the boundary resources made up of software tools and regulations that govern the arms length relationship between the parties involved. It is through boundary resources that a firm that owns the infrastructure can secure its control over the service system, while allowing diverse actors to participate in and contribute to the service

system. They come up with the model depicted in Figure 3 to describe how platform owners try to respond to perceived external contribution and control concerns.

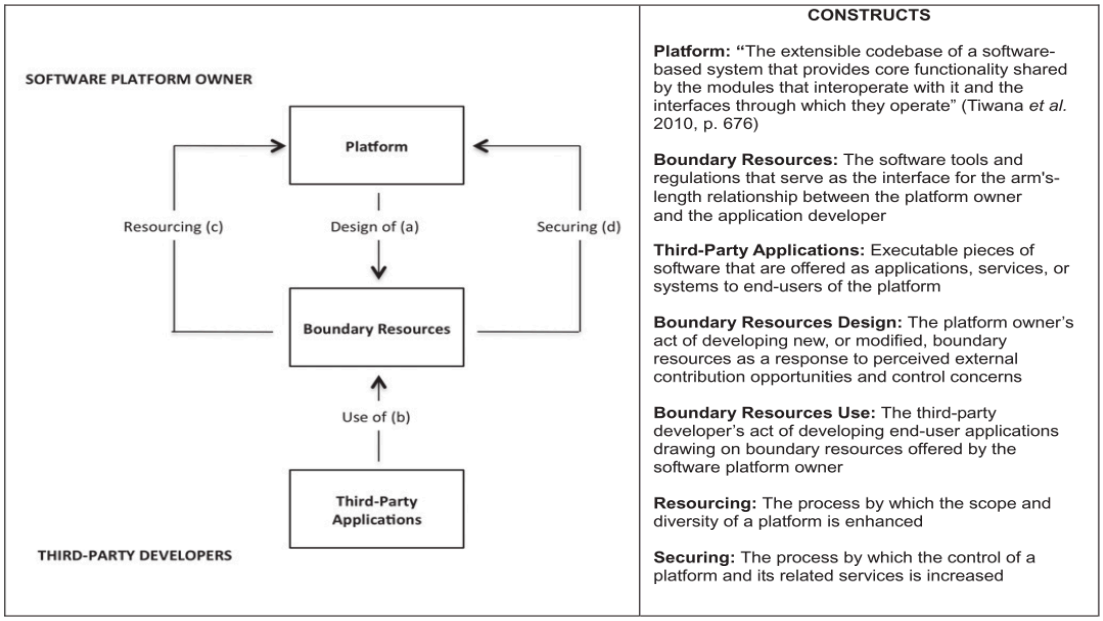



**Figure 3 - Boundary resource model** (Ghazawneh & Henfridsson, 2013)

The notion of boundary resource tuning is added to this model by Eaton, Elaluf-Calderwood, Sørensen, & Yoo, (2013). Although boundary resources might be the key to solving the paradox of generativity versus control they do not just spring into being from nowhere. In fact, because interaction takes place between heterogeneous actors with conflicting goals and different levels of power and resources, boundary resources are not simply developed by the platform owner, but evolve through a process of distributed tuning. In this process the platform owner will iteratively adjust the existing boundary resources, or develop new ones as a response to political tensions from other actors in the ecosystem.

8. **Create initial boundary resources in close cooperation with partners to prevent inefficient tuning of boundary resources**

### 2.4.3 Platform openness

If boundary resources are the platform owner's tools to control access of the ecosystem participants to the platform, then an important question that remains to be answered is the degree to which ecosystem participants should be allowed access to the platform. This is an important question to answer because there is a tension between retaining control to extract value from the platform with opening up the platform with the purpose of stimulating innovation (Ghazawneh & Henfridsson, 2013). Platform openness is the degree to which platform owners share platform technologies with third party developers (G. Parker, Alstyne, & Van Alstyne, 2010). Openness can either be technical (accessibility of API's & SDK's) or organizational (which roles of platform providers, service providers, application developers and end-users can participate in the development, commercialization and usage of the platform) (Nikayin, 2014).

In general scholars believe that a high degree of openness results in higher adoption, generativity and innovation on the platform. However, it might also create more competition resulting in lower incentives for complementary providers to invest in the platform or loss of pricing power for the platform owner (T. R. Eisenmann, Eisenmann, Parker, Alstyne, & Eisenmann, 2008; Nikayin, 2014; G. Parker et al., 2010). It is also important to note that even though opening up a platform during development can increase innovation, doing so might require extensive control arrangements to coordinate all contributors. Something that not all platform providers may be able to do (K. Boudreau, 2010; Nikayin, 2014).

How much and when to open a platform is for a large part dependent on the stage of platform development. More mature platforms will find it easier to gain support for their standards and technologies, whereas start-ups often lack the relationships and influence needed in the standards-setting process. This could lead to loss of a startup's superior technology in

favor of simpler technology that creates a level playing field for existing parties (T. R. Eisenmann et al., 2008). Opening in early stages of development might on the other hand help to reduce R&D costs by sharing with other parties and improve platform quality because of constant feedback (Nikayin, 2014).

According to Nikayin (2014) there is currently no consensus in the scientific community whether opening the platform in the early stage outperforms opening at a later stage. Because there are limited resources available for development in early stage start-ups the following guideline is constructed.

9. **Open the platform to a limited number of (partner) participants during the early stages, to reduce R&D costs and improve platform quality, whilst limiting the need for extensive control arrangements**

## 2.5 Platform life cycle

As is pointed out by Reuver et al. (2016) there is a lack of research on platform during early stages of development. Most researched is performed ex-post on successful platforms, and there is a lack of research on failed platforms and how platforms come into being. One of the few works that focuses on platform development from an early stage is the work by Tan, Lu, Pan, & Huang, (2015). They develop a maturity model that distinguishes between the different stages of platform development, and identify different strategies suitable for each stage by looking at the case of Chinese trading platform Alibaba from the perspective of IS capabilities. The model is displayed in Figure 4 - Process model of MSP development **(Tan et al., 2015)**.

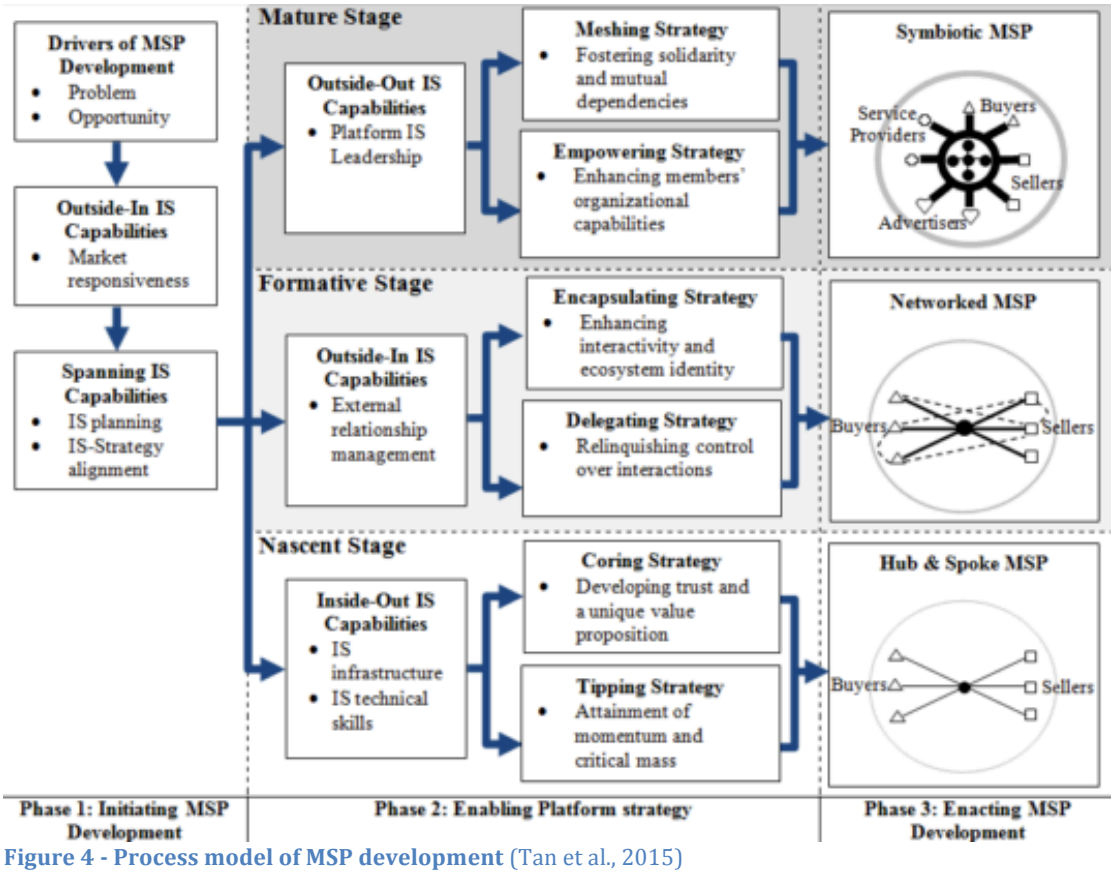



**Figure 4 - Process model of MSP development** (Tan et al., 2015)

The stage that is currently most relevant to Checkmetrix is the nascent stage. In this earliest stage of platform development platform providers should focus on inside out IS capabilities and use a coring and tipping strategy to build a hub-and-spoke platform. Inside out IS capabilities that are specifically important are the IS infrastructure and IS technical skills. The hub-and-spoke platform is the simplest form of a platform, enabling simple, direct interaction between two parties (e.g. buyers and sellers).

The strategies, developed in Gawer & Cusumano (2008) work as follows. In case of 'coring' platform providers try to solve an essential system problem for many industry players by creating a platform were no platform existed before. Add-ons by external complementors are facilitated, but the core technology remains proprietary. Key aspect of this strategy is that the service offered by the platform provider is value creating. Tipping on the other hand is especially useful when trying to win a platform war. By creating unique and compelling features that are hard to imitate, possibly bundling features from a platform in an adjacent market, it might be possible to tip the market in favor of the platform provider.

Gawer & Cusumano, (2008) also note that although small and medium sized companies as well as large companies can apply these strategies, smaller companies might have a hard time negotiating with large enterprise customers. Smaller companies will find it difficult to tip markets, and might need to establish ecosystem partnerships or coalitions of providers and users. Although this point seems logical they provide no empirical evidence to uphold it.

*10.* **Nascent stage platforms should use coring and tipping strategies, in order to develop a hub & spoke MSP**

## 2.6 Conclusion

This chapter discusses the different aspect of digital multi-sided platforms. It is clear that from an IS perspective platforms should be approached differently than in the existing innovation management and economic streams of research. This does not mean lessons learned from those fields are lost, they apply to the IS field as well, but need to be enriched with a more comprehensive set of topics. For starters this chapter defined digital multi-sided platforms as *The modular, extensible codebase of a software-based system along with the organizational structures and interfaces, that creates value by mediating between different participants of the platform's network*

By creating an overview of the available literature on multi sided platforms guidelines for the design of the Checkmetrix platform were distilled. This overview is displayed in Table 2 - Overview of platform design guidelines.

| No | Guideline |
|---|---|
| 1 | Solve chicken and egg problem before launching platform by subsidizing quality and price sensitive users, in order to quickly attain critical mass |
| 2 | Create clear vision and business model that balances pricing strategy, portfolio growth and user attraction, in order to deal with complex environments |
| 3 | Components of digital platforms must be loosely coupled through standardized interfaces, in order to reduce system complexity. |
| 4 | Layers must be coupled through standards and protocols shared by heterogeneous firms, in order to increase connectivity between platform participants. |
| 5 | Platforms must be generative and evolvable, in order to promote innovation on the platform by platform participants |
| 6 | Build a coherent vision of what the platform and its ecosystem should look like, to help build a reputation as neutral industry broker |
| 7 | Build strong partnerships with partners who share the platform vision, in order to reduce risk and increase power for the platform owner |
| 8 | Create initial boundary resources in close cooperation with partners to prevent inefficient tuning of boundary resources |
| 9 | Open the platform to a limited number of (partner) participants during the early stages, to reduce R&D costs and improve platform quality, whilst limiting the need for extensive control arrangements |
| 10 | Nascent stage platforms should use coring and tipping strategies, in order to develop a hub & spoke MSP |

**Table 2 - Overview of platform design guidelines**

The combination of guidelines displayed in Table 2 is also the answer to the first research question of this thesis. *What are relevant guidelines from the field of digital multi-sided platforms?*

# 3 Domain

The platform that Checkmetrix is looking to develop will have to operate in a complex environment with stakeholders of different sizes and interests. This chapter will give an overview of the foodservice industry (hospitality industry with its supply chain), as well as data analytics solutions currently available for the foodservice industry. This description of the structure of the industry, and the challenges it currently faces helps to provide the context necessary to understand the need for the Checkmetrix solution, as well as a basis for understanding the rest of this research.

The chapter will start by going into the three main links in the foodservice chain: Hospitality, wholesalers and suppliers. Following this an outline of the POS market will be provided because this is key to understanding the value of the Checkmetrix solution. To conclude an overview of the data analytics market is added because Checkmetrix will be competing with existing solutions from this market.

## 3.1 Foodservice industry

The foodservice industry spans the entire value chain of hospitality (bars, restaurants, hotels) together with the wholesalers and producers that supply them with goods for their customers. Besides bars, restaurants and hotels the foodservice industry also entails comfort (delivery services) and catering. For the purpose of this research the focus will be on the hospitality together with its supply chain.

### 3.1.1 Bars & restaurants

Generally the hospitality industry is divided into three types of enterprises: hotels, bars & cafes, and restaurants. The hospitality industry in the Netherlands has an annual turnover of about 18 billion euros, the largest part of which is made up by restaurants (41%), followed by hotels (28%) and cafes (17%). With an average yearly growth in turnover of about 2% the hospitality industry in the Netherlands is mature and relatively stable (Ernst & Young, 2013). This part of the market is very fragmented, as can be seen from Table 3. A majority of the 22.280 enterprises in the market has less than 10 employees. This is quite different from the hotel sector, which is much more dominated by a few large chains with very large venues. This makes the sector much less interesting for the Checkmetrix solution, and because of this the hotel sector is left out of scope for the rest of this research (Delta loyd, 2014).

| | 1 | 2 | 3-5 | 5-10 | 10-20 | 20-50 | 50-100 | >100 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Restaurant | 2.290 | 2.120 | 2.635 | 2.955 | 1.365 | 375 | 25 | 15 | 11.790 |
| Cafe | 4.480 | 2.400 | 1.685 | 1.285 | 475 | 135 | 20 | 10 | 10.490 |
| Total | 6.770 | 4.520 | 4.320 | 4.240 | 1.840 | 510 | 45 | 25 | 22.280 |

**Table 3 - Cafes & restaurants by number of employees** (Delta loyd, 2014)

It is expected that the hospitality market will continue to grow (+/- 3%) in years to come. This growth will go together with increasing economies of scale and larger chains of enterprises on the one hand, and an increase in small local exploitations like food trucks and pop-up outlets as counter-reaction. To be able to stay competitive hospitality entrepreneurs must look for cooperation with recreation, retail and other hospitality enterprises. Besides this creating the right online proposition will be very important for enterprises to prevail (Rabobank, 2015a).

### 3.1.2 Wholesalers

Wholesalers are the main suppliers of bars and restaurants. This is the case for beverages as well as food. This part of the market is dominated by four large players (Sligro,

Lekkerland, DeliXL, Hanos, Makro), who together account for about 60% of the market. On the purchasing side the wholesalers cooperate in buying partnerships, and here the four big players account for more than 75% of the market (AMRO, 2012). A complete overview of all the players in this market is presented in Figure 5

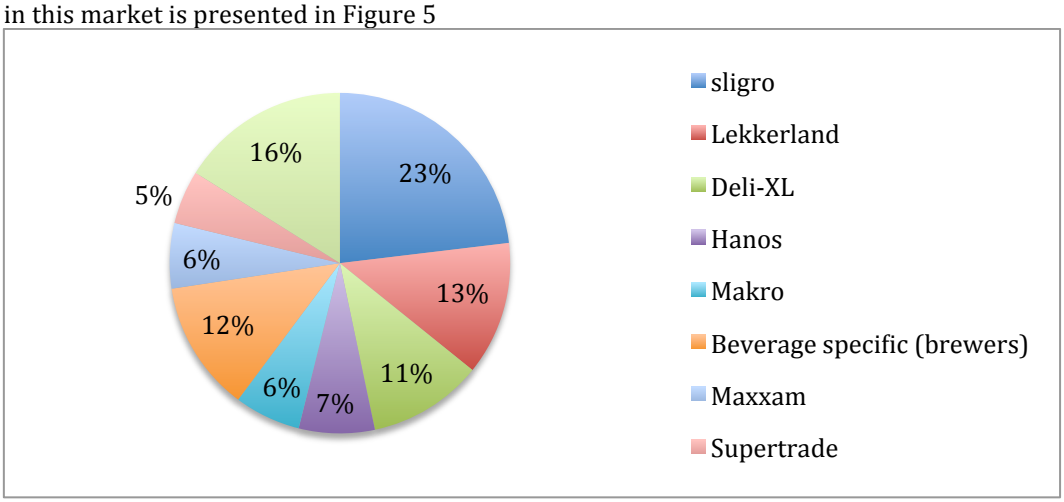



**Figure 5 - Market share wholesalers** (Sligro, 2015)

Currently the entire foodservice industry is facing huge competition from players outside the industry. Key new competitors are supermarkets and reservation / delivery websites. Examples of this are the takeover of La Place (hospitality chain) by Jumbo (supermarket) and the Iens restaurant marketing campaign by Albert Heijn. It is unexpected to see companies from the food retail industry mobilizing consumers to such large extents, and this could be a sign of more changes to come. The use of big data by large players means that small hospitality owners and their wholesalers have much less insight into the wishes of the consumer, and are simply not as well equipped when it comes to influencing customer interaction. Especially compared to large supermarkets that have already invested much in the use of big data and online initiatives like Thuisbezorgd.nl and Foodora, the traditional foodservice industry lags behind when it comes to analytics (Rabobank, 2016). This leads to that assumption that

**All parties in the foodservice industry are interested in market research**

### 3.1.3 Producers

Producers for the hospitality are part of the Fast Moving Consumer Good (FMCG) market. This includes all food and beverage producers (non-food is left out of scope for this research). Although the hospitality industry is already large with an annual value of 18 bn. Euro, this is only 30,9% of the total FMCG market. Other channels for FMCG producers are supermarkets, specialty business, comfort (delivery) services and markets. The relative sizes of these distribution channels are depicted in Figure 6.

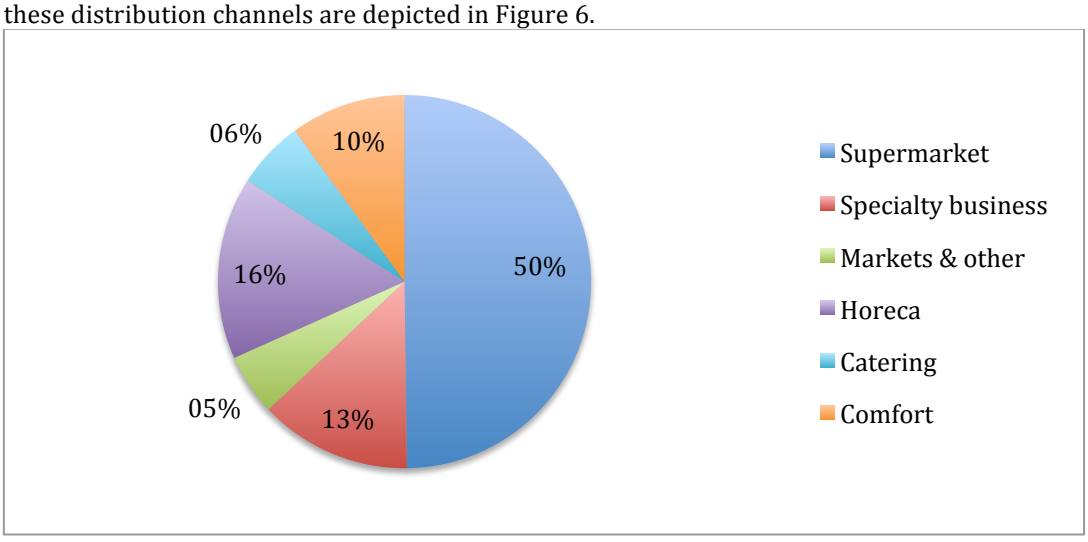



**Figure 6 - Hospitality relative to FMCG market** (Sligro, 2015)

It is expected that the FMCG industry will continue to grow by about 2% annually. Most of this growth will however be the result of export and growing markets in Asia, South-America and Africa. Volumes for the Northern European market are expected to stabilize at the current level. This industry is marked by a consistent increase in integration, economies of scale and consolidation. Main topics the industry will be focusing on for the following years are durability, food safety & health, online & data and employee quality (Rabobank, 2015b).

### 3.1.4 POS system manufacturers

Key parties for modernization of market research in the foodservice industry are manufacturers of POS systems. A POS system is the place where a transaction occurs between the customer and bar/restaurant. They come in the form of a simple cash register or more advanced computer system. Often a pin machine is referred to as POS-terminal as well, but in this research pin terminals are left out of scope because they do not contain any sales data. Currently market research suggests that about 40% of all POS-systems are computer systems ("Het aanbod van kassasystemen | Checkout," 2015). This number regards the entire retail market, so is not necessarily completely reflective of the hospitality industry. According to Corporation, (2013) globally about 50% of hospitality venues have computerized POS systems.

The market for POS systems is quite fragmented. In total there are over 130 suppliers of POS systems in the Netherlands who together offer more than 250 different systems. Although automation of large (supermarket) chains is mainly fulfilled by about 7 suppliers (making them market leaders), the majority of the market focuses (about 75%) on enterprises with just 1 or 2 venues and 1 or 2 points of sale per venue ("Het aanbod van kassasystemen | Checkout," 2015). In the hospitality specifically the largest players are Eijsink, Bork and Until.

Traditionally POS providers are known to be quite hesitant when it comes to opening up their systems to third parties and offering integrations. Their focus is very much on stability, and guaranteeing delivery of service. More recently POS manufacturers do start to feel the pressure from new entrants to the market that offer modern, cloud based solutions. These cloud-based parties are more open to integrating with third parties and allow easier extraction of data. Over the full retail market about 16% of suppliers currently have one or more POS systems with cloud backend and 26% offer one or more full cloud solutions. Another 38% are developing at least a cloud backend. It is however expected that these percentages are lower for the hospitality industry ("Het aanbod van kassasystemen | Checkout," 2015).

Even though suppliers are now actively developing cloud based solutions it can be expected that it will take a long time before a large part of the market actually changes to one of these solutions. This is because the high costs of computerized POS systems. Especially in the hospitality these systems need to be robust and can cost up to 8.000 Euro per terminal. Because hospitality enterprises aim to only spend about 1,5% of their revenue on electronics and inventory a new POS system is a huge investment for them (Delta loyd, 2014). This leads to the following assumption.

**Hospitality entrepreneurs do no want to invest in a modern POS system because the investment is too high, or they invested a large sum in their current system**

## 3.2 Data analytics

Globally the market for market research is worth more than 40 bn. Euro. With a market size of 16 bn. Euro Europe takes up a sizable part of this market. And although this market for market research seemed to stagnate on a European level in 2014, this was not the case for France, The Netherlands, Denmark and Luxembourg. These markets recorded net growth levels of nearly 2% (Esomar, 2014). As indicated by Morren, (2015) & Rabobank, (2016) data analytics will become an increasingly more important tool for enterprises in the foodservice industry to deliver better services to consumers, be able to compete with new entrants from the food retail industry, and deal with modern start-ups like delivery services. For the foodservice industry to be able to do this there is however a huge issue that remains to be solved. The collection of data in the highly fragmented hospitality industry remains unsolved. Some of the currently available solutions used are described in the section below. A full overview of these solutions, ordered by the type of industry they are most useful to and scale to which the method can be applied, is depicted in Figure 7.

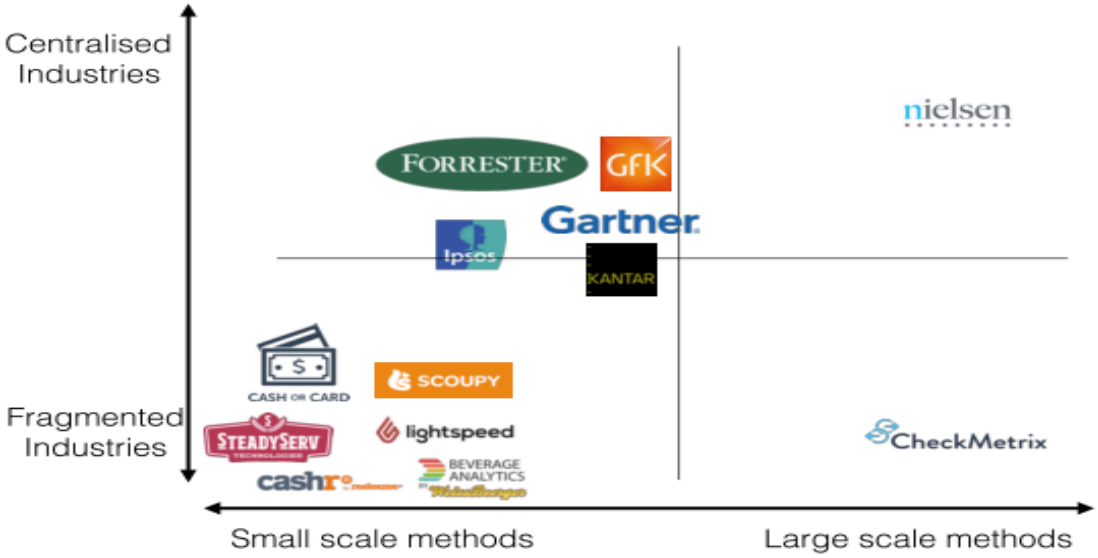



Figure 7 - Market research solutions

### 3.2.1 Large scale solutions

The fragmentation in the hospitality sector and on the POS market means there is no unified solution to collect sales data in the foodservice industry. Most of the market insights are currently collected in two main ways. A commonly used solution is market data and analyses from Nielsen. By integrating with POS and back-office systems Nielsen collects very detailed data that allows deep insights in to the market. Problem with this data is that it mainly includes data from supermarkets, offering very little insight into the foodservice market. Rolling out the Nielsen solution in the foodservice industry is very challenging due to the fragmented nature of the hospitality industry and POS system market. Integrating with all the different systems, in all the different venues is simply too costly and time-consuming.

### 3.2.2 Medium scale solutions

The second solution is retrieving data through companies like Gfk and Datlinq. Although these companies offer insight in the foodservice market they mainly collect their data through the use of consumer panels, or visits to hospitality venues. This means the data they provide only shows a limited or outdated view of the market.

A third solution is the Foodservice Insituut Nederland. This institute is an industry initiative from leading companies in the foodservice market to collect and share data with the purpose of creating market level insights. Although this solution is a great help in viewing a part of the foodservice market it is severely limited. Because industry leaders supply all the data it only includes data from wholesalers and suppliers. This means still no insight is generated in the final part of the market, the actual hospitality industry, or what the consumer actually wants.

### 3.2.3 Small scale solutions

Besides the large market research companies several (start-up) initiatives exist that try to enable market research in the hospitality industry. Examples of this are Weissbeerger, a company that tries to monitor venue performance by installing all kinds of sensors in bars and restaurants, and Scoupy, a mobile app where consumers upload their receipt in return for discounts. Besides this some of the more modern POS systems, like Cash or Card, enable easier extraction of data by offering easy integrations.

Although all of these solutions provide the type of data that are needed to really dive into consumer preferences and market analytics they all have a small-scale collection method. All of the solutions rely on the installation of sensors (time consuming), POS replacement (high barrier for hospitality entrepreneurs) or consumers (unreliable) for collection of their data. This means it will be hard to get a complete overview of the market using these solutions. This leads to formulation of the following assumption.

**Market level analytics research in the foodservice market is only performed on a small scale because the retailers in the hospitality industry and the POS market are too fragmented**

## 3.3 Conclusion

The foodservice market is facing increasing competition from new entrants, and existing competitors from the food retail industry. To be able to better understand the consumer, and keep up with new competitors, investments must be made in data analytics and market research. A problem that suppliers and wholesalers face when trying to get a full view of the market and its consumers is that they have no direct access to consumers, and that the final tier of the supply chain, the hospitality industry is very fragmented.

Currently existing solutions are either not fit for the foodservice market because they only work in less fragmented markets, have outdated and incomplete data, or are too small scale too get a full view of the market. This means that a large-scale method for sales data collection that works in the hospitality industry would most likely be welcomed by producers as well as wholesalers. The above is also the answer to the following research question. *What is the need of a digital multi-sided platform for data analytics in the foodservice industry?* However, not all sub questions of this research questions can be answered yet. Based on the research in this chapter the following assumptions can be formed. Whether these assumptions hold in reality will be tested in a later stage of this research.

1. **All parties in the foodservice industry are interested in market research**

2. **Market level analytics research in the foodservice market is only performed on a small scale because the retailers in the hospitality industry and the POS market are too fragmented**

3. **Hospitality entrepreneurs do no want to invest in a modern POS system because the investment is too high, or they invested a large sum in their current system**

Evaluating those assumptions will contribute to a answering the sub-questions

a) Which stakeholders in the foodservice industry are interested in data analytics?
b) What are barriers for cooperation between stakeholders?
c) Under what conditions do stakeholders from all sides join the platform?

# 4 First hunch

The Checkmetrix team thinks it holds technology that can provide the foodservice industry with the market research it requires to better compete with new entrants to the market. Besides this the Checkmetrix team thinks it can monetize on this technology by developing a multi-sided platform that connects suppliers from the foodservice industry with bars & restaurant from the hospitality industry. These beliefs are based on several assumptions that have not yet been completely validated. This chapter describes the Checkmetrix solution (or first hunch) in more detail, as well as the assumptions this hunch is based on.

The purpose of this chapter is to provide a frame of reference for the rest of this research. By clearly describing the Checkmetrix solution and the assumptions on which it is based, it becomes possible to validate those assumptions and check whether Checkmetrix can indeed provide valuable information to the foodservice industry. Besides this a thorough understanding of the Checkmetrix solutions is needed because this limits the design space for the platform that is being designed in this study.

Important input for a pilot version of the Checkmetrix platform is the research on digital multi-sided platforms presented in chapter 2. Because Checkmetrix is looking to develop a multi-sided platform the artifact should be designed as such. However because the state of the art research on digital multi sided platforms is mainly focused on fully developed platforms it is not certain whether the design guidelines hold in the earliest stages of development. By specifying a pilot platform based on the design guidelines from chapter 2, creation of the Checkmetrix platform contributes to science by testing if the platform design guidelines hold true in the earliest stages of platform development.

The rest of this chapter is structured in the following manner. Section 4.1 gives an overview of the different envisioned platform models. Any legal implications related to Checkmetrix are discussed in section 4.2. Following this section 4.3 describes the first hunch based on theoretical guidelines and domain knowledge. Finally non-functional requirements of the platform (as set by Checkmetrix) are presented in section 4.4.

## 4.1 Possible platform models

Started as a spin-off from hospitality start-up Tabster, Checkmetrix holds the technology to connect to any existing Point of Sale (POS) system and retrieve data regarding customer transactions. The technology works by connecting a small device (called Printerbox) to the POS system through either an Ethernet or serial cable. When this is done the Printerbox will act as a printer and listen for receipt data. This data is then parsed and sent to the Checkmetrix backend. The Printerbox can be considered as the main input for the Checkmetrix platform. Because the Printerbox does not influence any interactions between different parties on the platform, and because the Printerbox and corresponding parser have already been developed they are left out of scope as a technical artifact for the rest of this research. Table 4 – displays an overview of all the data the Printerbox can provide to the Checkmetrix backend. It is important to note that transactions are not directly related to consumers, and that it is not possible to track transactions made by the same person without first enriching the data.

| **Primary** (always available) | **Secondary** (Not always available) |
|---|---|
| Product quantity | VAT |
| Product description | Table number |
| Product price | Pin transaction ID |
| Transaction date & time | Pin machine identifier |
| Transaction cost | Employee name |
| Location | Discounts |
| | Loyalty points |

**Table 4 – Data collected by Printerbox**

Currently Checkmetrix is working with different prospective customers to build a platform that supports different use cases for different customer needs. The main business cases that are currently being developed are

1. Analytics & benchmarks,
2. Supply chain
3. Customer interaction.

The rationale behind these models is a hunch from the Checkmetrix team that these are the three main applications that can be built using the Checkmetrix Printerbox. This hunch is mainly inspired by exploratory talks between the Checkmetrix team and employees of foodservice industry suppliers. The actual demand in the market as well as the expected cost for each of these solutions have however not been thoroughly researched yet. Neither has it been thoroughly researched whether other solutions are possible. The following paragraphs describe the different use cases in more detail.

### 4.1.1 Analytics & Benchmarks

This situation mainly consists of collecting and analyzing data from retailers. The Printerbox sends all data to the Checkmetrix platform where it is either analyzed, or passed to third parties who then do their own analyses on the data. Possible types of analyses are

- In-store for specific retailers (e.g. How much products are sold, what are peak hours etc.)
- Benchmarks with different retailers
- Trend analysis (Which product sales are rising, decreasing etc.)

This business case is probably least technically challenging because the data does not need to be collected and analyzed in real-time. The collected transaction data can be stored on the Checkmetrix platform and prepared by analysts or developers before the data, or resulting analyses, are sold to any third parties. It is only possible to perform benchmarks with different retailers and trend analysis when retailers allow aggregation of their data on the Checkmetrix platform for further analysis. Checkmetrix believes that food service industry suppliers are highly interested in market research data, and willing to pay a lot of money for this data because it can create a competitive advantage for them. Checkmetrix also thinks hospitality entrepreneurs will show some interest in data analytics because it can help them to improve the performance of their hospitality enterprises. It is expected that hospitality entrepreneurs are even willing to pay a small amount of money for data analytics because of this. The analytics & benchmarks platform model is based on the following assumptions. These assumptions are added to the list of already assumptions extracted in chapter 3.

4. **Food service suppliers are willing to pay large amounts of money for hospitality market research**

5. **Hospitality entrepreneurs are interested in analysis of the data generated in their enterprises because it can help to increase the performance of those enterprises**

6. **Hospitality entrepreneurs are willing to pay a small amount of money for data analytics services**

7. **Hospitality entrepreneurs are willing to share their data on a platform so that market benchmarks and trend analyses can be created**

8. **Hospitality entrepreneurs will trust Checkmetrix to provide the technology and data analytics services**

### 4.1.2 Supply chain

Besides analysis the data collected can also be used to improve retailer's ordering cycles. By closely monitoring what products are being sold and in what quantities, an inventory management system can be created. This can be connected to supplier's systems to automatically order new products when stock goes down. Thereby the risk of running out of stock is decreased for the retailer, as well as the time needed to manage inventories. This solution is more complicated than the analytics & benchmarks use case because data needs to be near real-time, and besides connections to supplier systems incoming inventory must also be tracked.

This business case is based on the following assumptions.

9. **Hospitality entrepreneurs as well as foodservice suppliers are interested in shortened ordering cycles**

10. **Foodservice suppliers are willing to connect their existing planning systems to the Checkmetrix platform to achieve shorter ordering cycles**

11. **Hospitality entrepreneurs trust Checkmetrix to automate ordering of the entrepreneurs' inventory**

### 4.1.3 Customer interaction

The third use case is the platform open to all third parties. In this case the Checkmetrix platform can be used to power all kinds of mobile applications. This could for example be loyalty apps, allowing saving for discounts, or a bill splitting app. This solution is by far the most technologically challenging because it needs real-time data and a connection must be made between transactions and specific end-users. This solution needs real-time data because consumers who download apps that depend on POS-system data expect that data to be available in the app as soon as they make a transaction. When for example receiving a receipt, or loyalty points, on their phone the data must be immediately available. For this reason it is also needed to connect a transaction to a specific end-user. Consumers should not be able to view data of other consumers, or for example collect loyalty points that they have not really earned. This business case is based on a single assumption.

12. **Hospitality entrepreneurs are interested in offering mobile apps to improve the customer experience in their enterprises**

Because the technical difficulty of this use case is too complex too handle for the existing Checkmetrix team the decision has been made to put off developing this use case for now. Because of this it is also left out of scope for the rest of this research.

### 4.1.4 Supplier trust

All of the use cases depend on hospitality entrepreneurs as well as foodservice suppliers joining the platform. Hospitality entrepreneurs are required for providing the data, and the suppliers are needed because they are the most valuable target customers. Because of this it is essential that both parties trust Checkmetrix to provide the platform on which they can interact and share their data. The assumption that this holds true for hospitality entrepreneurs has been covered in A8 and A11. However this must also be true for suppliers. Because of this one more assumption is added.

13. **Foodservice suppliers trust Checkmetrix to provide the technology and data analytics services**

## 4.2 Legal framework

### 4.2.1 Privacy

Although the data collected by Checkmetrix is not directly related to consumers, and is therefor not personal data, it might in the future be possible (in the customer interaction use case) to relate the transactional data to customers. Because of this privacy is an important issue, and this section will briefly discuss the legal framework within which Checkmetrix operates.

According to Dutch law any data that can be reduced, or traced back to an identifiable natural person should be considered personal data (Persoonsgegevens, 2000). Any party that processes personal data must have a reasonable purpose for doing so, as well as the consent of the person whose data is being processed. This definition means that if it is possible to trace data back to an individual, as is the case when e.g. a specific transaction is combined with extra data like video or bank accounts, the transaction data can be considered personal data.

Privacy jurists that have been consulted by Checkmetrix indicate that the transaction data collected may or may not be personal data depending on the specific use case. Care must be given to dealing with the data, however as long as data is sufficiently aggregated there should be no issues. Sufficiently aggregated means that the transaction data cannot be traced back to consumers, even when extra data is added to the transaction data. E.g. If only a single transaction is made in a certain store on a certain date this must not show in any dashboard or data set as such, because combining the transaction data with a video from the store allows to trace the data to a specific person. If on the other hand hundreds of transactions are made throughout the day it will not be possible to link the data back to a specific person (as long as only aggregated data is shared, so e.g. average price per transaction). In case of any specific transaction data being used the customer's consent must be requested.

Based on the consults with legal advice the Checkmetrix team expects that no issues will arrive within the analytics and supply chain use case as long as data is treated with care, and aggregated sufficiently. Because of this an in-depth study of the privacy regulations regarding the Checkmetrix case is regarded as beyond the scope of this research. In case the customer interaction use case is developed thorough research of the legal framework is highly recommended.

### 4.2.2 Connecting to POS systems

The connection made to POS systems is non-intrusive. Connecting an extra device using existing, available interfaces on the POS systems only collects data. Secondly the POS system is owned by the bar owner. This means he is free to use it in any way he likes, and is therefor allowed to connect the Checkmetrix Printerbox.

## 4.3 Pilot platform

Based on the assumptions for each of the business cases described in section 4.1 - Possible platform models, and the guidelines developed during the literature review in chapter 2, an initial picture of the Checkmetrix platform can be formed. This section describes this first hunch of what that platform and its ecosystem should look like based on the domain knowledge presented in chapter 3 and the guidelines developed in chapter 2.

Based on the expected technical difficulty of building each of the three business cases the Checkmetrix team believes that for the development of a pilot it should focus on business case 1 (analytics & benchmarks). In a later stage business case 2 & 3 can be developed when more funds become available. The numbers Gx between brackets refer to the guidelines of chapter 2.

### 4.3.1 Vision & business model (G2)

The vision for the pilot platform is to develop the first business case. This means a platform on which data from hospitality entrepreneurs is collected, and made available for analysis by several parties. Hospitality entrepreneurs, as well as suppliers both pay for access to the platform. Foodservice suppliers will pay large sums for access to market data, whereas hospitality entrepreneurs pay a small fee for analyses of their own data.

### 4.3.2 Ecosystem (G6)

Figure 8 - Analytics platform ecosystem displays the envisioned value network of the platform. In this picture Checkmetrix is displayed in the middle, being the platform that enables interaction between the hospitality industry and suppliers. Transaction data is collected from the hospitality, and send to suppliers as market data, in return for subscription fees.

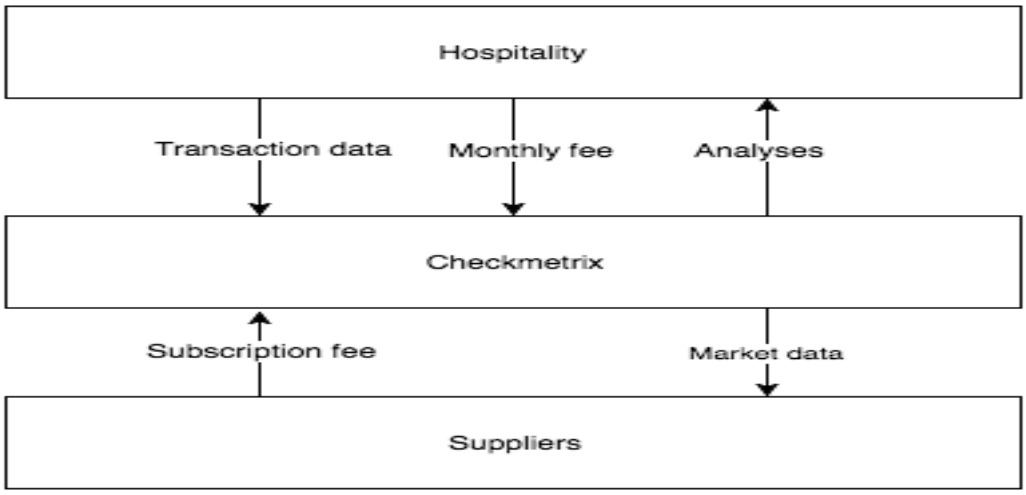


Figure 8 - Analytics platform ecosystem

### 4.3.3 Technical artifact (G3, G4, G5)

When developing this technical artifact it is especially important to pay attention to guideline 3, 4 and 5 of platform theory (platforms must be loosely coupled, standardized and evolvable). Adhering to these guidelines by creating modular application programming interfaces (API's) through which the platform partners connect will allow to easily grow the platform in a later stage, as well as extend it with business cases 2 & 3. A more thorough discussion of how these guidelines are applied is presented in chapter 6.1 - Architecture.

### 4.3.4 Roll out (G1, G7)

Based on the assumption that all parties in the foodservice industry are interested in market research (A1), that foodservice suppliers are willing to pay large amounts of money for this research (A4), and that foodservice providers trust Checkmetrix (A13) it is expected that Checkmetrix can build strong partnerships with large foodservice suppliers (G7) and use these partnerships to roll out in the hospitality industry, thereby solving the chicken and egg problem before launching the platform (G1). The chicken and egg problem can be solved this way because the power of large foodservice providers can be used to push the Checkmetrix solution onto hospitality entrepreneurs.

A possible strategy for Checkmetrix to further increase its chances of a fluent rollout, as well as a foot in the door with foodservice suppliers is a partnership with Salesforce. Salesforce is a large platform/software as a service provider that amongst other things provides customer relationship management (CRM) software, server infrastructure, and supply chain solutions. Salesforce shares the Checkmetrix platform vision and has expressed intent to partner in the development of the Checkmetrix platform. A partnership with Salesforce is expected to increase credibility of Checkmetrix amongst foodservice suppliers, as well as ease development of the platform by building on top of existing Salesforce technology.

### 4.3.5 Platform openness (G9)

In the pilot stage of development Checkmetrix must be very careful to open the platform to all kinds of complementors. To be able to create a pilot version of the platform it will probably have to dedicate all of its efforts on building a stable first version with one or two suppliers, and a selection of hospitality entrepreneurs. Until the pilot has ended successfully the platform should remain closed for other parties.

## 4.4 Non-functional requirements

Apart from the functional requirements, non-functional requirements often referred to as –ilities, play a key role in defining the platform. The non-functional requirements generally refer to the quality aspects of an artifact. The definition of quality given by the IEEE is as follows: "*Software quality is the degree to which software possesses a desired combination of attributes (e.g. reliability, interoperability*)" (Chung & Leite, 2009). The main characteristics that make up

software quality (besides functional suitability) are reliability, maintainability, usability, efficiency, security and portability (International Organization for Standardization, 2011).

### 4.4.1 Reliability

Reliability is defined as the probability of failure, the frequency of failures, or in terms of availability. Often reliability is expressed in percentages, or number of 9's (e.g. 99,9% or 99,99%). An uptime of 99% translates to an acceptable monthly downtime of 7,2 hours, and 99,9% translates to an acceptable downtime of 43,2 minutes per month (Sage, Armstrong, & Wiley, 2000).

When the Checkmetrix platform is primarily used for analytics, as is the case in this research, reliability is not very important. Although sufficient collection of data on the hospitality side is important, it is not a big problem if collection fails for a short while. The same is the case on the side of the supplier. If data, or dashboards, cannot be retrieved for short periods of time this will probably not affect any business processes. Because of this 99% availability is more than acceptable.

### 4.4.2 Maintainability

Maintainability of a system is the extent to which the architecture is maintainable after it has been built, and how much effort must be put into updating the system. A commonly accepted measurement for maintainability is the Maintainability Index that combines several code quality metrics into a single index with a scale of 0 to 100. On this scale any projects scoring below 64 are deemed to have low maintainability, anything between 65 – 84 has medium maintainability, and anything above 80 has high maintainability (Oman & Hagemeister, 1992).

Because the Checkmetrix platform is still in its pilot phase it can be expected that a lot of changes will need to be made in the near future. This means extra care should be taken in creating a maintainable system. Care should at the same time be taken to not spend too many resources on creating "the perfect system", because functionality might be change or removed completely. Therefor developers should aim to achieve medium maintainability for the pilot project.

### 4.4.3 Usability

Degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use. Usability will especially affect the users on the hospitality side of the platform. These will interact on a regular basis with the platform, whereas business users are more likely to build their own products and analytics on top of the platform. Interfaces for hospitality should be design in a simple manner, and offer easy to understand controls.

### 4.4.4 Performance efficiency

Performance efficiency is performance relative to the amount of resources used under stated conditions. Performance will be especially important once the platform starts scaling, because in that case an efficient system will help to keep hardware costs down. A pilot version of the platform will not generate amounts of traffic that require multiple, or large server configurations. Because of this performance efficiency is not an important target yet, optimizations can be done later when needed.

### 4.4.5 Compatibility

Degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment. This requirement is especially important to allow connecting different systems to the Checkmetrix platform. Compatibility is especially important in boundary resources, and is therefor reflected in guideline 8.

### 4.4.6 Portability

Degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another. Portability is not important at this stage for Checkmetrix. Because all systems are managed by

Checkmetrix, and run in a Checkmetrix environment, there is no need for much attention to portability.

### 4.4.7 Security

Security is an important concept in the non-functional requirements. The system must be protected against malicious intruders to prevent loss of data, or disturbance of system operations. Although loss or leakage data in the current settings does not include any personal data in the current situation, such an event would greatly reduce the trust from platform participants in the capabilities of Checkmetrix. Possibly even resulting in the loss of (potential) participants.

### 4.4.8 Cost

Cost is of course non-functional requirement for any design project. In case of Checkmetrix this might be even more so. Because the company has only been founded recently only a small amount of money (50.000 euro) is currently available, and the company is looking to raise another 150.000 euros during its initial round of funding in September 2016. This means that the cost for a pilot project must be well within this budget, because any overhead fees like management and marketing will also need to be paid from it, or that Checkmetrix must find partners that are willing to pay for (part) of the pilot.

# 5 Requirements & assumptions

Although Checkmetrix has been working on its product for some time it is clear from the previous chapter that the different business cases are based on a number of assumptions. To be able to design and roll out a platform that connects suppliers and retailers in the hospitality industry those assumptions must first be validated.

This chapter presents the different steps that were taken to validate the assumptions from chapter 3 and 4. To validate the assumptions interviews were conducted with retailers and suppliers from the foodservice industry. An overview of all the assumptions to be validated is presented in Table 5. Results of the hospitality interviews are presented in section 5.1 - Hospitality industry. This section also contains the elicited and prioritized requirements for the hospitality entrepreneurs. Following this section 5.2 goes into the results of the supplier research. Finally section 5.3 - Conclusion assumptions validation draws conclusions based on the supplier and hospitality research with respect to the different Checkmetrix business cases.

| No | Assumption |
|---|---|
| 1 | All parties in the foodservice industry are interested in market research |
| 2 | Market level analytics research in the foodservice market is currently not being performed because the hospitality industry is too fragmented |
| 3 | Hospitality entrepreneurs do no want to invest in a modern POS system because the cost is too high, or they invested a large sum in their current system |
| 4 | Food service suppliers are willing to pay large amounts of money for hospitality market research |
| 5 | Hospitality entrepreneurs are interested in analysis of the data generated in their enterprises because it can help to increase the performance of those enterprises |
| 6 | Hospitality entrepreneurs are willing to pay a small amount of money for data analytics services |
| 7 | Hospitality entrepreneurs are willing to aggregate their data on a platform so that market benchmarks and trend analysis can be created |
| 8 | Hospitality entrepreneurs will trust Checkmetrix to provide the technology and data analytics services |
| 9 | Hospitality entrepreneurs as well as foodservice suppliers are interested in shortened ordering cycles |
| 10 | Foodservice suppliers are willing to connect their existing planning systems to the Checkmetrix platform to achieve shorter ordering cycle |
| 11 | Hospitality entrepreneurs trust Checkmetrix to automate ordering of the entrepreneurs' inventory |
| 12 | Foodservice suppliers trust Checkmetrix to deliver valuable market research |

**Table 5 - Overview of assumptions**

## 5.1 Hospitality industry

To get a better understanding of the way bars and restaurants currently monitor performance, manage inventory, monitor trends and find out whether they are interested in a Checkmetrix-like solution at all, semi-structured interviews were conducted amongst among 8 owners of bars and restaurants. The venues owned by entrepreneurs interviewed range from single venues with an annual revenue of 150.000 euros and no employees, to over ten venues with revenues of more than five million per venue and 80 employees per venue. This means the enterprises of interviewees represent restaurants throughout the entire range of size groups of the Dutch hospitality industry (see Table 3 - Cafes & restaurants by number of employees **(Delta loyd, 2014)** in chapter 3.1.1).

The rest of this section is structured as follows. First section 5.1.1 describes the interview setup. This is followed by a discussion of the interview results in section 5.1.2, and a conclusion based on the interviews in section 5.1.3. Finally, the interviews with hospitality entrepreneurs inform the user stories, as well as requirements selection in section 5.1.5 and 5.1.6 respectively.

### 5.1.1 Interview setup

The interview consisted of 20 questions that each help in testing one or more of the assumptions for each of the three business cases. The questions, related to the assumptions they are testing are shown in Table 6. Explanation of the questions is given below the table.

| | Assumption | Question | No |
|---|---|---|---|
| Analytics & benchmarks | 2,5 | What financial data do you use to manage your company | 1 |
| | 2, 3, 5 | What insights do you get from the POS? How do you do reporting? | 2 |
| | 2, 5 | How do you monitor performance? How do you act on this? | 3 |
| | 2 | How do you recognize trends? | 4 |
| | 7 | Do you work together with your supplier or competitors (other bar owners) | 5 |
| | 1,4 | What kind of insights would you like to have / improve in your company? | 6 |
| | 3 | Do you use any administrative technology? What kind? What problems do you experience with this? What are you planning to do about this? | 7 |
| | 5, 6, 7, 8 | Would you be willing to share sales data with your suppliers to get insights into benchmarks and trends in the hospitality market, why (not)? | 8 |
| | 6, 7, 8 | Would you be willing to share anonymised sales data with your colleague hospitality entrepreneurs to get insight in your own performance compared to the rest of the market, and trends, why (not)? | 9 |
| Supply chain | 9 | How do you manage your inventory? | 10 |
| | 9 | What does your order process look like? How often do you order? | 11 |
| | 9 | What could be improved in this process? | 12 |
| | 9 | Are there any other problems you perceive in the ordering process? | 13 |
| | 6, 9, 11 | Would you be willing to share sales data with your suppliers in order to make your buying process faster and easier, why (not)? | 14 |
| | 9, 11 | Would you be prepared to share sales data with suppliers to need lower inventory, why (not)? | 15 |
| General | | Who is your beverage supplier? | 18 |
| | | Who is your food supplier? | 19 |
| | 6 | Would you be interested in doing a pilot? | 20 |

**Table 6 - Interview questions per business case & assumptions**

Questions 1 – 4 & 6 -7 each try to retrieve information regarding current analysis of data. The understanding of what hospitality entrepreneurs are currently doing with their data, and whether they are interested in further market research helps to test assumptions that there is interest in data analytics, as well as test assumptions as to why it is currently hard or not possible to perform data analytics (assumptions 1,2,3,5).

Assumptions regarding the willingness to share data and cooperate with suppliers (6,7,8, 10) are tested by questions 5, 8, 9, 14 and 15. By first asking a general question regarding the relationship between suppliers and hospitality entrepreneurs a better understanding of possible barriers for data sharing is created. Following this, questions regarding data sharing with different parties help to understand if there might be a difference in willingness to share data with different parties. The questions also help to gain insight into possible compensations that might convince hospitality entrepreneurs to share their data.

Questions 11,12 and 14 all look into the existing inventory management process to check if improvements in this process are possible, and whether there is need for this. This helps to validate assumption 9. Following this questions 15 and 5 help to further validate assumption

9, as well as assumption 11 (assumption that hospitality entrepreneurs trust Checkmetrix to automate inventory management).

To conclude question 18,19 and 20 are general questions that check whether the entrepreneurs might be interested in doing a pilot, and whether a match between suppliers / hospitality can be created if they join in a pilot. In addition to this question 20 tests the entrepreneurs' willingness to pay.

### 5.1.2 Interview analysis

The interviews lasted 30 – 50 minutes. This is a relatively small amount of time to conduct 20 interview questions, but over the course of the interviews it turned out that some of the questions were slightly overlapping. Because of this the interviews could be conducted faster. The interviews were recorded and the answers were summarized per topic for further analysis. The full interview summaries are presented in Appendix II – semi structured interview results. During analysis the interviewees will be referred to by codes I1 – I8. These codes are also displayed in the interviews' respective summaries in the Appendix.

#### 5.1.2.1 Financial and administrative data (Q1, Q7)

During the interviews it turned out that there is almost no distinction between administrative and financial data in the context of hospitality enterprises. Because of this the results of question 1 and 7 are discussed together.

All but one of the interviewees indicated the use of one or multiple tools for managing their financial and administrative data. Only I5 indicated that revenue print outs are sent straight to the accountant, with no analysis in between. All of the other interviewees use Excel for managing their data, with the exception of I2, who has a modern POS system with cloud backend. Four interviewees use Exact or Accountview in combination with Excel to do their bookkeeping.

In all cases management, or sometimes an accountant, enters the data manually. Cases I1, I3, I6 and I8 indicated to use the data extensively for managing their venues, but only in the case of I3 and I7 is the data updated on a weekly basis. All other cases indicated to update the data/reports in bulk on a monthly or quarterly basis. Of those 4 cases all interviewees said to spend on average 3-5 hours per week on collecting the data and creating management reports from it. Because of this they indicate to be interested in a solution that reduces the time they spend on data management.

#### 5.1.2.2 Point of sale system (Q2)

The interviewed entrepreneurs use a variety of POS-systems, but the most common is Eijsink (4 out of 8 cases). The smaller enterprises (<500.000 euro annual revenue) use cash registers that only allow printing of daily totals, sometimes per product group. Although these entrepreneurs are interested in a more sophisticated POS system they indicate that the investment is too high for them. From this it is concluded that assumption 3 is valid.

| No | Assumption | Result |
|---|---|---|
| 3 | Hospitality entrepreneurs do no want to invest in a modern POS system because the cost is too high, or they invested a large sum in their current system | **Validated** |

Table 7 - POS assumptions result

When entrepreneurs do have a POS-system they use it to extract sales reports containing sales data per product group or individual items, and timesheets from these systems. Because the POS-systems often lack integrations with administrative software retrieving, and making sense of the data costs 3-5 hours per week. This makes it a costly activity, because management employees or owners themself always spend this time. Only in one case did the enterprise own a cloud-based POS-system that allowed easier extraction and analysis of the data.

#### 5.1.2.3 Performance (Q3)

Enterprises with < 10 employees almost always have at least one owner available in the bar or restaurant (except for may be 1 day per week). Because of this owners feel a strong sense of control over their enterprise and its employees, because they are always there to check on them. This causes them to not feel the need to use data for optimizing performance. As enterprises grow larger they tend to show more interest in the usage of data for performance management. This is mainly because they need to check their personnel and make sure the

enterprises stay profitable. When checking on their personnel entrepreneurs especially need to make sure they do not steal, give away products for free, or work inefficiently. Smaller entrepreneurs indicate an interest in performance data when their business grows in the future.

The main indicators used for management reporting are revenue, personnel costs, and inventory costs. Entrepreneurs use these indicators to adjust their scheduling and purchasing strategies. All entrepreneurs that analyze data indicate that the most important drivers for a high profit are effective scheduling of personnel and low loss of inventory. Only cases I2, I3 and I6 indicate to set specific targets based on the data, and this is done on a yearly basis. Some of the entrepreneurs try to improve profits by trying to make their personnel work more efficiently or guiding customers to certain high margin product, but in none of the interviewee's business is this based on recent data.

| No | Assumption | Result |
|---|---|---|
| 5 | Hospitality entrepreneurs are interested in analysis of the data generated in their enterprises because it can help to increase the performance of those enterprises | **Partially validated** |

**Table 8 - Performance assumptions result**

#### 5.1.2.4 Trends (Q4)

Cases I1, I2, I5, I6, I8 indicate interest in trend watching, but do say that it does not have a large impact on their business. To them it is most important to listen to what their customers tell them and combine this with their own ideas and the specific hospitality concept they try to emit in their venues. When they are looking at trends they tend to look at some specific competition, or market leaders for inspiration. An important driver for extension of their assortment are visits by salesmen from food and beverage suppliers, but all entrepreneurs do indicate regular visits from different salesmen to be distracting. The exception is I8 who thinks it is the responsibility of the supplier to spot new trends in the market on time, and sell products accordingly.

#### 5.1.2.5 Supplier cooperation (Q5)

The interviewees indicated a variety of preferred suppliers. All entrepreneurs preferred to work with local suppliers for their food products, and Heineken was the most common supplier for beverages (5 cases). Besides this all entrepreneurs indicated the use of at least one complementary beverage supplier or wholesaler, due to the lack in specialty beverages available from Heineken.

All interviewees rated the relationship with their suppliers as positive, but did note that the larger the supplier the less room was left for negotiation and custom arrangements. An interesting point made was that only the very large enterprises (I3, I6, I8), consisting of multiple bars and restaurants made a big point out of negotiating better pricing arrangements with their suppliers. Although all parties tried to negotiate discounts the smaller entrepreneurs did not seem to bother that much.

#### 5.1.2.6 Insight wishes (Q6)

The most requested feature from entrepreneurs is not necessarily extra insight from data but connection to their existing tools (indicated by I1, I3, I6). It would be a huge timesaver (3-5 hours per week) for them if they can easily load their data into e.g. Exact or Excel and do their analysis there. When enterprises get larger they are also more interested in easier generation of management reports based on their data (I3, I6), in this case an easy to use tool as replacement for Excel would be appreciated. Connecting to for example inventory management systems, or automatic ordering is of interest to the very large enterprises (I3, I6). Interesting contrast is that the largest enterprise (I8) indicated to not trust automated inventory management due to the need for manual corrections when products break, are stolen, or go over date.

Besides integrating POS-data into existing systems entrepreneurs are mostly interested in benchmark data (I1, I4, I5, I6). Although all of them say at first they "like to do their own thing", they would like to see their performance compared to market average. I1 thought market data from a specific area might be useful when starting a new business, or rethinking her existing concept.

#### 5.1.2.7 Inventory (Q10, Q11, Q12, Q13)

Larger, beverage oriented enterprises (I3, I6) show interest in inventory management automation because it can save them time ordering products and the risk of running out of products becomes smaller. The reason only the beverage oriented enterprises are interested in automated ordering is because their products have lower risk of going over date, so can be kept in stock longer. Smaller enterprises (I4, I5, I7) either spent nearly no time ordering and keeping track of inventory, or the interviewed restaurant owners indicate they always need to customize orders depending on current conditions (weather, menu, group reservations etc.).

Going through inventory and sales is a recurring (weekly) activity for the entrepreneurs owning multiple venues (I3, I6). That way they can recognize mistakes in orders, or patterns that are out of the ordinary. This allows them to manage the local personnel by discussing the patterns and agreeing on actions that need to be taken to mitigate the identified problems. All of the interviewed entrepreneurs indicated that their suppliers make deliveries multiple times per week when this is needed, and that there is no need for increasing this.

| No | Assumption | Result |
|---|---|---|
| 9 | Hospitality entrepreneurs as well as foodservice suppliers are interested in shortened ordering cycles | **Not validated** |
| 11 | Hospitality entrepreneurs trust Checkmetrix to automate ordering of the entrepreneurs' inventory | **Partially validated** |

**Table 9 - Inventory assumptions result**

#### 5.1.2.8 Data sharing (Q8, Q9, Q14, Q15)

When it comes to sharing their data with suppliers the smaller entrepreneurs (I4, I5, I7) do not have a strong opinion on it. They are fine with sharing their data because they think their supplier has most of the data anyway. The larger enterprises (I1, I3, I6, I8), which do more with data analysis themselves, give more value to their data. They want something in return for sharing their data with suppliers. This can either be extra tooling and analysis of their own data (I3, I6), a discount from their supplier (I1), or data in return from the suppliers (I3). In all cases the interview did not leave them with enough time to put an exact price on the data.

All entrepreneurs felt a little wary of sharing their data with competitors at first. But after some thought they were all ok with sharing anonymised data. Although they see value in using market research for their own good they do not believe there is value in data of specific enterprises. Or as one of the larger restaurant entrepreneurs (I6) put it *"In this market you can know exactly what someone has in stock, and for how much and when he sells it. But that doesn't mean you can copy him and create any value from that knowledge".* It was important for all entrepreneurs to be in control over who can access their data.

### 5.1.3 Conclusion semi-structured interviews

From the interviews it can be concluded the main interest from retailers regarding Checkmetrix products is two-fold. The main problem they currently have regarding data analytics is combining their different administrative tools and performing analysis on them. Checkmetrix could add most value for them if the Printerbox / platform became a key element in integrating the different data sources, combined with easy data insights (graphs/overviews). A second option that especially the larger enterprises seem to be interested in is automatic recognition of diverging patterns in their data. This means business case number one is the most interesting to them. Checkmetrix should however look to enrich this business case with a solution to integrate different data sources besides the POS system

Regarding supplier cooperation most enterprises seem satisfied with the current state of the relationship (no need for improvement). Although some parties indicate small annoyances like for example too many visits from salesmen, and slow responses from the large suppliers (due to being a small party doing business with a large corporation), this does not consider them to use different suppliers at all. They do generally understand the value of their data for the larger suppliers and hence expect some remuneration (in the form of data, discounts or plain money) in return for the data.

Another takeaway is to make a strong distinction between small (<10 employees) and larger enterprises (>10 employees). Owners of the smaller venues do not currently use data for managing their enterprises at all because they think they can easily manage their enterprise by being on premise most of the time. This makes it hard to interest them in the Checkmetrix

solution without offering discounts or money in return. Owners of larger venues on the other hand are easier to interest in extra insights.

The answers on the topics of trends (section 5.1.2.4) and data sharing (section 5.1.2.8) indicate there is some interest in trend analysis and benchmarking, and that hospitality entrepreneurs are willing to share their data for the right incentive. Because the specific incentive remains unknown assumption 7 is considered partially validated.

| No | Assumption | Result |
|---|---|---|
| 7 | Hospitality entrepreneurs are willing to aggregate their data on a platform so that market benchmarks and trend analysis can be created | **Partially validated** |

**Table 10 - Data sharing assumptions result**

As a general question all of the hospitality entrepreneurs were asked their interest in doing a pilot with Checkmetrix. I1, I3, I4, I5 and I6 indicated they would be willing to do a pilot because of interest in (part of) the Checkmetrix solution. Because of this assumption 8 can be validated because if interested parties do not trust Checkmetrix they would not join in a pilot.

| No | Assumption | Result |
|---|---|---|
| 8 | Hospitality entrepreneurs will trust Checkmetrix to provide the technology and data analytics services | **Validated** |

**Table 11 - Data sharing assumptions result 2**

### 5.1.4 User types

Based on the interviews with hospitality entrepreneurs three archetypes were identified. These are "the serial entrepreneur", managing multiple venues, "the professional" who manages a large venue and has a background in hospitality, and the "fortune-hunter" who runs a smaller venue and likes it that way (traditional fortune hunter). From the interviews it is concluded that user type 3 – the fortune hunter will probably be least interested in the platform because they can benefit the least. This is once again confirmed after more thorough analysis of the requirements using user stories (see next paragraph). Because of this this section will mainly focus on requirements of user type 1 and 2.

### 5.1.5 User stories

Based on the interviews with hospitality owners an initial set of user stories was developed for each of the personas. User stories describe functionality that will be valuable to a user of the system. It is a written description of the story in the following format. As a <type of user> I want <some goal> so that <some reason>. This structure helps to really flesh out the requirement and create a better understanding of the user (Cohn, 2004).

Besides this user stories are categorized as functional requirements, user requirements, or contextual requirements. Functional requirements indicate the functions that the artifact should fulfill once it has been developed. User requirements describe the interface between the designed artifact and the user, and contextual requirements are the prerequisites set by the political, economical, juridical and or social environment (Verschuren & Hartog, 2005).

To give some priority to the different requirements a simplified version of the MoSCoW methodology is used. Where the MoSCoW method distinguishes between must-have, should-have, would-have and won't have requirements this research only distinguishes between must-haves and nice-to-haves. This is done to create an understanding of what functionalities are absolutely necessary in the platform and which ones can be added in a later stage, while still allowing for a clear presentation of the requirements (Tierstein, 1997).

The full overview of all user stories per user type is presented in appendix V - User stories.

### 5.1.6 Requirements selection

The specified set of requirements defined for each of the user types is too broad to implement completely for a first pilot of the Checkmetrix platform. Because of this a selection of the requirements must be made. In order to do so several brainstorm sessions have been held with Checkmetrix team members (development/business). In these sessions the main trade-off to be made was between building a product that is attractive enough to a sufficiently large group of hospitality entrepreneurs, whilst still being within the technological capabilities and resources of the current Checkmetrix team.

The main conclusion that can be drawn from the discussions is that the focus should first be on creating sales reporting dashboards and analytics, because this can be done without adding any extra data sources. Besides this the most important goal from a business point of view is to make the application just attractive enough to gain sufficient penetration in the hospitality market, to sell the data on the supplier side. An overview of the selected requirements is presented in Table 12. The main requirement, getting an overview of all the sales is presented as requirement 1 in Table 12.

From the interviews it was concluded that hospitality entrepreneurs think the dashboards can especially provide value to their business if they help to identify patterns that are out of the ordinary. Because of this requirement 2 is added as a must-have.

Requirement 3 adding extra data is added as a nice-to-have because this is the most requested functionality from hospitality managers. Because of this Checkmetrix should strive to add this functionality, but the effort for a first pilot application might be too high.

Requirement 4, real-time insights is added as a nice-to-have because this allows hospitality managers to act on the data much faster, something that is important because profit increase can be achieved by quickly responding to changes in e.g. personnel need. Real-time insights do mean much higher quality guarantees and availability, so this might once again be too much of an effort for Checkmetrix for a pilot.

Requirements 5, 6 and 7 are added because they describe the usability level of the analytics interface. There is a difference in the preferred level of control between user type 1 and user type 2 (user type 1 want more control over creating dashboards), but to keep complexity low for Checkmetrix the fixed dashboard will be developed first. More advanced creation of dashboards are added as a nice to have in requirement 9.

To manage a larger chain of bars and/or restaurants it must be possible to get an overview of multiple venues in the same dashboard. This might not necessarily happen in a pilot version of the Checkmetrix platform, and because of this requirement 8 is added as a nice-to-have.

The team at Checkmetrix thinks that the platform can be especially beneficial when taking into account the rest of the market. By for example checking a restaurants performance against the rest of the market at specific times a restaurant owner can know if he might need to do marketing actions because he is not doings so well as the rest of the market on certain days. During the interviews hospitality entrepreneurs did however indicate less interest in this functionality. Because of this requirement 10 is added as a nice-to-have.

| | **Must-haves** | **Nice-to-haves** |
|---|---|---|
| | | |
| **Functional** | 1. I need to get an overview of all the sales in my venues, so that I can check inventory levels<br>2. I want the dashboards to compare current numbers with averages, so that I can check for diverging patterns | 3. I want to add extra data (e.g. schedules, purchasing data) to the Checkmetrix dashboards, so that I can make more elaborate analyses<br>4. I want real-time insights, so that I can immediately respond when something goes wrong in one of my bars or restaurants. |
| **User** | 5. I need the dashboards to give me a simple overview of my sales, so that I can check the performance of the restaurant<br>6. I need the dashboards to give me a weekly overview of sales, so that I can use this to adjust my ordering and plan my personnel<br>7. I need fixed dashboards, so that I don't need to spend any time setting up analytics | 8. I want to be able to aggregate the results of different restaurants so that I can see how my company as a whole is doing<br>9. I need to be able to create my own dashboards, so that I can analyze the data according to my own needs |
| **Context** | | 10. I want to know how I'm doing compared to neighboring restaurants at specific times, so that I can adjust my marketing and personnel to this |

**Table 12 - Requirements Checkmetrix platform**

## 5.2 Suppliers

From the interviews with hospitality entrepreneurs it becomes clear that hospitality enterprises use a variety of suppliers. For food they often work with local suppliers and beverages are supplied either by wholesalers, or brewers directly. Although all suppliers could be interesting parties for joining the Checkmetrix platform, Checkmetrix is initially interested in larger suppliers. This is because these suppliers are expected to have a higher interest in market data analytics, because they are expected to have more funds available, and could possibly use their power as large supplier to speed up roll out of the Checkmetrix solution. Working with a few large suppliers in the early stage also allows for more customized, yet sustainable business, because specific requirements can be taken into account more easily. Because of this the analysis of suppliers will focus on beverage wholesalers and producers.

### 5.2.1 Supplier research setup

During this stage of the research five meetings were held with representatives of FMCG companies, wholesalers and large brewers. The main purpose of the meetings was to try to set up a pilot with the supplier companies. Besides this the meetings were used to extract information regarding the corporations' requirements of a data analytics product, and possible barriers for cooperation between Checkmetrix and the supplier companies. The companies included are Heineken, AB-InBev, Vrumona, Pesico and Friesland Campina. The reason for this is that these were the large parties that were immediately interested in the Checkmetrix product, and followed up by setting up a meeting. Summaries of the interviews are presented in I – Summaries supplier meetings.

It should be noted that although the researcher was present at all meetings the main purpose was of the meetings was securing business with the suppliers, meaning that it was not always possible to completely go into specific reasons or statements made. The exception to this is the meeting with a representative of Vrumona. Here a semi-structured interview was conducted (questions are presented in Appendix III – Questions supplier research).

### 5.2.2 Results

Depending on the company interviewed the main goals differ slightly, but all companies especially want more market insights in some way or another. In general it can be concluded that the closer a company is to the consumer, the more market insights are available. This means wholesalers, or companies that have their own in-house wholesale services (like Heineken and AB-InBev) have more insight into the market than companies that only deliver their goods through wholesalers (Vrumona, PepsiCo, Friesland Campina). But even companies that have their in-house wholesalers deliver a large part of their goods through other wholesalers (like Sligro, Makro or Hanos) meaning they still have a very limited view of the total market, because a large part of their goods is delivered through different wholesalers.

All companies indicated an interest in more specific market data (e.g. product level market shares, sold product combinations) than what they currently have. According to representatives from Heineken and PepsiCo market data is the main input for developing new marketing strategies and empowering sales and account managers to better target customers. Because of this the quality of the market data should be improved. Although no specifics were negotiated all parties indicated they would be fine with paying between 100 - 500 euros per connected enterprise for a half-year pilot.

Based on the supplier meetings four barriers that need to be overcome before any of the suppliers consider making investments into a Checkmetrix like solution have been identified. These barriers are labeled as competition, size, provided data and privacy. What these barriers entail is discussed in the following sections.

#### 5.2.2.1 Competition

Both of the interviewed large brewers, AB InBev and Heineken indicated some competitive issues when it comes to rolling out the Checkmetrix Printerbox. AB InBev especially sees it as a risk that Checkmetrix tries to leverage them in securing a better position in negotiations with Heineken. To mitigate this risk they might want an exclusive contract before joining in a pilot with Checkmetrix.

For Heineken mitigation of legal competition issues is especially important. Because their market share is currently more than 30% they are already limited in the way they can

secure contracts with hospitality enterprises and this might also impact their negotiation power when possibly helping with the roll out of the Checkmetrix system. Because of this they would prefer Checkmetrix to take full responsibility of collecting and setting up all enterprises for a pilot.

#### 5.2.2.2 Size

The main issue for the FMCG companies, PepsiCo, Vrumona and Friesland Campina is the size of the solution. For data analytics to be useful a large enough part of the market must be captured. Even though complete insight in the market is not necessary from the start, enough data must be captured to make sure analyses are representative of the market. Heineken and AB-InBev indicated more interest in being part of the Checkmetrix solution from the beginning, when the retailer density is still low. This was not the case for the FMCG companies; they would only be interested in the solution when larger parts of the market (>30%) are being captured by the system. It was indicated by Pesico that if very valuable analytics can be provided through the Checkmetrix system, that are immediately useful for their account managers, it might be possible to combine sales efforts of Checkmetrix and PepsiCo to increase the Checkmetrix Printerbox density. However, it remained unclear what this meant specifically.

#### 5.2.2.3 Provided data

Although the data provided by Checkmetrix can provide very rich data (product level for all products sold in a hospitality enterprise) regarding sales and market share it was indicated by some companies that this might not be enough. Especially AB InBev is also looking at alternatives like Weissbeerger that offer even deeper insights by installing all kinds of sensors in bars (e.g. measuring temperature and pressure on beer taps). The main trade-off made by AB-InBev in this case is the higher price of these kinds of systems versus the low cost of the Checkmetrix solution.

#### 5.2.2.4 Privacy

An important issue for all parties that must be settled before taking part in any data solution is protection of consumer privacy. All companies have large brands to protect and this means that no mistakes can be made when it comes to living up to privacy regulations. This especially causes them to be a little more hesitant towards any customer facing (business case 3) initiatives because these require the processing of personal data.

### 5.2.3 Supplier conclusion

All interviewed suppliers indicated they are interested in higher quality market research but are currently not able to collect sufficient, and sufficiently precise data because they have no connection to the consumer, and the enterprises selling their products. Suppliers also indicated willingness to pay large amounts of money (100-500 per venue for a half year pilot) in case the data analytics business case meets their requirements Because of this assumption 2 and 4 can be validated. Assumption 1 is partially validated because not all foodservice suppliers were interviewed.

| No | Assumption | Result |
|---|---|---|
| 1 | All parties in the foodservice industry are interested in market research | **Partially Validated** |
| 2 | Market level analytics research in the foodservice market is currently not being performed because the hospitality industry is too fragmented | **Validated** |
| 4 | Food service suppliers are willing to pay large amounts of money for hospitality market research | **Validated** |

Table 13 - Supplier assumptions result

Currently all of the foodservice suppliers see several barriers that must be overcome before they would consider doing a pilot with Checkmetrix. This assumption is partially invalidated because although foodservice suppliers indicated no trust in Checkmetrix at this moment; they remain interested in a more mature solution.

| No | Assumption | Result |
|---|---|---|
| 13 | Foodservice suppliers trust Checkmetrix to deliver valuable market research | **Partially invalidated** |

Table 14 - Supplier assumptions result 2

## 5.3 Conclusion assumptions validation

The analysis in the previous paragraphs goes into the assumptions underlying the different Checkmetrix business cases. The purpose of this was to validate the assumptions. An overview of all the assumptions and the validation results is presented in Table 15 - Overview validation results.

| No | Assumption | Result |
|---|---|---|
| 1 | All parties in the foodservice industry are interested in market research | **Partially Validated** |
| 2 | Market level analytics research in the foodservice market is currently not being performed because the hospitality industry is too fragmented | **Validated** |
| 3 | Hospitality entrepreneurs do no want to invest in a modern POS system because the cost is too high, or they invested a large sum in their current system | **Validated** |
| 4 | Food service suppliers are willing to pay large amounts of money for hospitality market research | **Validated** |
| 5 | Hospitality entrepreneurs are interested in analysis of the data generated in their enterprises because it can help to increase the performance of those enterprises | **Partially validated** |
| 6 | Hospitality entrepreneurs are willing to pay a small amount of money for data analytics services | **Partially validated** |
| 7 | Hospitality entrepreneurs are willing to aggregate their data on a platform so that market benchmarks and trend analysis can be created | **Partially validated** |
| 8 | Hospitality entrepreneurs will trust Checkmetrix to provide the technology and data analytics services | **Validated** |
| 9 | Hospitality entrepreneurs as well as foodservice suppliers are interested in shortened ordering cycles | **Not validated** |
| 10 | Foodservice suppliers are willing to connect their existing planning systems to the Checkmetrix platform to achieve shorter ordering cycle | **Partially invalidated** |
| 11 | Hospitality entrepreneurs trust Checkmetrix to automate ordering of the entrepreneurs' inventory | **Partially validated** |
| 12 | Foodservice suppliers trust Checkmetrix to deliver valuable market research | **Partially invalidated** |

**Table 15 - Overview validation results**

Besides validating the assumptions underlying the three Checkmetrix business cases the information extracted in this chapter can also be used to answer two of the research questions.

*What are barriers for cooperation between stakeholders?*

- Hospitality owners understand the value of their data to suppliers; they must therefor be incentivized to share their data. The interviews conducted amongst hospitality entrepreneurs did not extract conclusive information on how large the incentive must be.
- Large suppliers (Heineken, AB InBev) might be limited in the types of cooperation they participate in due to competition issues.
- Strong competition between large brewers inhibits willingness to cooperate. When a large investment is to be made by one of the main brewers they might want exclusivity.
- Foodservice suppliers do not currently deliver Checkmetrix to deliver valuable market data, because the platform is still too early stage

*What are the conditions under which stakeholders from all sides join the platform?*

- All sides must benefit from the platform. For suppliers the benefit is market insights. Benefit for hospitality retailers will most likely be one of the following items; Integration of existing administrative tools, easy generation of insights, monetary incentive.
- Analytics generated on the platform must be of a representative sample of the market. Foodservice providers are not willing to join the platform until it has matured more.
- Hospitality owners must to be in control of who gets access to their data.

- Privacy issues must be solved before participation in any interactive applications can take place.

### 5.3.1 Practical implications

In section 4.3 - Pilot platform, the idea was presented that Checkmetrix could solve the chicken and egg problem before launching the platform (G1) by building strong partnerships with foodservice providers (G7). Because the assumption that foodservice suppliers trust Checkmetrix to deliver valuable market research (A13) has been invalidated at least for the time being, this strategy is no longer applicable.

Suppliers did indicate that even though they do not currently trust Checkmetrix enough to invest in the platform right now, they did indicate interest in the platform once it matures. More specifically they indicated that they would be interested in the solution if it were rolled out in multiple venues, and multiple cities. This means Checkmetrix will need to change its strategy from partnering with large suppliers to getting hospitality entrepreneurs on board first.

Because a lack of strong partners means that the funds available for roll out will be limited to Checkmetrix (no clients paying large amounts of money) this means it will need to create a product that is attractive enough to hospitality entrepreneurs so that they will allow sharing of the data without any monetary remuneration.

The initial interviews showed that at least a selection of entrepreneurs (5 out of 10) is interested in data analytics solutions. However assumptions relating to the interest in data analytics (A5), data sharing (A7) and possible remuneration (A6,) of hospitality entrepreneurs could only be partially validated.

The above has an implication for Checkmetrix' strategy. First of all Checkmetrix should focus on validating that it can create a solution that attracts sufficient hospitality entrepreneurs to become interesting to foodservice suppliers. Once it is validated that Checkmetrix can create a valuable product for the hospitality industry it can start implementation of its artifact. Once sufficient hospitality enterprises are connected, the company can once again try to attract customers from the foodservice industry. This means that for the remainder of this study the focus will be on creating a platform that creates value for the hospitality industry, and does not (yet) incorporate suppliers from the foodservice industry.

# 6 Structural specification

When following a typical design cycle the step following requirements analysis is that of structural specifications. In this stage the characteristics and aspects of the artifact to be designed are derived from the requirements. The structural specifications form the basis for realization of the artifact (usually in the form of a prototype). An important distinction to be made is that between a general and detailed design. The decisions made for a general design are usually of strategic nature and impact the remainder of the designing process for all subsystems. A detailed design on the other hand is more tactical and only impacts the specific subsystem that is specified in the respective design (Verschuren & Hartog, 2005).

In case of Checkmetrix it is not yet certain whether Checkmetrix will be able to develop a product that allows them to roll out their solution to sufficient hospitality enterprises, and thereby attract suppliers as well. Besides this the current maturity of the company means that proper analysis of the suppliers' requirements could not be fulfilled. This means that this section will mainly focus on designing a product that will help Checkmetrix in achieving large enough coverage of hospitality enterprises. However, as stated by Verschuren & Hartog, (2005) the general design decisions made in the structural specifications stage do impact the entire artifact, and the right balance must be found between the different infrastructural circumstances, desires of stakeholders and costs. Because of this the chapter will also include a general design of the Checkmetrix platform. This will help to give an indication of whether or not the Checkmetrix platform is technically feasible at all (in the case that sufficient hospitality coverage can be achieved).

The technical specifications of the artifact are especially impacted by guidelines G3, G4 and G5 from section 2.3 - Digital perspective. These guidelines are especially important because applying them correctly should lead to the creation of a platform that is extensible in the long run and that fosters unforeseen innovations. They also allow designing a first version of the platform when the final product is not yet completely known.

The rest of this chapter is structured as follows. Section 6.1 - Architecture gives an overview of the envisioned platform architecture. Following this section 6.2 - Retailer dashboard mockups presents the detailed design of the artifact that can be presented to the hospitality entrepreneurs. To conclude section 6.3 - Design motivation shows how the design fulfills the elicited requirements from the previous chapter.

## 6.1 Architecture

A key element for a generative and evolvable platform (G5) is decomposition of the platform into different modules, which help to reduce complexity and increase flexibility. To keep the modules manageable they must in turn be loosely coupled through standardized interfaces (G3). Figure 6 displays the different modules of the Checkmetrix platform and how they interact.

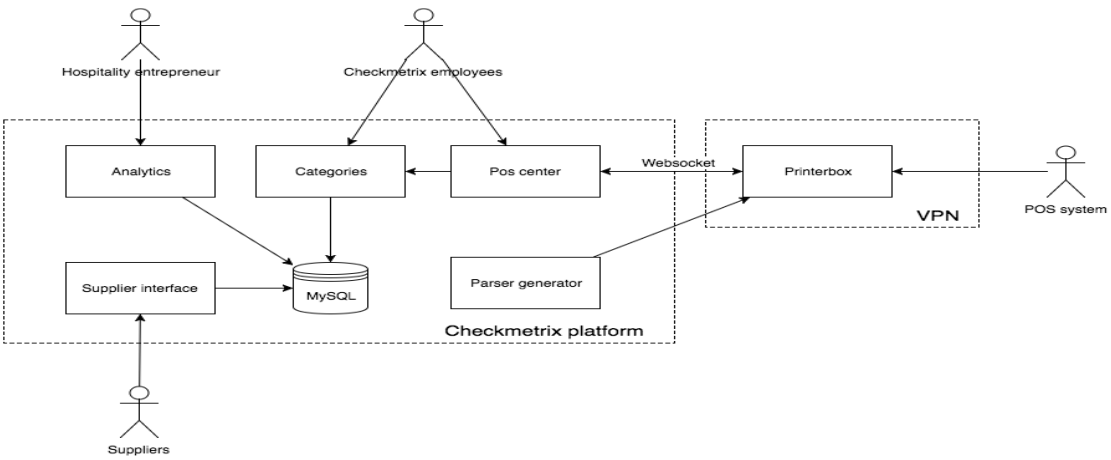



Figure 9 - architecture overview

All Printerboxes are part of a VPN network. On startup they automatically connect to this VPN network, as well as the Checkmetrix POS center. This setup allows remote management of the Printerboxes, even when these are behind routers and firewalls (these usually allow outbound traffic, so the Printerbox can setup connections, and as long as the Printerbox initiates the connection the connection can then be maintained). The Printerbox uses a parser to translate data from the POS system to JSON format, so it can be send to the platform backend. Parsers are specific for each hospitality enterprise and are created on the parser generator module, after which they are uploaded to the Printerbox.

The POS center is responsible for managing all Printerbox connections as well as the merchant to which they belong. When a Printerbox picks up a new consumption it sends this to the POS center where a web socket server receives it. After performing authentication and linking the consumption to a specific venue it is handed off to the categories module. On receiving a new consumption the categories web service stores the consumption in the database, and tries to automatically normalize it. This is needed for further analysis, because different bars and restaurant might refer to the same type of product in different ways. If a consumption cannot be immediately categorized it is displayed in the categories web interface where categorization can be done manually.

Hospitality entrepreneurs can log into the analytics module where they can display charts and tables based on the data collected from their enterprises. Suppliers will interact with the Checkmetrix system through the supplier interface. This module will take care of controlling what data they will be able to view and how they receive it. This interface will probably be REST API because this allows them to integrate the data in their existing systems and thereby build new innovations on top of the platform. However, as G8 from section 2.4.2 - Boundary resources states, boundary resources should be created in close cooperation with the partners that will be using them. Because of this design of the actual interface will be postponed until suppliers show more interest in the platform, and their preferences can be researched more thoroughly. Table 16 - Platform modules gives an overview of the different modules, their status and who developed the respective module.

| Module | Description | Status | Built by |
|---|---|---|---|
| Printerbox | Interface to the POS system | Operational | Tabster |
| Parser generator | Generates parsers used by the Printerbox | Operational | Tabster |
| POS center | Manages message passing between platform and Printerboxes | Operational | Researcher |
| Categories | Stores and categorizes consumptions received from the pos center | Operational | Researcher & CM Developer |
| Analytics | Displays charts and tables based on hospitality data | To be built | Researcher |
| Supplier interface | Manages interaction between suppliers and Checkmetrix platform | Postponed | N/A |

**Table 16 - Platform modules**

### 6.1.1 Meta framework

A more in depth discussion of the architecture is presented using the Meta framework by (Janssen, 2009). The framework is a useful guide for discussing the platform architecture because its division of a system in different layers and subsystems, whilst also keeping track of the relations between them helps to get a comprehensive, and coherent overview of the entire system. The different layers of the Meta framework are depicted in Figure 10 - Meta framework by **Janssen, (2009)**.

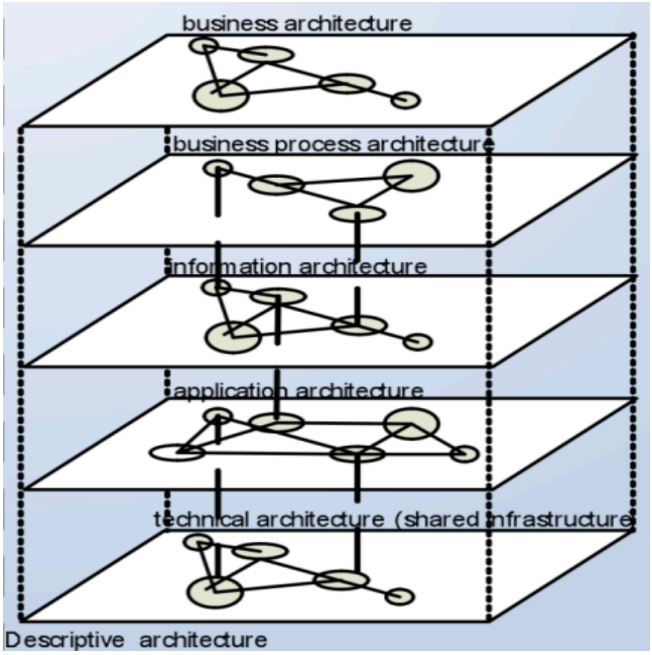


**Figure 10 - Meta framework by** Janssen, (2009)

Although the meta-framework contains other elements, like a program of business requirements and architectural governance, these have been kept out for the sake of brevity. These elements are in one way or another discussed in different parts of this thesis (e.g. section 5.1.6 - Requirements selection). This chapter focuses especially on the structure of the platform. In all but one cases the presented architecture is descriptive of the current situation. The exception is the analytics module, which is yet to be built.

### 6.1.2 Business architecture

The business architecture of the platform display the different stakeholders involved. The stakeholders and their relations are depicted using a value network in Figure 11 – Value network. As can be seen from the picture hospitality entrepreneurs will give Checkmetrix their transaction data and a monthly fee in return for analyses of their data.

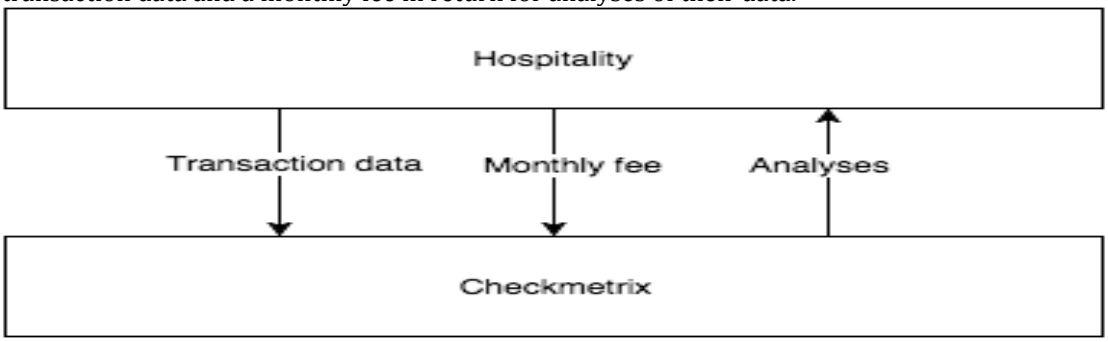


**Figure 11 – Value network**

### 6.1.3 Business process architecture

Figure 12 - Sign up process on the next page displays the single main business process that is relevant to Checkmetrix in its current form. After signing a contract with hospitality entrepreneurs for delivering analytics services, Checkmetrix will have to send an engineer to the hospitality entrepreneur to install a Printerbox. Once the Printerbox has been installed data can be captured, and insights can be (automatically) generated, which can in turn be viewed by the entrepreneur.

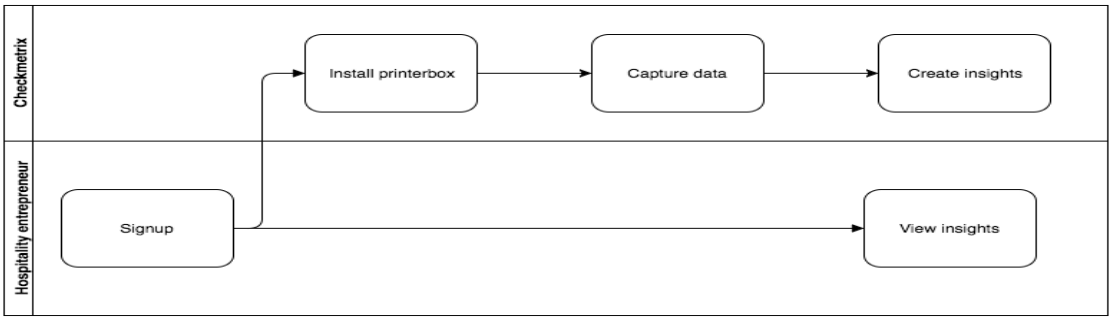



Figure 12 - Sign up process

### 6.1.4 Information architecture

Although the different modules in the platform all perform different functions this functionality is always based on the same data. An overview of the information architecture is presented using an entity relationship diagram in Figure 13 - Entity relationship diagram. The Printerbox receives data from the POS system when a transaction is executed, or in other words a receipt is created. The main information on receipts is consumptions, and they are stored as such in the database. A relation with the receipt is retained so that analysis regarding product combinations can be performed, and extra information (e.g. employee name, or table number) regarding the transaction can be stored with the receipt. Through a many-to-many relationship consumptions are linked to a specific, standardized product, and possibly different tags as well. Tagging consumptions allows adding extra information before analysis, like for example high/low margin, or product category (e.g. food, non-food, alcoholic etc.).

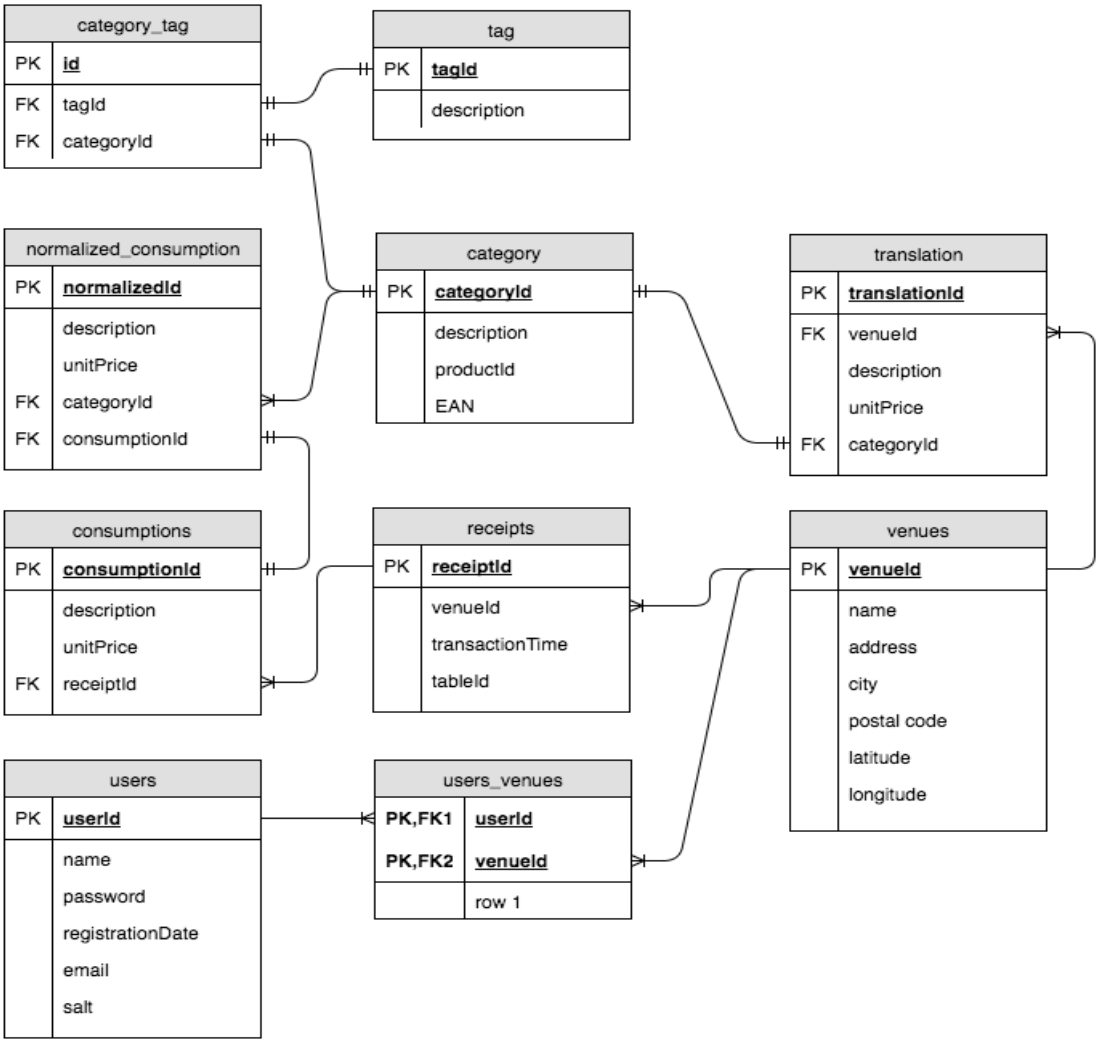



Figure 13 - Entity relationship diagram

### 6.1.5 Application architecture

This section describes the architecture for the different modules in the Checkmetrix platform. In case of the categories module and pos center this architecture is descriptive, as these modules have been built over the course of this research, by the researcher and CM developers. In case of the analytics module the architecture is prescriptive, as development of this module has yet to start. The Printerbox and parser generator are left out of scope because they were developed by a different company and bought by Checkmetrix. Also, they simply deliver input for the Checkmetrix platform, but do not directly influence the interactions of hospitality entrepreneurs and suppliers with the Checkmetrix platform.

#### 6.1.5.1 Pos center

The pos center module is a watered down version of the POS center as used by Tabster. It is based on the popular Python web framework Tornado ("Tornado Web Server — Tornado 4.3 documentation," n.d.). The use of an asynchronous framework, combined with bidirectional communication over web sockets should allow the pos center to easily manage communication with hundreds of Printerboxes at the same time. Although the current version of the Checkmetrix pos center only allows receiving of consumptions from the Printerbox, the choice for using a bidirectional protocol was made to support the (future) business case of customer interaction (section 4.1.3). In this case it will be necessary to send data back to the Printerbox and/or POS center, and building this functionality will be less costly if the underlying architecture remains the same.

#### 6.1.5.2 Categories module

The categories module is also based on the python Tornado web framework to ease development. In this case its asynchronous capabilities are not used, and the application is based on the Model View Controller (MVC) pattern. This architectural pattern is especially useful when designing interactive applications (Leff & Rayfield, 2001). An overview of the main models, views and controllers is depicted in Figure 14 - Categories module architecture. Although the researcher of this thesis was involved in the design of the categories module, most of the implementation was performed by one of the Checkmetrix developers.

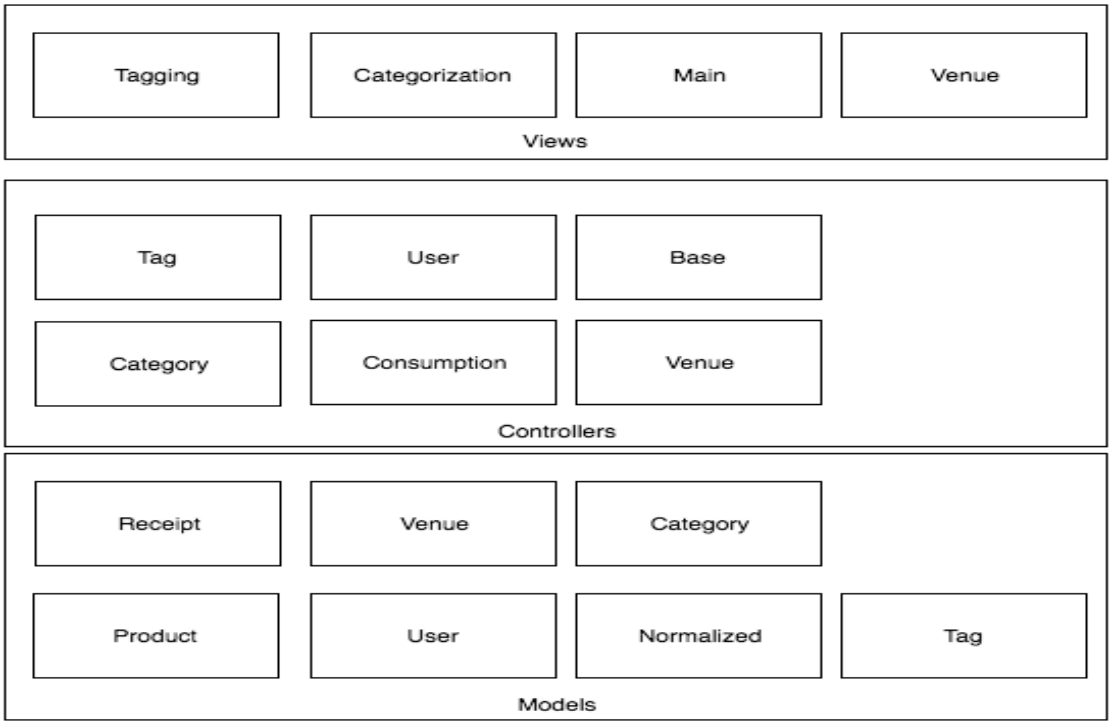



**Figure 14 - Categories module architecture**

#### 6.1.5.3 Analytics module

This section describes the prescriptive architecture of the analytics module. This module will, like the categories module, be based on the Tornado web framework and employ

the MVC pattern for its basic architecture. The MVC pattern is especially useful for the analytics module because there will be a lot of interaction with hospitality entrepreneurs. Besides this many different charts (views) will have to be displayed on top of the same data (model). Employing the MVC pattern will help to clearly separate the different layers, which will in turn be helpful to adding new charts without need for adjustment in the data layer. To ease building of (interactive) charts for the web browser either the Javascript library GoogleChart or Highcharts will be used (depending on funds available). The different models, views and controllers are depicted in Figure 15 - MVC elements of analytics module.

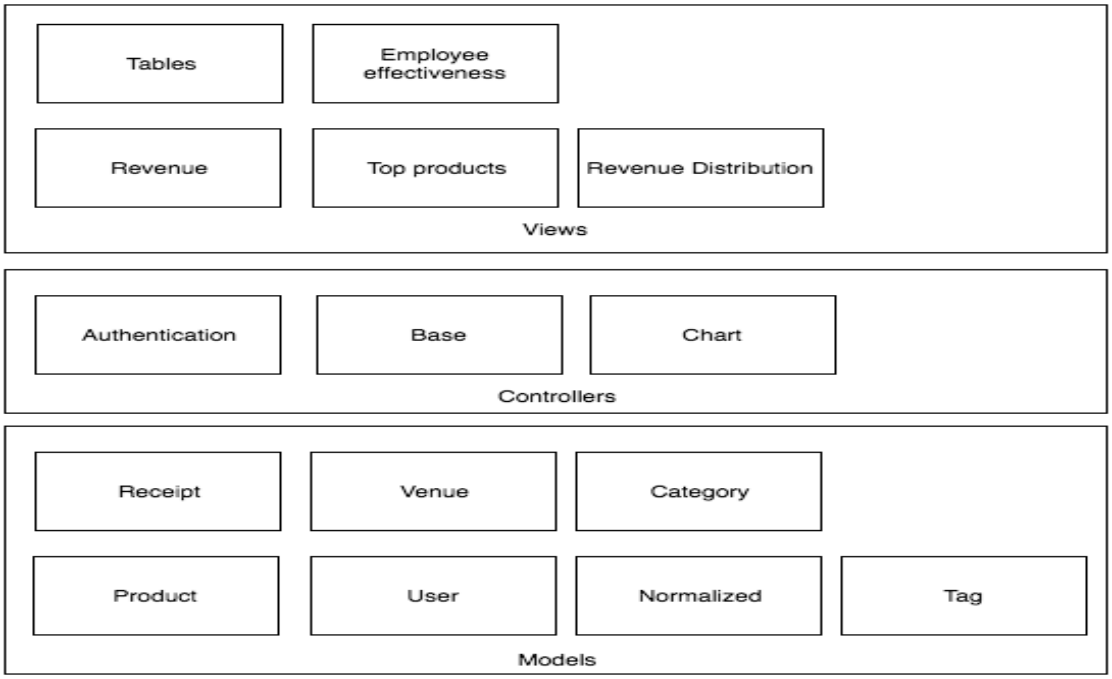



Figure 15 - MVC elements of analytics module

### 6.1.6 Technical architecture (shared infrastructure)

The Checkmetrix applications are all built using Python 2.7 and run on elastic compute instances from Amazon Web Services (AWS). Configuration management of these instances is done using Ansible configuration management scripts ("Ansible Documentation — Ansible Documentation," n.d.). The different environments (staging, production) are managed using a Jenkins orchestration server ("Jenkins," n.d.). All log data is collected centrally using Loggly log management ("Log Management | Cloud Log Management Service | Loggly," n.d.). Data is stored on a managed MySQL server (AWS Relational Database Service (RDS). Using this combination of tools allows easy deployment and testing of the modules on different environments with the purpose of increasing code quality, and preventing user-facing errors. Figure 16 - infrastructure overview shows an overview of the different parts of the infrastructure and their interaction.

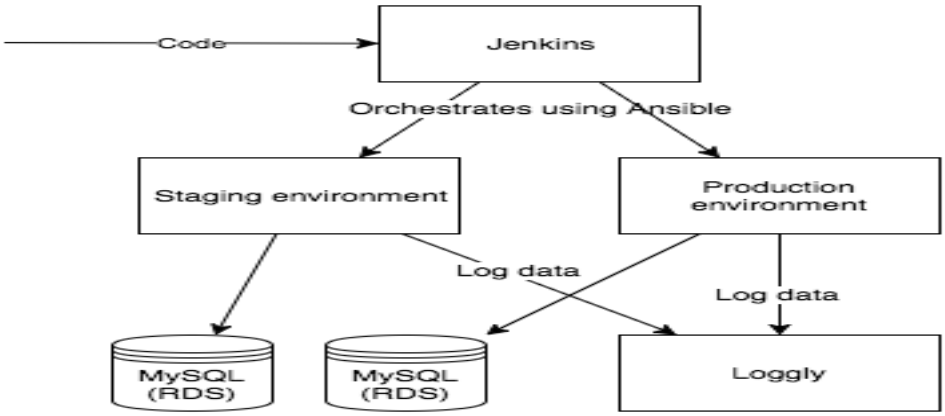



Figure 16 - infrastructure overview

## 6.2 Retailer dashboard mockups

To test whether retailers can be interested in the Checkmetrix platform mock-ups of possible graphs were created. Mock-ups are a quick and easy way to create a reflection of what the actual Checkmetrix product might look like. The mock-ups are actual graphs made from a test data set. This data is partial data from a collection of actual bars and restaurants that has been anonymised and collected after the bar owners gave their consent. Each of the different dashboards is discussed below. An overview of how the dashboards relate to the requirements elicited is presented in section 6.3.

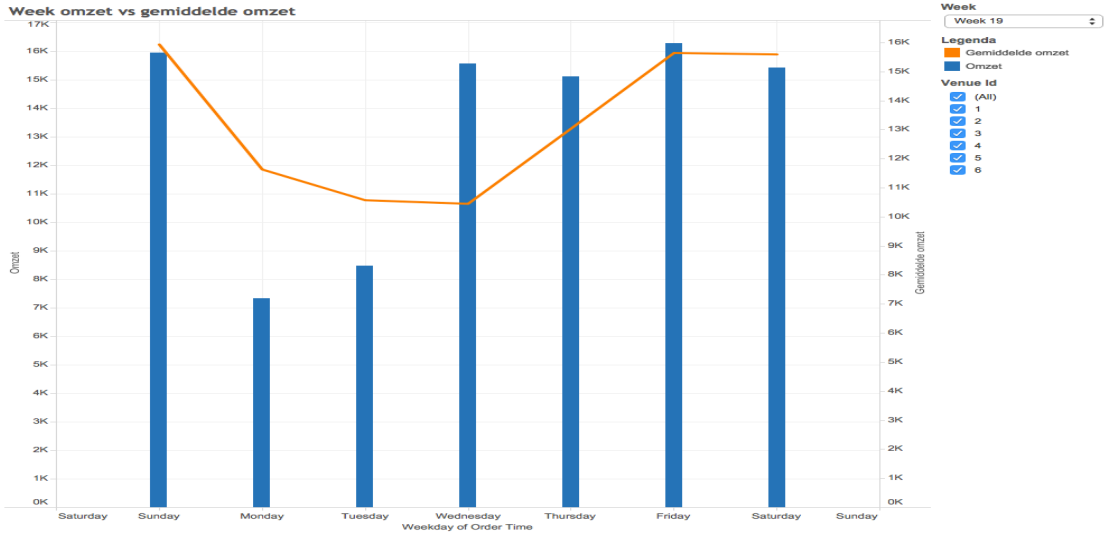



Figure 17 – Dashboard 1: Weekly revenue vs. average revenue

Figure 8 shows a venue's revenue for every day throughout the week. To easily identify diverging patterns the average revenue for the venue is shown in the same chart. Controls for the chart are shown on the right. The controls allow to select different weeks or change which venues are selected (in case the entrepreneur has access to multiple venues). This allows viewing the aggregate revenue for an enterprise consisting of multiple venues.

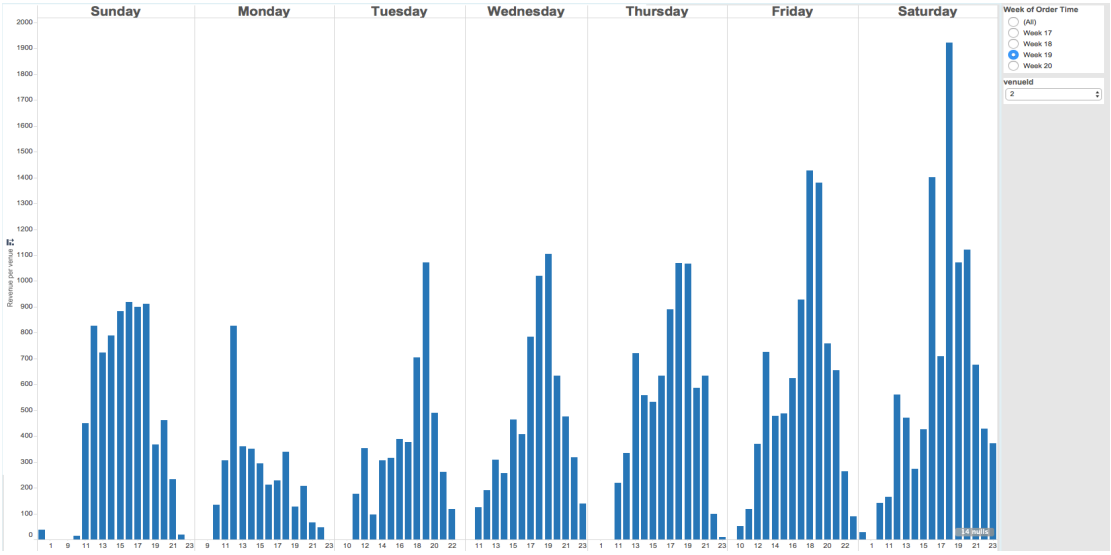



Figure 18 – Dashboard 2: Revenue per hour

Because hospitality entrepreneurs indicated that personnel cost, as a percentage of their revenue is an important target for them, requirement 6 states that the dashboards should show revenue per hour. Figure 18 – Dashboard 2: Revenue per hour shows dashboard 2, which shows the revenue per hour throughout the week. Presenting the revenue per hour lets hospitality entrepreneurs compare the revenue with employee schedules. Controls on the right of the chart

allow entrepreneurs to change the selection of the week, and if possible change the venue being viewed.

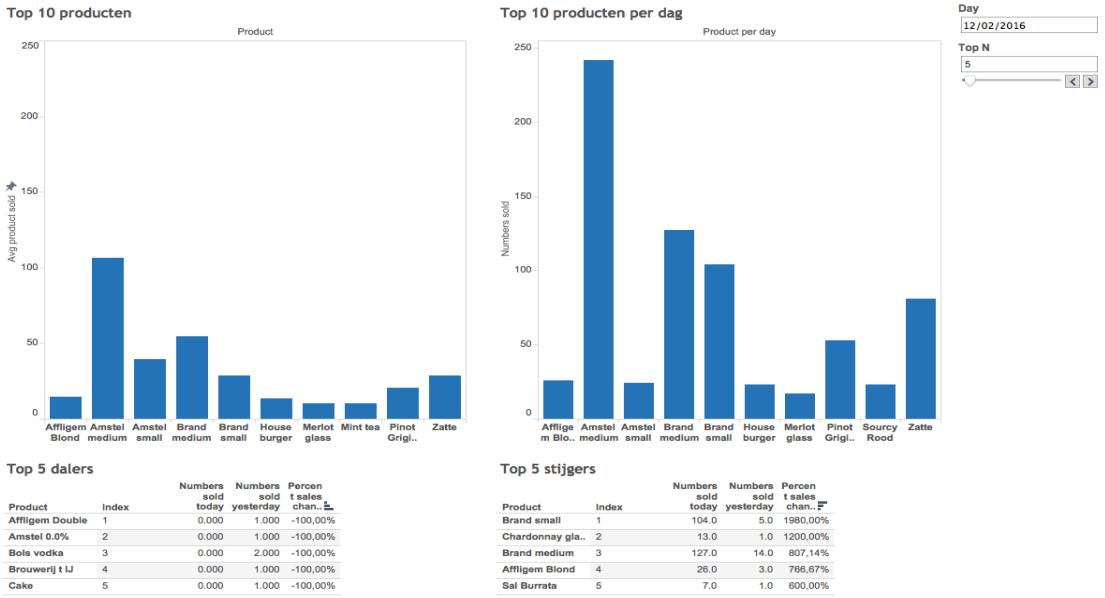



Figure 19 - Dashboard 3: Top products

Dashboard 3 shown in Figure 19 allows analyzing sales by product. Top left of the dashboard shows a chart that displays the top 10 products on average. Right next to this a chart with the top products for a specific day is shown. Presenting these charts in this manner allows checking whether sales for a specific day are out of the ordinary. To further analyze whether product sales are changing, and possibly spot new trends the tables below the charts show top products sales increasing and decreasing.

Controls on the right of the page allow selecting a specific date for the top ten products per day. Changing the top N parameter shows more, or less products in the top products charts. This also helps to fulfill the requirements that entrepreneurs want to see sales per product (R5).

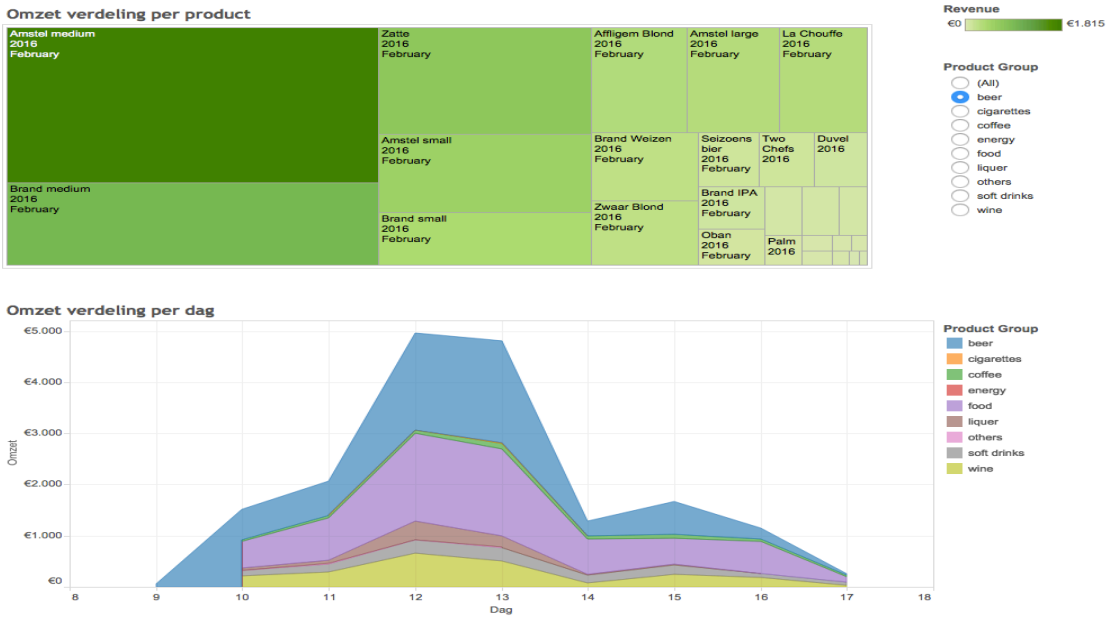



Figure 20 - Dashboard 4: Revenue distribution

Although dashboard 3 shows the sales per product it can be hard to analyze these sales because there might be large differences between the numbers of products sold (e.g. Hundreds of Pilsners might be sold on a specific night vs. only a few house burgers). To better support

hospitality entrepreneurs in analyzing their product sales dashboard 4 (Figure 20) shows the revenue distribution per product group, and per product in a specific product group.

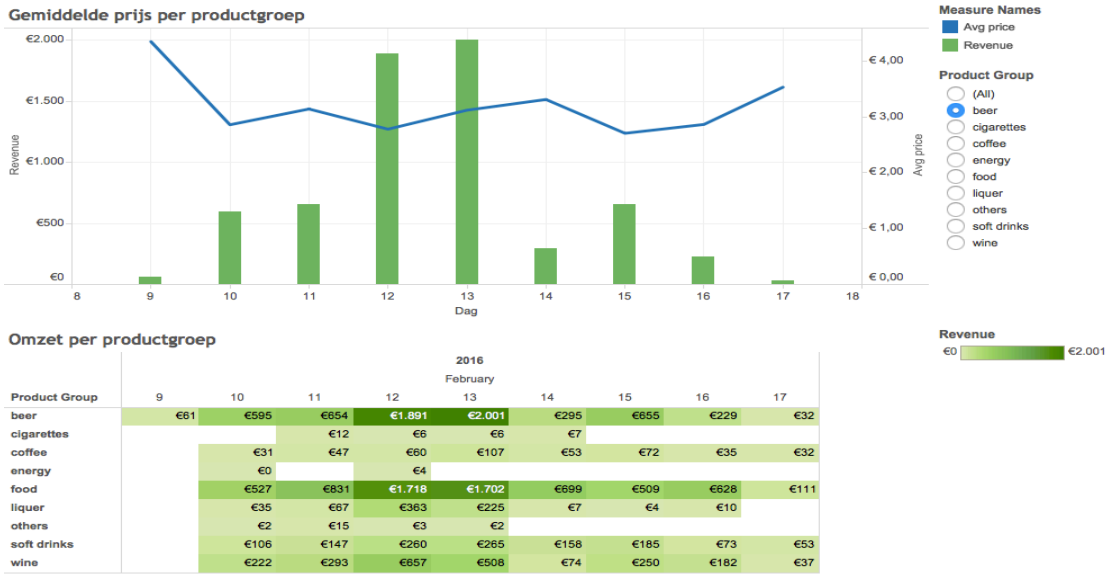
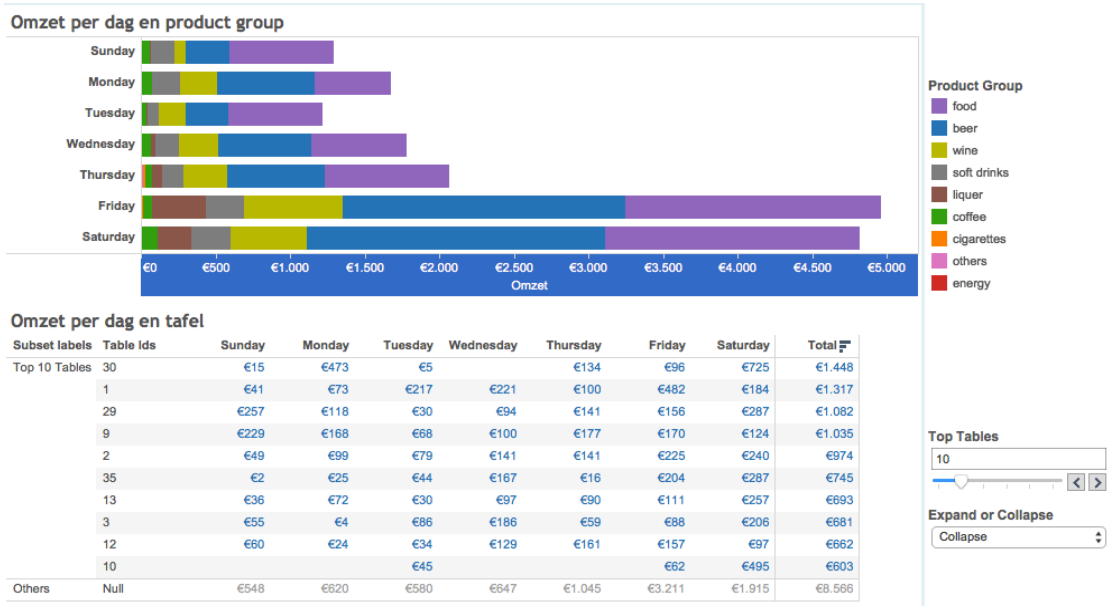



Figure 21 - Dashboard 5: Revenue distribution throughout the week

Dashboard 5 displayed in Figure 21 displays the revenue per product group per day throughout the week. Although the distribution per product group is already displayed in dashboard 4, dashboard 5 makes the revenue per product group specific. It is expected that this is helpful to entrepreneurs because revenue per product group is often displayed in existing POS systems as well. Adding it to the Checkmetrix dashboards might help them to easier relate the new dashboards to their currently used systems.




| Subset labels | Table Ids | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Total |
|---|---|---|---|---|---|---|---|---|---|
| Top 10 Tables | 30 | €15 | €473 | €5 | | €134 | €96 | €725 | €1.448 |
| | 1 | €41 | €73 | €217 | €221 | €100 | €482 | €184 | €1.317 |
| | 29 | €257 | €118 | €30 | €94 | €141 | €156 | €287 | €1.082 |
| | 9 | €229 | €168 | €68 | €100 | €177 | €170 | €124 | €1.035 |
| | 2 | €49 | €99 | €79 | €141 | €141 | €225 | €240 | €974 |
| | 35 | €2 | €25 | €44 | €167 | €16 | €204 | €287 | €745 |
| | 13 | €36 | €72 | €30 | €97 | €90 | €111 | €257 | €693 |
| | 3 | €55 | €4 | €86 | €186 | €59 | €88 | €206 | €681 |
| | 12 | €60 | €24 | €34 | €129 | €161 | €157 | €97 | €662 |
| | 10 | | | €45 | | | €62 | €495 | €603 |
| Others | Null | €548 | €620 | €580 | €647 | €1.045 | €3.211 | €1.915 | €8.566 |

Figure 22 - Dashboard 6: Revenue per table

Dashboard 6, presented in Figure 22 is added as a further deepening to the product group distribution. Presenting the product group revenue as a stacked bar chart per day allows identification of customer preferences for specific product groups on certain days of the week. Product sales per table are added because these further support an entrepreneur in identifying patterns. If certain table are constantly doing better than others the entrepreneur can research underlying reasons for this, and possibly apply this knowledge to also increase sales on other tables.

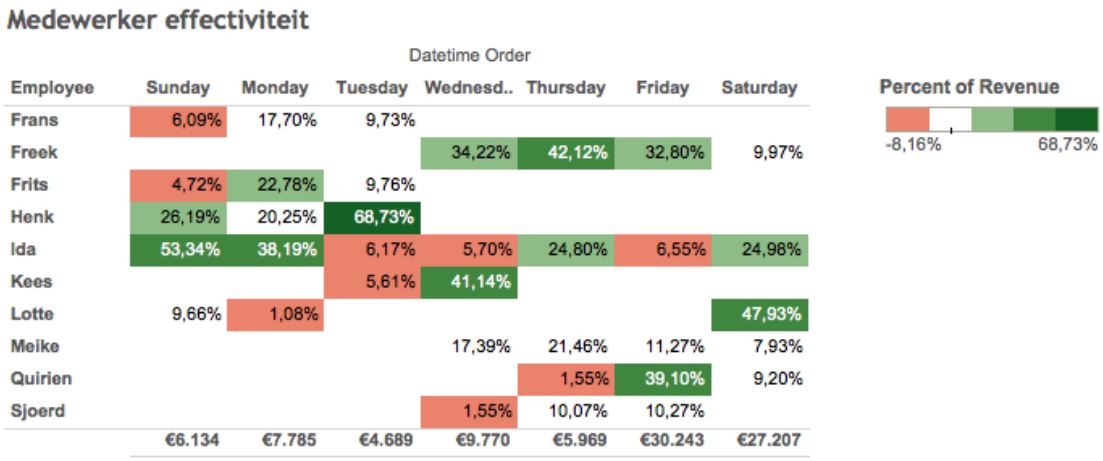



Figure 23 - Dashboard 7: Employee effectiveness

Figure 20 shows dashboard 7, which displays employee effectiveness. If restaurants use an employee key with their POS this allows logging which employee enters an order. This allows displaying the percentage of sales that is made by a certain employee. Employee effectiveness is useful information for hospitality entrepreneurs because it allows them to schedule their personnel more efficiently.

## 6.3 Design motivation

This section gives an overview of the different choices made when designing the dashboards for the hospitality industry. Besides this it also shows how the dashboards help to fulfill the requirements from section 5.1.6 - Requirements selection. Table 17 - Must have requirements coverage displays how the must have requirements have been fulfilled. Following that Table 18 - Nice to have requirements coverage displays fulfillment of the nice to have requirements. In case a requirement has not been fulfilled a motivation is included as well.

| Requirement | Dashboard | Motivation |
|---|---|---|
| 1 | 3 | Increasing top N allows to display the number of sold items for each products sold in a venue |
| 2 | 1, 3, 6 | - Dashboard 1 allows comparing average revenue with current revenue; this allows easily identifying diverging patterns.<br>- Dashboard three allows zooming into specific product sales compared to average top product sales.<br>- Although dashboard 6 does not show averages, showing table usage throughout the week does allow identification of patterns. Besides this presenting product group revenue as a bar chart allows comparing product group distribution throughout the week, and check if patterns change |
| 5 | 3,4,5 | - Dashboard 3 can show sales number for all products, also includes changes in sales<br>- 4 Shows distribution of sales per product and product group. This helps to show whether sales distribution is according to normal patterns (NB. 3 only shows sales, but not whether distribution between products is normal)<br>- Five displays sales per product group. This is a commonly used overview in the hospitality, gives a more concise overview than specific products |
| 6 | 2,7 | - Dashboard 2 gives an hourly overview of sales |

| | | |
|---|---|---|
| | | throughout the weeks. Presenting it on an hourly basis allows to compare with personnel schedules<br>- Dashboard 7 shows employee effectiveness, this is useful to decide which employees should be planned on a certain day (e.g. busy days might require effective employees). |
| 7 | All | All dashboards are fixed. Only showing simple controls for changing date selection & venue, or number of selected products. |

Table 17 - Must have requirements coverage

| Requirement | Dashboard | Motivation |
|---|---|---|
| 3 | - | Not possible with current Checkmetrix technology, therefor Checkmetrix wants to test whether a pilot version without this functionality will be attractive enough for hospitality entrepreneurs. |
| 4 | N/A | Dashboard design is not related to timeliness of data and report generation |
| 8 | 1 | Selecting multiple venues aggregates data of those venues so that an overview of the entire company can be created |
| 9 | - | Too complex / expensive to build right now |
| 10 | | |

Table 18 - Nice to have requirements coverage

## 6.4 Conclusion

This chapter presented the structural specification of the Checkmetrix platform. The structural specifications of the Checkmetrix platform can be split up into two main parts. The first part is the architecture for the Checkmetrix system. This design is presented using the main Meta framework by Janssen, (2009). The main modules of this system are the POS module, used for connecting to the Printerboxes, the categories module for ingesting the transaction data, and the analytics module needed for presenting analytics to retailers. In a later stage the supplier interface must be added, but this has been put off to a later stage when there is more interest in the platform from suppliers.

The second part of this chapter presented the design of the dashboards that will be displayed in the analytics module. The main tradeoffs that had to be made in the design of the dashboards were between displaying sufficient information whilst still being simple enough that the message of each dashboard can be easily grasped, and to offer sufficient control to advanced users whilst still maintaining minimal setup time for new users.

The controls offered in the current dashboard design allow to change the date and range for which the dashboards are displayed, as well as what venues are selected. The use of standard controls allows users to display the data as they see fit, whilst being easy to access for new users.

# 7 Evaluation

The last step of the design cycle is checking whether all the goals and requirements of the various stakeholders have been met. When evaluating the design multiple aspects must be considered. In case of Checkmetrix the goal of requirements evaluation is to test whether the artifact presented in section 6.2 Retailer dashboard mockups contributes to fulfilling the requirements developed in section 5.1.6 - Requirements selection. The purpose of goal evaluation is to test whether the designed artifact can be used to fulfill the (partially validated) assumptions from section 5.3 Conclusion. More specifically Table 19 - partially validated assumptions presents the assumptions to be validated. There is no need to evaluate any of the other assumptions because those assumptions either relate to foodservice suppliers (and are therefor out of scope), or they are related to the underlying reasons for a lack of data analytics in the hospitality industry (instead of stakeholder goals). From the perspective of Checkmetrix these assumptions must be tested because if they are all validated this means that building a data-sharing platform by first convincing hospitality entrepreneurs to join might be a viable strategy.

| No | Assumption |
|---|---|
| 5 | Hospitality entrepreneurs are interested in analysis of the data generated in their enterprises because it can help to increase the performance of those enterprises |
| 6 | Hospitality entrepreneurs are willing to pay a small amount of money for data analytics services |
| 7 | Hospitality entrepreneurs are willing to aggregate their data on a platform so that market benchmarks and trend analysis can be created |

**Table 19 - partially validated assumptions**

The rest of this chapter is structured as follows. To start of, section 7.1 - Evaluation method shows how interviews with potential users help to evaluate the dashboards. Following this section 7.2 - Interview results presents the results of the interviews. The results of the interviews are first used to test if the requirements of the platform have been fulfilled in section 7.3. Based on the interview results presented in the previous section, this section draws conclusion on whether the designed artifact meets the requirements set in section 5.1.6 - Requirements selection. Because every interview question tests (a part of) the artifact, and because specific parts of the artifact cover one (or multiple) requirements, the conclusion whether a requirement has been met can be inferred from the interview results. Following this the interview results are also used to create section 7.4 - Evaluation of goals. The results from those two sections are in turn used to create an overview of changes that must be made to the designed artifact in section 7.5 - Impact on design, before the chapter finishes with a conclusion in section 7.6 - Conclusion. An overview of the sections in this chapter, along with their purpose is presented in Table 20 - Overview of chapter sections.

| Section No | Section heading | Purpose |
|---|---|---|
| 7.1 | Evaluation method | Describe evaluation method |
| 7.2 | Interview results | Analyze interviews |
| 7.3 | Evaluation of requirements | Evaluate if dashboards fulfill the requirements of hospitality entrepreneurs |
| 7.4 | Evaluation of goals | Evaluate if dashboards contribute to achieving the goals of Checkmetrix |
| 7.5 | Impact on design | Present improvements that must be made to the dashboards |
| 7.6 | Conclusion | Draw conclusions and recap chapter |

**Table 20 - Overview of chapter sections**

## 7.1 Evaluation method

To evaluate the artifact interviews were conducted with potential users. Potential users of the Checkmetrix dashboards are hospitality entrepreneurs with a medium to large sized business (500.000 - 3.000.000 revenue per year). This selection is made based on previous interviews in which owners of small venues (< 500.000 annual revenue) indicated no interest in data analytics, and the interviewed owners of large enterprises indicated to already have sufficient data analytics solutions in place.

Questions for the interviews are split up into two main themes. The first theme covers requirements evaluation, and the second covers goal evaluation. To evaluate requirements fulfillment the interviewees are presented with one dashboard at a time, and then asked on their opinion and potential use for that dashboard. Following this more specific questions are asked to test whether the artifact really fulfills the requirements. An overview of all questions, and the requirements they cover is displayed in Table 21 - Evaluation of requirements.

| No | **Question** | **Covers** |
|---|---|---|
| 1 | I would use dashboard 1. Why (not)? | R2, R5, R8 |
| 2 | I would use dashboard 2. Why (not)? | R6 |
| 3 | I would use dashboard 3. Why (not)? | R1, R2, R5 |
| 4 | I would use dashboard 4. Why (not)? | R5 |
| 5 | I would use dashboard 5. Why (not)? | R5 |
| 6 | I would use dashboard 6. Why (not)? | R2 |
| 7 | I would use dashboard 7. Why (not)? | |
| 8 | It's useful to aggregate the results of multiple venues. Why not? | R8 |
| 9 | Changing the date precision between day – week – month offers sufficient flexibility in the dashboards | R7 |
| 10 | The dashboards help me to better schedule my personnel. Why (not)? | R6 |
| 11 | The dashboards help me to better plan my purchasing. Why (not)? | R1, R6 |
| 12 | I can get a good overview of my sales using the dashboards. Why (not)? | R5 |
| 13 | The dashboards help me to easily spot diverging patterns | R2 |

**Table 21 - Evaluation of requirements**

The goal of goal evaluation of the dashboards is to test assumptions A5, A6 and A7. To be able to do this several questions are mapped to the assumptions, and presented to the interviewees. Questions 1, 4 and 5 test the interest of hospitality entrepreneurs in data analytics. To prevent entrepreneurs from saying that they are interested, when they are in fact not interested question one asks whether they would actually use the dashboards. Question 4 and 5, regarding missing functionality, are added to test whether it might be possible to (further) interest them in case they are not interested in the current solution.

Question 2 and 3 test hospitality entrepreneurs' willingness to pay. Question 2 is added because initial interviews showed that one of the major expected benefits from a CM like solution would be time saving, and entrepreneurs indicated they might be willing to pay in case the solution saves them time (see section 5.1.2 for a detailed analysis of previous interviews). Question 3 not only tests willingness to pay, but also tries to put a number on this willingness. This will be very useful information for Checkmetrix because it will help them in calculating their business model.

To conclude question 6 tests whether entrepreneurs are willing to share their data (in return for the dashboards). This is important information because development of a multi-sided platform will not be possible if entrepreneurs do not want to share their data. An overview of how the questions help to validate the assumptions is presented in Table 22 – Evaluation of goals.

| **No** | **Question** | **Motivation** | **Assumption** |
|---|---|---|---|
| 1 | I would use the provided dashboards on a regular basis. Why (not)? | If entrepreneurs are not interested in data analytics they won't use the dashboards on a regular basis | A5 |
| 2 | The dashboards would save me time in management activities. Why (not)? | If the dashboards save time entrepreneurs will be more likely to be willing to pay | A6 |

| | | | |
|---|---|---|---|
| 3 | I would be willing to pay for these dashboards. How much? | Checks whether entrepreneurs can be incentivized to add a PB with this dashboard and if they are willing to pay for it | A6 |
| 4 | The following functionality should be included in the dashboards<br>1. Personnel schedules<br>2. Current/incoming inventory<br>3. Ability to create my own dashboards<br>4. Comparing my data with market averages | Functionalities are not tested, its being tested whether they are required to fulfill the goal of selling Printerboxes (Also relates to R3, R9, R10 -> check whether requirements are fulfilled without this functionality) | A5 |
| 5 | I would like to see the following extra information | Checks what information needs to be added to make the entrepreneur use the CM platform | A5 |
| 6 | I would be willing to anonymously share my bar's data in exchange for these dashboards | Are entrepreneurs willing to share? | A7 |

Table 22 – Evaluation of goals

## 7.2 Interview results

To perform the evaluation 8 interviews were conducted. The interviewed hospitality entrepreneurs come from different areas in the Netherlands. Two of the entrepreneurs were also interviewed during the earlier stage of this research. The others were approached randomly, or through mutual acquaintances. The smallest business owned by one of the interviewees has annual revenue of 700.000 euros. The largest restaurant has 800 seats and estimated revenue of 4 million euros. Four of the interviewees owned a single bar or restaurant, and the others had multiple bars and/or restaurants. The largest organization consists of ten bars, restaurants and beach clubs.

The conducted interviews were recorded and lasted between 30 and 60 minutes. To analyze the interviews they were first summarized, and after this encoded using open coding. The full interview summaries with their encoding can be found in attachment VI - Evaluation interviews. The interviews will be referred to by their number I1 – I8.

### 7.2.1 Evaluation of requirements results

This section discusses the part of the interview that deals with formative evaluation of the artifact. The results for each of the questions are discussed per question in the sections below.

#### 7.2.1.1 Dashboard 1

All of the interviewees indicated they would use dashboard 1, but adjustments were suggested. One entrepreneur indicated that the dashboard should be corrected for holidays and events because it would otherwise not be possible to compare current results with average numbers. When posing this suggestion to other entrepreneurs none of them confirmed this problem. The reason for this being that it is impossible to correct for all events (especially internal), and this will be easy to infer for managers because they are always around. Instead of this, three of the interviewees suggested that displaying the same week last year besides the average would suffice to quickly get an overview of the current performance. All of the interviewed entrepreneurs indicated to currently use a solution like this dashboard, either created in Excel or using their POS system. Four of the interviewees would also like to at least include personnel cost, and possibly purchasing cost in the chart, because this enables them to see their actual profit.

#### 7.2.1.2 Dashboard 2

All of the interviewees said they would use this dashboard. Only 1 interviewee indicated to not currently have, or work on creating, a similar solution because it is too costly for him. The main purpose for the dashboard would be to plan, and manage employees on the floor. As I5 put it "*Managers always find it hard to make decisions on sending employees home, because there is a risk that it might become busier later. From an organizational perspective we find it hard to pinpoint when and why managers make mistakes in this. A chart like this would be very useful in identifying these issues.*"

Again all interviewees indicated they would like to include personnel costs in the picture because this helps to check if margin targets are actually being reached at specific times. One interviewee suggested changing the time axis from hours to personnel shifts, but this was not confirmed by any of the other interviewees. Two interviewees did indicate that including averages just as in the previous chart might be useful to more easily identify diverging patterns.

#### 7.2.1.3 Dashboard 3

All but one of the interviewees indicated they would use a dashboard like this. Currently two of the interviewees have an existing solution that provides them with this kind of data. One is the owner of the largest restaurant among the interviewees, where they own an advanced POS that gives a full overview of everything in the restaurant (including personnel and purchasing costs). The other was provided with this data based on purchasing from his brewer.

Five interviewees indicated that this chart would be especially useful when connected to some sort of inventory management system. Such a system should according to them provide automatic ordering, or at least generation of an ordering list.

Three interviewees indicated the dashboard could be useful to measure the effects of hit training, or new menus, on sales. When doing hit-training employees are instructed on specific products that they should focus on in their sales. The reason for doing this is to increase sales of high margin products, or get rid of products that are going over date, or about to be replaced. To better support this use cases three interviewees would also like to see in what combinations products are being sold.

The interviewee that indicated that she would not use the dashboard would not do so because she is in her venue on a regular basis and has a clear overview of the products in stock.

#### 7.2.1.4 Dashboard 4

With the exception of two, all the interviewees said they would not use dashboard 4. Three main reasons were mentioned for not using the dashboard. The first one being that the dashboard did not fit their type of enterprise. This was the case in restaurants that are only open during the night, and therefor have nearly the same distribution of revenue every day. The second reason mentioned is that the owner/manager knows the revenue distribution from being on the floor. Finally it was mentioned that the chart is too complicated to convey to employees, and creates a sense of distance between management and employees.

Creating a sense of distance between employees and management is a risk that more interviewees saw. The two interviewees that did see some use for the chart in supporting hit training, did also see the risk of steering by charts too much. Because of this those interviewees were also not sure that they would use the chart, and they will certainly not use it on a regular basis. No improvements were suggested that might convince the entrepreneurs to start using the chart.

One interviewee suggested displaying the product distribution over time, so that it becomes possible to monitor changes in distribution. This would allow monitoring the effect of changes in assortment.

#### 7.2.1.5 Dashboard 5

The opinions on dashboard 5 varied more between interviewees. Two interviewees indicated they would definitely use it, three said they might, and three said they would not use it. Three of the interviewees have a similar product. Four of the interviewees suggested removing the third axis on the average price per product group chart, and all of the interviewees had some trouble to immediately grasp the chart.

The main reason for not using the chart was that the owners had as I3 called it *"homogeneous concepts with little variation in sales per product group because this is the easiest way to make a profit".* The owners that doubted between using and not using the chart indicated

they find the data "*Interesting, but not sure if they would actually use it to adjust anything in their operations*" – I5. The main reason mentioned for using the chart is to monitor whether the right (high margin) type of products are being sold enough, and what possibilities there are for cross selling products (e.g. offering certain wines with specific meals). Because of this, these interviewees once again indicated they would like to see in what combination products are sold.

#### 7.2.1.6 Dashboard 6

The top chart of dashboard 6 would be used by all but one interviewee. The main reason for this is that it gives a very clear overview of the distribution and actual sales throughout the week. This data can in turn be used to monitor employee performance, or possibly influence hit training.

The bottom chart was not received as positive as the top chart. Although 4 interviewees indicated they would use it, they would not do so to e.g. adjust the table setting (as was expected). The main reason would be to monitor employee performance, and to properly do this the tables will need to be connected to so called neighborhoods. A neighborhood is a group of tables, served by a specific employee. Monitoring the neighborhoods will be very useful to monitor employee performance.

The single interviewee that indicated no interested in the entire dashboard said that is was too complicated to communicate to employees, and will create too much distance between management and employees.

#### 7.2.1.7 Dashboard 7

All but two of the interviewee indicated they would use dashboard 7. The interviewees that showed no interest did however point out that he would probably use it if he had a restaurant or bar with more employees. Of the other interviewees, two indicated to use (now or in the near future) a similar tool. Although all of the interviewees said that the dashboard could be very helpful, four of them did point out that a dashboard like this should be used carefully, because it leaves a lot of interpretation. Because of this it was suggested to at least connect the dashboard the revenue per table chart, so that employee effectiveness can be corrected for busy or quiet neighborhoods.

#### 7.2.1.8 Interface controls: Aggregating results & date precision (Q8, Q9)

Of the interviewees that owned multiple venues one indicated that aggregating the results of multiple venues to check the performance of the entire organization is not useful. The reason for this is that he always looks at a specific restaurant and does not care about the total organization. The other interviewees said they would be interested in seeing aggregated results.

All interviewees confirmed that changing the date precision between daily, weekly and monthly offers enough control. Throughout the interviews four interviewees mentioned they currently always analyze their data per week. This might be enough to start with.

#### 7.2.1.9 Fulfilling functions (Q10 – Q13)

To test if the dashboards are actually useful to help in fulfilling the function for which they are designed four questions were added to the interviews. These functions are: help to schedule personnel, help plan purchasing, give an overview of sales, and spot diverging patterns.

Whether the dashboards can be used to schedule personnel more efficiently differs among the interviewees. Three of them indicated they would not use the dashboards for this because their planning is set, and they know when to sent personnel home, or they already have a (more advanced) scheduling system in place. The other interviewees indicated they would use the dashboards to improve employee scheduling because the current system they have does not offer enough insight into when personnel should be send home, or they have nothing in place at all.

Three of the interviewees indicated they would use the dashboards to improve their ordering. They would especially do so if the system could e.g. create ordering lists automatically based on sold products. The rest of the interviewees said they would not use the system to improve purchasing. The reasons for this are because they already automated ordering (I1, I4) or there is no practical improvement possible because they get daily deliveries when necessary (I2, I5).

All interviewees indicated that the dashboards help them to get a good overview of their sales. Three of the interviewees did however indicated they already have similar systems in

place, and would not use the dashboards for this. The other interviewees said they would definitely use the dashboards to get better insight in their sales.

Again all of the interviewees confirmed that the dashboards help them to spot diverging patterns. One of them did indicate he has no real need for this because he is in his restaurant nearly all of the time. The others (including the owner with a restaurant that has a fully automated system) said they would definitely use the dashboards to spot diverging patterns.

### 7.2.2 Evaluation of goals results

This section discusses the part of the interview that deals with evaluation of goals. The results for each of the questions from this part of the interview are discussed per question in the sections below.

#### 7.2.2.1 Usage & time saving

All interviewees indicated that they would use the dashboards on a regular basis. The interviewees said they would use the dashboards weekly in meetings with their personnel and management to more easily communicate what is going on in the enterprises, and how they can improve on this.

Two of the interviewees indicated the current solution would result in a 1-hour time saving per week for them (I1, I2). The other interviewees said they viewed the dashboards in current form not as a time-saving tool, but as something they would use to create extra insights on top of their existing systems In case certain functionality is added the system might result in 1 – 3 hour time-saving per week for them as well. Section 7.2.2.3 & 7.2.2.4 below discuss the specific functionality that might result in extra time saving.

#### 7.2.2.2 Willingness to pay & share

All interviewees but one are willing to pay for the current collection of dashboards. All of them expect a monthly recurring fee for the dashboards. One of the interviewees (I1) indicated that he would prefer a one-off fee, but expects the fee to be monthly. The interviewee (I2) that indicated no willingness to pay preferred to do his analytics himself because he just recently took over the restaurant, and wants to get as much insight as possible from his data.

How much the interviewees are willing to pay varies from 20 euros per month to 100 euro per month. All of the interviewees indicated to be willing to pay more than what they proposed now if certain functionality is added to the Checkmetrix tool (See section 7.2.2.3 & 7.2.2.4 below for which functionality specifically).

Out of the interviewed hospitality entrepreneurs all but one had no problem with anonymously sharing his enterprises data. All of them think that the data from just their enterprise is not that valuable anyway. The dashboards definitely offer enough remuneration to share the data. The one interviewee (I1) that did mind sharing the data could not clearly explain why he did not want to share, and indicated that he might share in return for a monetary remuneration (undecided on how much).

#### 7.2.2.3 Requested extra functionality (suggested beforehand)

During the interviews four examples of extra functionality were suggested to entrepreneurs to test if they are interested in this functionality. The suggested functionalities are the possibility to add personnel schedules, manage inventory, create new dashboards and compare the data with market averages. Only one interviewee (I4) indicated no interest in any extra functionality at all because he already has a complete POS system in place. The requests from the other interviewees are in the next couple of paragraphs.

All but two of the interviewees indicated that they want to include personnel schedules and costs in the dashboards. The reason for this is that it gives them a more complete overview of the performance of their enterprise. The interviewees (I1, I4) that did not want this either have no need for it, or have existing systems in place.

Two interviewees requested the functionality of connecting the dashboards to an inventory management system (I3, I6), because currently a lot of mistakes are made in their ordering process. The other interviewees indicated no interest in this because they have no ordering problems, or have automated ordering systems in place.

Although no interviewees showed interest in creating their own dashboards, several interviewees (I5, I7, I8) did indicate they would like to adjust the current dashboards. More

specifically they would like to be able to add their own tags and product groups to the dashboards.

One of the interviewees (I1) indicated a strong interest in market averages because he thinks it is interesting, and useful to benchmark his restaurant. The other interviewees indicated no interest. The main reason for this is that they think it is very hard to compare their enterprises to different enterprises because all have (slightly) different concepts. Besides this they prefer to focus on their own strengths, and making sure service is consistent.

#### 7.2.2.4 Requested extra information

Besides the functionality discussed above the interviewed entrepreneurs requested three extra functionalities. One entrepreneur (I1) requested to also keep track of tips, because this is an important performance indicator for him. One interviewee (I8) indicated she would like to be able to see the distribution of cash vs. pin payments.

Besides this two entrepreneurs (I1 I5) requested an interest in product combinations being sold. These entrepreneurs would like to see in what combinations products are being sold because selling extra products can increase their profits, and because it allows them to test the balance of their menus. Especially I5 described not so much an interest in specific product combinations (e.g. which beers are sold with what courses), but an interest in product type combinations (e.g. does a group of people take a starter before their main). He was very interested in this because incentivizing clients to take an extra course has a relatively large impact on profit made per group (N.B. In the time it takes to create and serve a starter the table cannot be filled by another group anyway, so its better to sell as much as possible to a single group).

## 7.3 Evaluation of requirements

Based on the interview results presented in the previous section, this section draws conclusions on whether the designed artifact meets the requirements set in section 5.1.6 - Requirements selection. Because every interview question tests (a part of) the artifact, and because specific parts of the artifact cover one (or multiple) requirements, the conclusion whether a requirement has been met can be inferred from the interview results. This becomes possible by relating the requirements to specific interview questions.

### 7.3.1 R1: Overview of sales

R1: I need the dashboards to give me a simple overview of my sales, so that I can check the performance of the restaurant leaves much to interpretation. Because of this 3 dashboards were developed to fulfill the requirement. These dashboards are dashboard 2, 4 and 5. Out of these dashboards the hospitality entrepreneurs indicated they would use dashboard 3, would not use dashboard 4, and might use dashboard 5 depending on the size of their organization. Question 12 of the interview checked whether the entrepreneurs were satisfied with the overview of sales from the dashboards. Although two entrepreneurs requested to add a dashboard with cross sales of products, all entrepreneurs deemed the sales overview dashboards satisfactory. Because of this R1 is considered fulfilled.

### 7.3.2 R2: diverging patterns

R2: I want the dashboards to compare current numbers with averages, so that I can check for diverging patterns is a requirement that can only be met through multiple dashboards. Dashboards that were specifically built with diverging patterns in mind are dashboard 1, 3 and 6. As an extra test to check whether hospitality entrepreneurs can use the dashboards to check for diverging patterns Q13 was added to the interview. Because all interviewees indicated that they would use dashboard 1,2 and 6 (all but 1 in case of dashboard 6), and because the answers to Q13 were positive as well, this requirement can be considered fulfilled.

### 7.3.3 R3: Add extra data & R4: Real-time insights

Nothing was designed for requirement 3 (as discussed in section 6.3 - Design motivation), so this requirement is considered not fulfilled. From interviews it becomes clear that personnel schedules and costs must be added (see evaluation of goals for more elaborate

discussion of extra functionality). A small part of entrepreneurs also request automated ordering lists.

With respect to requirement four there is no need to an evaluation of the requirements. Real-time insight is not functionality that can be fulfilled by the dashboard prototypes. Interviews also confirm there is no need for real-time insights (entrepreneurs only use dashboards on weekly basis).

### 7.3.4 R5: Simple overview of sales, inventory

Dashboard 3 (top products chart) was designed to fulfill R5: I need to get an overview of all the sales in my venues, so that I can check inventory levels. Considering that all of the interviewees indicated that they would use dashboard 3 (Q3), but that only two would do so to manage their inventory (Q11), and that those two requested automated ordering lists as a requirement for inventory management, this requirement is considered partially fulfilled.

### 7.3.5 R6: Weekly overview of sales, personnel management

Dashboards 2 and 7 try to fulfill R6: I need to get the dashboards to give me a weekly overview of sales, so that I can use them to manage my personnel. Besides this Q11 specifically checks if the dashboards help in managing personnel. Question 4 from the summative evaluation question (S4) also checks if there is a need for personnel schedules besides the dashboards, and in that way it helps to check if the requirement is fulfilled sufficiently.

Because the interviewees indicate that they would use dashboard 2 and dashboard 7, and might use them to manage personnel (Q11), but all of them ask for personnel schedules this requirement is considered partially fulfilled.

### 7.3.6 R7: Fixed dashboards

Adding different date selectors (daily, weekly, monthly) to the dashboards is the suggested solution for offering some control to the hospitality entrepreneurs, whilst still providing them with fixed dashboards. The purpose of this is to fulfill R7: I need fixed dashboards, so that I don't need to spend any time setting up analytics. To test whether this offers sufficient control Q9 was added to the interview. Because the result of Q9 is that this date selection offers sufficient control it can be concluded that this requirement is fulfilled.

### 7.3.7 R8: Aggregated venues

To fulfill R8: I want to be able to aggregate the results of different restaurants so that I can see how my company as a whole is doing; a selector for multiple venues was added to dashboard 1. To test whether this requirement has been fulfilled dashboard 1 was tested in the interview and Q8 was added to test whether the entrepreneurs find the functionality useful. Because all entrepreneurs indicate they would use dashboard 1, and because 2 out of 3 entrepreneurs with multiple venues indicate it to be useful functionality this requirement can be considered fulfilled.

| Requirement | Dashboard | Question | Answer | Nuance | Conclusion |
|---|---|---|---|---|---|
| 1. Comprehensive overview of sales | 3. Top products | Q3 | Would use | | Fulfilled |
| | 4. Revenue distribution | Q4 | Would not use | Bottom chart might be used | |
| | 5. Weekly distribution | Q5 | Might use | Top chart unclear | |
| | | Q13 | Satisfactory | Add cross sales | |
| 2. Diverging patterns | 1. Weekly revenue | Q1 | Would use | | Fulfilled |
| | 3. Top products | Q3 | Would use | | |
| | 6. Revenue per table | Q6 | Would use | | |
| | | Q13 | Dashboards help to spot | | |

| | | | | | |
|---|---|---|---|---|---|
| | | | diverging patterns | | |
| 3. Add extra data | - | S4.1 | Add personnel schedules + costs | | Not fulfilled |
| | | S4.2 | | | |
| 4. Real-time insights | - | S1 | Dashboards used on weekly basis | | N/A |
| 5. Simple overview of sales to manage inventory | 3. Top products | Q3 | Would use | | Partially fulfilled |
| | | Q11 | No need for better purchasing or add ordering lists | | |
| 6. Weekly overview of sales to plan personnel | 2. Hourly revenue | Q2 | Would use | Add personnel costs | Partially fulfilled |
| | 7. Employee effectiveness | Q7 | Would use | Correct for busyness | |
| | | Q11 | Might use | Depends on restaurant size | |
| | | S4.1 | Add personnel schedules + cost | | |
| 7. Fixed dashboards | All | Q9 | Sufficient control offered | | Fulfilled |
| 8. Aggregate venues | 1. Weekly revenue | Q1 | Would use | | Fulfilled |
| | | Q8 | Useful | 2 out of 3 with multiple venues | |
| 9. Create dashboards | - | S4.3 | Not useful | | Not fulfilled |
| 10. Market averages | - | S4.4 | Not useful | | Not fulfilled |

**Table 23 - Overview of requirements evaluation**

To get an overview of all requirements, and whether they have been fulfilled or not Table 23 - Overview of requirements evaluation was created. This dashboard displays the requirements, the dashboards that have been designed to fulfill them, and the interview questions and summarized answers that test whether the requirements have been fulfilled. Finally, the most right column shows the conclusion regarding the specific requirement.

## 7.4 Evaluation of goals

In this section the contribution of the dashboards to achieving Checkmetrix' goal of achieving enough mass in the hospitality industry to convince hospitality suppliers to join the platform will be evaluated. To be able to reach this goal three assumptions must be confirmed. These assumptions are that hospitality entrepreneurs are interested in data analysis, willing to pay for analytics services, and willing to aggregate their data on a platform. Whether the assumptions hold for the designed dashboards, and thereby contribute to Checkmetrix' goal has been evaluated using the interviews. This section discusses the results per assumption.

#### 7.4.1.1 Hospitality entrepreneurs are interested in data analytics

The assumption that hospitality entrepreneurs are interested in data analytics because it can help them to increase the performance of their enterprises (A5) has been evaluated using three questions.

1. Whether they would use it on a regular basis
2. Whether specific extra functionality must be included (personnel costs, inventory etc.)
3. Whether any other functionality must be included

From the interviews it can be concluded that the hospitality entrepreneurs will use the dashboards on a regular basis (weekly in most cases, monthly in one case). Key functionality that must be included to make the dashboards really useful for the entrepreneurs is the possibility to add personnel schedules and costs. However, entrepreneurs indicated they would use the dashboards even in the current state. Because of this the assumption that entrepreneurs are interested in the dashboards because those can help to increase the performance of their enterprises is validated.

#### 7.4.1.2 Hospitality entrepreneurs are willing to pay for data analytics

The assumption that hospitality entrepreneurs are willing to pay a small amount of money for data analytics was validated using two questions. Question 2 checked if the dashboards saved them time in management activities (and therefor money), and question 3 tested if, and how much they are willing to pay for the dashboards. From the interviews it can be concluded that the dashboards will not save the entrepreneurs any time (except for a few cases where there is no analytics in place whatsoever), but entrepreneurs are still willing to pay 20 – 100 euros per month for the current solution. In case more functionality (like personnel schedules) is added, they are willing to pay more money. Because of this it can be concluded that A6 has been validated.

#### 7.4.1.3 Hospitality entrepreneurs are willing to share their data

Whether hospitality entrepreneurs are willing to aggregate their data on a platform so that market benchmarks can be created has been tested using interview question 6. From the interviews it becomes clear that the dashboards are more than enough remuneration for all but one the hospitality entrepreneurs to share their data on a platform. Because of this it can be concluded that assumption 7 has been validated.

| Assumption | Question | Answer | Conclusion |
|---|---|---|---|
| A5. Interest in data analytics | Q1 | Use on weekly basis | Validated |
| | Q4 | Need employee schedules + cost | |
| | Q5 | Product cross sales | |
| A6. Willingness to pay | Q2 | Small time saving, mostly extra insight | Validated |
| | Q3 | Willing to pay 20 – 100 euro/month | |
| | Q6 | Dashboards sufficient to share | |
| A7. Willingness to share | Q6 | Willing to share in return for dashboards | Validated |

Table 24 - Overview of goal evaluation

An overview of how the interview questions relate to a specific assumption is displayed in Table 24 - Overview of goal evaluation. This table also contains a summary of the answers in the interviews, and the final conclusion of whether the assumption has been validated or not.

## 7.5 Impact on design

Based on the evaluation of the dashboards several improvements can be made to the design. This section describes the improvements that must be made to the design before starting implementation. The section is split up into must-have changes and nice-to-have changes.

### 7.5.1 Must-have changes

Based on the interviews several changes were identified that were deemed important to all, or nearly all of the interviewees. These changes are described in this section, as changes that must be made before starting development of the platform. There are three main changes that must be made to the dashboards.

First of all dashboards 4 & 5 must be merged. Nearly all interviewees indicated they would not use the top chart from dashboard 4 and the top chart from dashboard 5. Besides this the top chart from dashboard 5 was unclear to all interviewees. Entrepreneurs did however (in half of the cases) indicate to like the bottom charts of dashboard 4 & 5. Because the sales overview is satisfactory to the entrepreneurs there is no need to improve the top charts of dashboard 4 & 5 to meet this requirement. Because of this the top charts from dashboard 4 & 5 should be removed. The bottom charts should in turn be merged together in a single dashboard, for the sake of simplicity.

Secondly personnel schedules must be added. All entrepreneurs indicated that personnel schedules and respective costs are one of the main drivers for the performance of their enterprises. Because of this the ability to monitor personnel cost is a must have requirement for them. This means the Checkmetrix artifact must include the possibility to add personnel schedules, so that personnel costs can be analyzed together with sales.

Finally data from the same week last year must also be displayed in dashboard 1. The interviewees indicated that it is hard, if not impossible to keep track and correct for all events that might influence revenue in a specific week. They did however indicate that the same week last year is usually a good comparison to check if a week's revenue is as expected. Because of this the revenue from the same week last year should be added to dashboard 1.

### 7.5.2 Nice-to-have changes

Besides the must-have changes optimizations or functionalities were suggested during the interviews that are relevant only to a selection of interviewees. Excluding these functionalities does not inhibit successful roll out of the platform, but including them might justify asking a higher fee to hospitality entrepreneurs. For this reason these functionalities are described as nice-to-have. The two nice to have functionalities that might be added are the ability to view product cross sales and the generation of ordering lists.

Two of the interviewees showed a high interest in the ability to see in what combinations products get sold. This allows them to for example monitor the results of hit training for their personnel, or the effect of a new menu. This is a nice-to-have functionality because it is only relevant to a selection of restaurant owners.

Two interviewees indicated that they would like to connect the dashboards to their inventory. That way it becomes possible to automatically create lists of products that must be ordered, thereby reducing mistakes in inventory management, and saving time spent ordering new products. This functionality is only relevant to a subset of entrepreneurs that do not have an automated inventory management system, and problems with their current ordering process. Because of this it is a nice-to-have functionality.

## 7.6 Conclusion

This chapter evaluates the artifact that was designed to allow data analytics in the hospitality industry. Using 8 interviews with hospitality entrepreneurs it was tested if the artifact fulfills the requirements from those entrepreneurs, and whether it help to achieve Checkmetrix' goal of creating a digital-multi sided platform in the foodservice industry.

The main findings from this chapter are that all requirements that the designed dashboards fulfill at least partially all of the requirements it aims to fulfill. The two requirements that have been partially fulfilled are R5: *"a simple overview of sales, to manage inventory",* and R6 *"overview of sales to manage personnel".* The first one has not been fulfilled because to really manage inventory automated ordering lists must be added. The second requirement has not been fulfilled because it must be possible to add personnel schedules to properly manage personnel.

Given the knowledge that all interviewees requested personnel schedules, but only two interviewees asked for inventory management (as a nice-to-have), it is recommended to at least add personnel schedules to the Checkmetrix solution. Besides this functionality several other design improvements were suggested.

Besides validating if the artifact fulfills the requirements of hospitality entrepreneurs this chapter also validated if the artifact contributes to the goals of Checkmetrix. Testing if the artifact triggers interest in data analytics from hospitality entrepreneurs, if they are willing to pay for the artifact, and if they are willing to share their data on a platform, helped to do this.

From the interviews it can be concluded that all of these goals can be achieved using the existing artifact. Entrepreneurs are willing to pay somewhere between 20 and 100 euros monthly to get data insights. In case more functionality, like personnel schedules, is added this amount can be increased further. The interviewed hospitality entrepreneurs (except for one) also have absolutely no problem sharing their data on a platform.

# 8 Discussion & conclusion

This chapter concludes the research by first presenting the main findings of the research in section 8.1 – Main findings. Following this the research its contribution to theory will be discussed in section 8.2 – contribution to theory. After this section 8.3 will present this research's contribution to practice and recommendations for the problem owner, Checkmetrix. To conclude, limitations of this research, and recommendations for future work will be discussed in section 8.5

## 8.1 Main findings

The main purpose of this research was to answer the following question. *Which design principles are useful for the design of a digital multi-sided platform for a start-up company, that enables market level data analytics and enables third party applications in the hospitality industry?*

Design science literature informed the methodology that allowed concretizing the steps needed to manage the designing process. More specifically the design cycle by Verschuren & Hartog (2005) allowed structuring of the design process. Execution of one full design cycle resulted in two main artifacts. The first artifact is a collection of data analytics dashboards for the hospitality industry, and the second artifact is design principles for digital multi-sided platforms in the nascent stage of development. The next section shortly discusses the current stage of the platform and how this was evaluated, because this is the main input for drawing conclusions with regard to the usefulness of the design principles. Following this the findings for each of the design principles will be discussed from section 8.1.2 onwards.

### 8.1.1 Platform & dashboards

The data analytics artifact is a collection of dashboards that gives hospitality entrepreneurs insight into the performance of their restaurant. Transaction data collected from POS-systems is collected on the Checkmetrix platform where it is stored for analysis. The collection and data storage modules have been designed and developed during this research, but the actual analytics module used for displaying the dashboards still needs to be developed. Mock-ups of the dashboards were created, and hospitality entrepreneurs evaluated these positively. In fact, interviews with hospitality entrepreneurs showed that the dashboards fulfill the goals of the problem owner because hospitality entrepreneurs are willing to pay for the dashboards, would use them on a regular basis, and are also willing to share the data collected from their enterprises on a platform.

Based on interviews with suppliers from the foodservice industry it is expected that if hospitality entrepreneurs do indeed adopt the platform, and data from the hospitality industry is successfully collected on the platform, that foodservice suppliers are willing to join the platform as well.

### 8.1.2 Critical mass guidelines

There are two guidelines related to the attainment of critical mass, being G1 and G7. This section presents the findings of this research with regard to those guidelines.

First of all G1 considered solving the chicken and egg problem by subsidizing quality and price sensitive users in order to quickly attain critical mass. From the perspective of an early-stage start up with only little funding this meant forming strong partnerships (G7) and quickly securing marquee users to raise sufficient funds for any subsidies. Because this turned out to not be possible it can be concluded that G1 is hard, if not impossible to apply for early stage start-ups. Although it was expected that G1 might be hard to execute it was also expected that this problem could be mitigated using G7, however this turned out to not be the case.

Building strong partnerships with partners who share the platform vision (G7) turned out to be moderately helpful. Even though subsidizing users was not possible through this strategy, the partnership with Salesforce helped to secure initial meetings with foodservice suppliers. Although it was not possible to create any partnerships with strong partners it is still expected that securing those partnerships in a later stage will help in reducing risk and attracting more

users. Because of this the guideline might still be useful in situations where a partnership can be created.

### 8.1.3 Technological guidelines

Guidelines G3, G4 and G5 appear to be useful in structuring the technical artifact. The current system is designed using these guidelines and it is expected that any future changes can be made with a relatively small effort. More research will however be needed once these changes are actually made to confirm this premise. G3 and G4 especially influenced the layered, modular design of the artifact. When designing the platform development of a single module was considered as well, because it can be expected that this will result in lower cost and higher performance in the short term. But because of G3 and G4 a modular architecture was chosen because this offers greater flexibility, something that is important because the current artifact will need to be greatly expanded.

Generativity on the platform is especially expected from foodservice suppliers and third parties. This is because hospitality entrepreneurs indicated during the interviews that they want to spend as little time as possible on doing analytics, and third parties and foodservice suppliers are expected to gain the most from development of new applications (NB. they can use the platform to reach the entire foodservice industry, whereas hospitality entrepreneurs focus mainly on there own business). During design the assumption was made that the use of an API will offer the required flexibility for a generative platform on the non-hospitality sides of the platform. In that sense G5 absolutely influenced the design, however actual usefulness of this guideline cannot be tested until other sides are added to the platform.

### 8.1.4 Vision & business model guidelines

Guidelines G2 and G6 both consider building a clear and coherent vision to deal with environmental complexity and build a reputation as neutral industry broker. These guidelines absolutely informed the design of the artifact, but the result is not as straightforward as expected. Building a vision and business model is an iterative process that depends on the environment as least as much as it influences it. Because of this, vision and business model should be continuously reassessed as development of the platform continues. The guidelines are useful in reminding the designer to do so, but is should not be expected that they immediately deliver a clear-cut product. Especially in the nascent stage of platform development it is not completely clear which parties are willing, and able to pay for usage of (parts of) the platform, and it can therefor be expected that pivots must be made when it comes to development of the vision and business model.

### 8.1.5 Boundary resources & openness

G8 had a big impact on design of the platform. From the perspective of the problem owner it would be wasteful to spend resources on continuously building and rebuilding the artifact. Because of this the dashboards were developed in close cooperation with hospitality entrepreneurs, and this resulted in dashboards that were positively evaluated.

The same goes for G9. Completely opening up the platform would have been very costly, if not impossible during this stage of development. By closely cooperating with a small number of hospitality entrepreneurs the development cost were kept to a minimum as well as the need for control arrangements.

### 8.1.6 Nascent stage development

The strategies of G10 proved impossible to execute during this stage of platform development. It was not possible to gain sufficient trust from foodservice suppliers, and because of this tipping proved impossible as well. The coring strategy, development of a platform in a market where no platform exists, might be possible, as it is currently expected that hospitality entrepreneurs will use the Checkmetrix platform. This does mean that a hub & spoke platform might already be a bridge too far and potential platform providers should first focus on a single side of the market before growing into a platform. This means that G10 is not useful in this stage of platform development. Instead G11 that focuses on the inception phase can be created which states.

*Guideline 11: Platform startups in markets where one side of the market is a large enterprise should focus on development of a value-creating product for a side of the market with small players, in order to reduce complexity, level the playing field with potential platform participants, and attain critical mass before connecting larger participants.*

### 8.1.7 Main research question answer

By executing a full design cycle it was possible to test the usefulness of 10 guidelines extracted from literature for the design of a digital multi-sided platform for a start-up company in the foodservice industry. From this it can be concluded that G2, G3, G4, G6, G7 and G8 are useful to at least some extent. Although G5 is expected to be useful, and has informed design of the current version of the platform it was not possible to conclusively assess this guideline over the course of this research.

From the perspective of an early stage platform it turned out to not be possible to subsidize users to solve the chicken & egg problem before launching the platform. Because of this G1 is deemed not useful for an early stage start-up company. G10 also turned out to not be useful. Instead it is suggested to add an extra guideline, G11. An overview of all the guidelines with their respective conclusions is displayed in Table 25 - guidelines with conclusion.

| No | Guideline | Conclusion |
|---|---|---|
| 1 | Solve chicken and egg problem before launching platform by subsidizing quality and price sensitive users, in order to quickly attain critical mass | Not useful for start-up |
| 2 | Create clear vision and business model that balances pricing strategy, portfolio growth and user attraction, in order to deal with complex environments | Useful |
| 3 | Components of digital platforms must be loosely coupled through standardized interfaces, in order to reduce system complexity. | Useful |
| 4 | Layers must be coupled through standards and protocols shared by heterogeneous firms, in order to increase connectivity between platform participants. | Useful |
| 5 | Platforms must be generative and evolvable, in order to promote innovation on the platform by platform participants | Not tested |
| 6 | Build a coherent vision of what the platform and its ecosystem should look like, to help build a reputation as neutral industry broker | Useful |
| 7 | Build strong partnerships with partners who share the platform vision, in order to reduce risk and increase power for the platform owner | Moderately useful |
| 8 | Create initial boundary resources in close cooperation with partners to prevent inefficient tuning of boundary resources | Useful |
| 9 | Open the platform to a limited number of (partner) participants during the early stages, to reduce R&D costs and improve platform quality, whilst minimizing the need for extensive control arrangements | Useful |
| 10 | Nascent stage platforms should use coring and tipping strategies, in order to develop a hub & spoke MSP | Not useful for start-up |
| 11 | Platform startups in markets where one side of the market is a large enterprise should focus on development of a value-creating product for a side of the market with small players, in order to reduce complexity, level the playing field with potential platform participants, and attain critical mass before connecting larger participants. | Useful, developed during research |

**Table 25 - guidelines with conclusion**

Based on this data the research question can be considered largely fulfilled. Although it was not possible to completely test the usefulness of all extracted principles clear conclusions can be drawn on which principles are useful for development of a multi-sided platform for an early stage start-up company in the foodservice industry.

## 8.2 Contribution to theory

This study is one of the first to research the design and development of a digital multi-sided platform from inception. It is also one of the first to study the development of a multi-sided

platform from the perspective of a start-up company without any prior achievements, and limited funding. Three main contributions can be extracted from this research.

First of all this research empirically confirms the idea presented in Gawer & Cusumano (2008) that start-ups are likely to have a harder time negotiating with large enterprise customers. Although this idea seems logical, this researcher has no knowledge of it being shown in practice. Interviews with foodservice industry suppliers specifically show that those enterprises have no interest in doing business with small start-ups when there is still only a small upside for them, but are willing to cooperate once the platform matures.

Secondly, because this research shows that large enterprises (at least in the Dutch foodservice industry) are unlikely to cooperate with early stage start-ups the process model of MSP development by Tan et al. (2015) does not hold under the condition that one of the two parties on the platform in the nascent stage is a large enterprise. To deal with this issue it is proposed to extend the process model of MSP development with an extra stage, the inception or start up stage. Enacting MSP development of this stage will be a single sided platform or product.

Besides these two ideas the research contributes to theory by confirming, refuting and developing several design principles. The main contributions in this case are the development of a new principle, G11, and the knowledge that G1 and G10 are not useful for early stage start-ups.

### 8.2.1 Newness of the artifact

This study is one of the first to research the design and development of a digital multi-sided platform from inception. It is also one of the first to study the development of a multi-sided platform from the perspective of a start-up company without any prior achievements, and limited funding.

Although the technologies and knowledge used as a basis for this research are not new to the world, the author also has no knowledge of any multi-sided platforms in the foodservice industry.

### 8.2.2 Generalizability

A key element in the findings of this research is that the developed guidelines seem to hold for development of the platform for the hospitality side, but not for the foodservice side of the platform. The explanation for this is that the problem owner does not yet offer enough benefit to the large corporate suppliers in the foodservice industry. This means the design principles are generalizable to the design of platforms where the platform owner's size is at least the same order of magnitude in size as the other parties involved.

Furthermore there are two other main issues with respect to the generalizability of this research. First of all the research has been performed only on a single case. Secondly the research has only been performed during the very earliest stage of development. Continuing this research will allow to identify if the extracted knowledge is also useful in later stages of development, or if it can be used as a basis to reach those later stages at all.

It is expected that the knowledge developed during this research is especially useful for the design of early stage platforms. More specifically the design principles for such an early-stage platform are useful when the purpose of the platform is to enable interaction between small parties in a fragmented market, and large enterprise parties.

## 8.3 Contribution to practice

On top of the contributions to theory, this research also contributes valuable knowledge for practitioners. The main recommendation is to not spend too many resources on securing contracts with large enterprise stakeholders when the start-up company is still early stage, because these parties will probably not be interested. Instead efforts should be focused on developing a value-creating product with a solid business model that generates profit without including large enterprises. Contracts with large enterprises might be secured more easily in a later stage.

To problem owner Checkmetrix it is recommended to continue development of the dashboard data analytics solution. When the improvements from the previous chapter are incorporated into the current dashboards a valuable solution for hospitality entrepreneurs can be created. Once this product is created it can be rolled out in the Dutch hospitality industry.

Once Checkmetrix proves its capabilities and value by creating a successful hospitality product, this product can be extended to provide data analytics to the foodservice industry as well.

It is recommended to let any further development and design of the product be inspired by the design guidelines developed in this research. This will make the step towards an actual multi-sided platform easier to make once the time is right. It should however be noted that extra guidelines might be extracted from the literature that are specific to later stages of platform development.

## 8.4 Limitations & future research

Because of the time available for this research it was not possible to create a live version of the dashboards, based on real data from hospitality entrepreneurs. Such a prototype would be useful to better test the interaction of hospitality entrepreneurs with the designed artifact. Creating a completely working analytics solution will also show whether the data from hospitality enterprises actually shows meaningful patterns on which management decisions can be based. It is therefor recommended to first do a small-scale pilot in which data analytics can be fine-tuned before rolling out on a larger scale.

Although meetings conducted with suppliers during this research show promising possibilities to connect foodservice suppliers to the Checkmetrix platform this intention can only be validated once the product is rolled out in the hospitality industry. This means the strategy of developing a platform by first creating a hospitality industry product can only be validated if development of the platform is monitored in later stages as well.

Further validation of the business case on the side of the hospitality industry is needed as well. Although a total of 16 interviews were conducted over the course of this research this is not enough data to be conclusive on the amount of hospitality entrepreneurs that is interested in data analytics solutions. This is essential information to determine whether Checkmetrix can be successful without the support of foodservice suppliers. Because of this it is recommended to perform quantitative research on the amount of hospitality entrepreneurs willing to pay for the Checkmetrix solution. This can e.g. be done using a survey among hospitality enterprises.

Because the process model of MSP development by Tan et al. (2015) takes an IS capability perspective on MSP development it is important to research the Checkmetrix case from an IS capability perspective as well. This is needed to fully extend the model with knowledge on the specific IS capabilities for the newly added inception stage, so that it is in line with the rest of the model.

Finally, although the foodservice industry seems to be the most promising business case from the perspective of Checkmetrix, the company is also looking to deploy the Printerbox in different markets. An example of this is the fashion industry. In at least one of those markets Checkmetrix was able to secure a pilot with ING, a large international bank. This means that it must be further researched to what extent the idea that start-ups can hardly negotiate with large enterprises can be extended to outside the Dutch foodservice industry.

# 9 Reflection

This section is meant as a reflection on the research. First scoping of the project will be discussed. Following this I will reflect on platform theory and concepts used from the different streams as literature, as well as the used methodology. Throughout this reflection the conflicting perspectives of business and science are touched upon, so finally this section will conclude with a key lesson that anyone trying to do a research project within a start-up environment should take into account.

## 9.1 Scoping

One of the main challenges during the research was scoping of the project. When initially starting out, the plan, although ambitious, was to design and develop a first version of the platform that included parties from both sides of the market. Possibly the platform should even be applicable in other markets as well, as Checkmetrix is not only active in the foodservice industry. Understandably this goal quickly turned out too big, but focusing on the hospitality case did not stop the constant struggle to find the right balance of what needed to be done and put in the report from an academic, as well as business point of view. One of the main reasons for this is the need for academic rigor and depth on one hand, and the need for speed on the business side. Business decisions made based on knowledge from other Checkmetrix projects seem to influence strategies for the foodservice industry, and not every business interaction can be written down, meaning that some tacit knowledge is seemingly lost. In the end I think the key decisions that had a large impact on the hospitality case were included, but it was not always easy to keep track of all of them.

## 9.2 Theoretical concepts

One of the main issues this research tries to solve, the lack of knowledge on platform design, was also one of the main challenges when applying the extracted theory. It is often hard to know if a strategy is applicable to a start-up, but at least this can be tested, and it that way a scientific contribution can be made. More challenging is the fact that existing theory is often very high level, and lacking in practical applications. This is further complicated because most business stakeholders have their own ideas and experience about steps that need to be taken, not always informed by science. Luckily I was able to translate some of the guidelines from literature into practice, but it often required a lot of time and patience to align all stakeholders.

Platform theory was especially useful through the development of principles. The principles help to translate pieces of scientific literature into actionable knowledge. If the principles are precise enough it becomes possible to evaluate their use throughout the designing process, and possibly even contribute new principles. For a long time I did unfortunately not really understand the value of the principles, which meant they were not defined precisely enough. When this is the case the principles are more like empty shells that are not practically useful to design anything. Had the principles been defined more precisely in an early stage of the research I expect it would have been possible to test and apply them even more thoroughly. Besides this I was often struggling with finding the possibility for a scientific contribution, more precise principles would probably have made the research direction much clearer at an earlier stage.

With respect to the different perspectives on platform literature I think the economic perspective is developed the most, but at the same time it is also the most theoretical one, and very limited by large successful cases. This makes the concepts from this stream of literature the hardest to practically apply on the case of a start-up. The digital perspective on the other hand is much easier to apply as most of these concepts or much more practical (architectural considerations etc.). However, these concepts are also (understandably) very much like concepts from software design literature. This means the stream is especially useful for understanding the digital aspects of platforms, but from a design perspective I think it adds the least value because the principles are very much like existing software design principles. Although it was not needed to use all of the ideas from the ecosystems & governance streams I think the socio-technical

complexity that is inherent to platforms is very well understood and clarified by the researchers working on these topics. The studies with respect to boundary resources and platform openness are very helpful to understand the interrelationship of technology and its ecosystem, as well as the interactions that shape both the technical artifact and its surrounding. On top of this they take an approach that is practical enough to successfully translate the knowledge into actionable principles, but still challenge the designer to consider the pros and cons of their decisions. Something that when done thoughtfully might actually give platform providers an edge over their competition. A great example is the literature on platform openness. Although there is no clear "right" answer, the theory gives designers all the knowledge they need for their specific situation.

## 9.3 Methodology

One of the areas were science and practice were (to me) surprisingly in sync was design methodology. The design cycle of Verschuren & Hartog is not unlike a regular design process used in business and especially the prototyping step is very useful. This prevents that resources are spent on functionality that turns out to be unnecessary. Although I would have liked to design and develop a platform that is more technologically advanced and production ready, the research, as well as Checkmetrix, is just not yet at that stage. Sticking to the prototyping phase, and thoroughly evaluating the results helped to scope the research, as well as limit the resources needed from Checkmetrix.

Besides applying theoretical ideas to practice, business goals occasionally also conflicted with science. Getting in touch with FMCG parties, or even contacting bar owners to use their time for scientific interviews is not always possible if deals need to be closed. This sometimes seemed to slow down research, but in the end information could always be extracted from different sources or at a later stage.

## 9.4 Conclusion

To conclude there is one key lesson that I would like to share with any future researchers or students planning to do a thesis, or different research project, with an early stage start-up company. Although the work can be very rewarding because it is possible develop scientifically relevant knowledge, while at the same time making an impact on a real business, there is also a risk of running into problems that no amount of planning or hard work can overcome. I was lucky that there was still a possibility to build an initial platform for the hospitality when initial meetings with FMCG companies turned out unsuccessful, but the business decision to stop work on this case altogether might have been made just as easily. And in that case a lot of hard work and time would have been lost.

# 10 Literature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# I. Semi structured interview

**Analytics**

- What financial data do you use to manage your company
- What insights do you get from the POS? How do you do reporting?
- How do you monitor performance? How do you act on this?
- How do you recognize trends?
- Do you work together with your supplier or competitors (other bar owners)
- What kind of insights would you like to have / improve in your company?
- Do you use any administrative technology? What kind? What problems do you experience with this?

**Supply chain**

- How do you manage your inventory?
- What does your order process look like? How often do you order?
- How much time does this take you?
- What could be improved in this process?
- Are there any other problems you perceive in the ordering process?

**Sharing**

- Introduce Checkmetrix platform
- Would you be willing to share sales data with your suppliers in order to make your buying process faster and easier, why?
- Would you be prepared to share sales data with suppliers to need lower inventory, why?
- Would you be willing to share sales data with your suppliers to get insights into benchmarks and trends in the hospitality market, why?
- Would you be willing to share anonymised sales data with your colleague hospitality entrepreneurs to get insight in your own performance compared to the rest of the market, and trends, why?
- Would you like sales data in an app on your phone, why?

**Apps**

- Do you offer the use of any mobile apps in your business (e.g. loyalty, mobile payments)
- Would you be interested in offering any (or multiple apps)? What kind?

**Finish**

- Who is your beverage supplier?
- Who is your food supplier?
- Would you be interested in doing a pilot

# II. Semi structured interview results

| **Company data – I1** | |
|---|---|
| 20 employees, half kitchen, half service. +/- 750,000 revenue. | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Since July 2014 accounting has been automated. No backoffice system connected. Uses "stuklijsten" to check inventory. Especially interesting to see what busy hours are. Omzetgroepen / Urenstaat manually inputted into Exact. Takes +/- 3 hours per week, but not done weekly. Generally done at once about quarterly. |
| POS (Q2) | Eijsink Vectron (omzetgroepen, urenstaat). Chose to buy exact because of promised connection to Eijsink, but not developed after all. |
| Performance (Q3) | Mainly uses personnel planning to influence performance. |
| Trends (Q4) | Looks somewhat at trends, but not too much. Better to specialize a little bit and deliver quality. Especially listening to customers is important. |
| Insight wishes (Q6) | Lack of connection between systems. Using excel for personnel together with Eijsink/Exact. But connected systems are too costly. Easy to see fast selling products etc, not much need for. Benchmarks / area data / market research could be very interesting. Especially for starting entrepreneurs or when optimizing / rethinking company concept. |
| Inventory (Q10, Q11, Q12, Q13) | No automation. Easy to see what's in stock in the cellar + most ordering done by owner so not much need for checking. |
| Supplier cooperation (Q5) | Supplier accountants come by to sell new (types) of products -> very annoying. Uses Heineken for most liquors/drinks. Grape district for wine. No contracts with wine supplier. You agree on discounts with all suppliers. Can either be default number, or varying per product. Also depending on products they want to sell. E.g. grape districts want to market products they have in their own stores, so they give discounts to these wines. Heineken default discounts (/hectoliter, extra if you get pepsico etc). Melger as extra supplier for "special" beers. Heineken quite cumbersome to work with -> inflexible as organization. But as long as you do everything by the book they are fine. |
| Data sharing (Q8, Q9, Q14, Q15) | Could be interesting if suppliers can act on your data, however it could be a little negative if they know too much. Understands multi-sided aspect very well, but wants something in return (money, discount). Not sure exactly how much. Could also be possible to share the data if enough functionality is offered in return (analytics etc). |

| **Company data – I2** | |
|---|---|
| 1 venue but some of the owners own multiple. >1 million revenue / year. Just over 20 employees. | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Weekly meeting with management. Revenue vs. salary costs and buying cost is calculated weekly. |
| POS (Q2) | Le credit Sportif pos system (counter pay). Has cloud backend available on computer and phone, shows all kinds of statistics regarding sales (hourly/daily/monthly). |

| | |
|---|---|
| Performance (Q3) | Target is set for cost as % of revenue. However, outgoing is decided quarterly, because it varies a lot per week. Target does not vary per week, but assessed yearly (depending on how close to achievement, price fluctuation). Especially important to schedule effectively. Personnel are instructed to work efficiently. Besides this focusing on certain high margin profits helps to reach target. |
| Trends (Q4) | Trends do not have much influence in business. Although management does sometimes look at different venues / customer requests. |
| Insight wishes (Q6) | We try to structure ordering based on order lists. But these are quite variable depending on weather / availability etc. Need to sometimes double check employees on ordering. |
| Inventory (Q10, Q11, Q12, Q13) | Ordering done on daily/weekly basis by management and chefs. A little too small for automatic ordering. |
| Supplier cooperation (Q5) | Good cooperation with many small suppliers. No large supplier. Ruiker is middle man that delivers most foods/drinks from Kweeker. +/- 5% fee on top of bought goods). Some negotiation regarding price, but not much because service is generally good. |
| Data sharing (Q8, Q9, Q14, Q15) | Open to some data sharing, depending on return. However not much need, and not much trust in possibility for automation on top of current situation, so quite hesitant. |

| **Company data – I3** | |
|---|---|
| About 10 venues, varying revenue. Different concepts. Some restaurants, some coffee bars. | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Weekly collection of sales / inventory / cost data. Takes about three hours to create management report. Report created centrally. Time profit would be appreciated, however going through all the data helps to notify outliers in ordering / sales -> Then used to steer employees. |
| POS (Q2) | Different systems per venue. Most allow for the export of basic sales data etc. However, cumbersome to collect all data in single place. |
| Performance (Q3) | Performance management mainly by looking at personnel/product/real estate costs as percentage of revenue. |
| Trends (Q4) | |
| Insight wishes (Q6) | High wish for generation of management reports + connection to inventory /stock could be very interesting |
| Inventory (Q10, Q11, Q12, Q13) | Inventory management mainly done by local personnel, but needs checking. Generally not a problem to have a little stock of non-perishable goods, but aim is to keep low inventory. |
| Supplier cooperation (Q5) | Main beverage supplier is Heineken. Some local suppliers for foods etc. If stuff is available in multiple venues they try to get it centrally. Pricing arrangements are negotiated centrally, but managers in the different locations do ordering. Negotiation position is relatively good compared to other hospitality due to size. Not much space for specific arrangements with Heineken, but relationship is good. Heineken offers all kinds of default arrangements -> take glasses/viltjes etc more discount, draft course for employers -> more discount, specific product combinations -> discount. |
| Data sharing (Q8, Q9, Q14, Q15) | Open to data sharing, but return is needed. Analytic functionality is very interesting, but in turn for data to suppliers supplier data is wanted. So e.g. sales/inventory data from supplier. |

| **Company data – I4** | |
|---|---|
| 1 venue. +/- 600.000 revenue | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Not really using any data. Looks at product group end of the week but that's about it. Not looking at individual products. Uses Accountview for accounting, but only financial data. |
| POS (Q2) | Old Eijsink Toshiba cash register (no computer). Could get a deal to get new POS system, but investment is still a little too big. Not much investments funds due to large renovation. But eventually looking to automate. |
| Performance (Q3) | Owners are in the bar on a daily basis so performance is mainly through personal management. When starting out they did keep track of all kinds of statistics, but at the end of the day only revenue matters. Average client spending has been stable for years. Automation would be interesting when owning multiple venues |
| Trends (Q4) | Suppliers offer new products. Especially listening to customers. All-round assortment, generally following trends. First wants to see if it starts to become successful. A little tired from all the salesmen. |
| Insight wishes (Q6) | Not much right now. But when growing inventory management could be interesting. |
| Inventory (Q10, Q11, Q12, Q13) | Ordering per crate, just looking at inventory. Would automate ordering if owner wasn't in the venue on daily basis -> needed to check personnel. Gains can also be made with non-drips/electronic beer tap. But not very user friendly and large investment (thinks harder to draft nice beers). |
| Supplier cooperation (Q5) | Heineken is main supplier. But does not supply all products. Likes to work with smaller suppliers (grape district, maxim, cava Barcelona etc.) for craftsmanship and distinguishing from competition. Relationship not optimal (owners a little stubborn, likes to have certain products which Heineken prefers not to see), but has been ok for about 16 years, so not much to complain. Relationship is less personal, less contact. They seem less important to Heineken than in the "old days". Relationship also depends very much on specific accountmanager. |
| Data sharing (Q8, Q9, Q14, Q15) | Not really any issues with sharing data. Does not consider data to be very private / valuable. Sharing with competition could be ok as well, although anonymisation is important. Not quite sure what could be done with the data. Might need to think it through a little before deciding. Does believe in own strategy very much, no need to compare with different venues. Trend spotting could be interesting |

| **Company data – I5** | |
|---|---|
| Small venue, restart from bankrupt venue. About 150.000 revenue. Just two owners, no personnel | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Accountant does all accounting using excel. Uses exact sales data in excel to get insight into sales. |
| POS (Q2) | Very simple cash register. |
| Performance (Q3) | Not looking into performance right now. Would be very interested when business grows and owners aren't available all the time anymore. |
| Trends (Q4) | Looks a lot at different bars and restaurants to see what's going |

| | |
|---|---|
| | on. Also internet/social media and talking with guests. Some specific bars (especially successful chains used for inspiration). |
| Insight wishes (Q6) | Especially following trends is interesting. No need for internal insights, but looking around could be very valuable. |
| Inventory (Q10, Q11, Q12, Q13) | Inventory is counted once a year. No personnel, no need for checking. Likes large inventory so never out of stock. Plenty of space for storage. |
| Supplier cooperation (Q5) | Single supplier, Moos beverage wholesaler. Some smaller breweries deliver themselves. Liquor ordered online. Supplier thinks quite weird of ordering lots of specific products, its other clients have more homogeneous propositions. |
| Data sharing (Q8, Q9, Q14, Q15) | Open to data sharing for certain benefits. But wants to think it through / discuss with some people. No problem with sharing data with supplier. |

| **Company data – I6** | |
|---|---|
| Owners have multiple venues, Interviewee is manager of venue. Target is +/- 1.5 million revenue / year. Target audience 25-35 years old. +/- 30 employees | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Revenue is most important target, split into product groups. Also insight in specific products sold. Revenue/employee. Employee schedules. Takes about 6 hours per week to collect and analyze all data. Linda for hour registration. Sales data from POS, analysis in Excel. Main problem is different systems aren't linked and time needed for analyses. Point for improvement would be automatic recognition of inconsistencies in data + deviating patterns. |
| POS (Q2) | Gastrofix as POS. But not very happy with it. Hard to retrieve data / not very insightful. Very familiar with Eijsink -> it contains all the required data. In that case especially connection is important. E.g. 500 euro's on yearly basis for system that connects everything would be very cheap. |
| Performance (Q3) | Purchase should be max 30% of revenue, depends a little on products groups (beverage vs. food etc). Employee costs should be max 28% of revenue, but currently not achieved because business is still starting up. Weekly analysis of data (revenue / purchase). Full analysis on monthly basis. Analysis helps to identify problems and solve them. Also works the other way around if employee costs are relatively too low, more employees must be scheduled. |
| Trends (Q4) | Not shopping around very much yet. Just looking around in the neighborhood. Big trend is going back to quality produce. Very important to work with smaller specialty suppliers. Not much attention given to trend watching right now. |
| Insight wishes (Q6) | Patterns and inconsistencies recognition. E.g. warning when you purchased 40 corona's and only sold 20. Important to see cash / inventory inconsistencies. Missing products etc. Making existing sources easier to analyze. For example personnel schedules in Linda only show schedule, but not actual time employee worked -> needs to be manually calculated in Excel. |
| Inventory (Q10, Q11, Q12, Q13) | Uses purchase lists for ordering. Minimum and maximum inventory for each product. Ordering done on weekly basis. Inventory can sometimes go missing / be incorrect. Would like to automatically order, directly from POS. All inventory management is paperwork right now. |
| Supplier cooperation (Q5) | Heineken is main beverage supplier. Is responsible for largest part of revenue. Besides this Hanos as supplier for specialties. Cooperation is ok. Default hectoliter discount, quite large |

| | |
|---|---|
| | because venue is large. Cooperation with Heineken is quite different from cooperation with Hanos. Hanos does not really care about which products are being sold, as long as they are sold -> more conflict in negotiation. Buying process could be improved. Previously account manager would take order, now everything is digital or over the phone. Would like to automatically order, directly from POS. Sometimes prices go up without warning -> very annoying -> need for shopping around. |
| Data sharing (Q8, Q9, Q14, Q15) | As entrepreneur you want to know exactly what's going on in business, but you don't want too share too much. Sharing specific venue data is tricky, because it influences negotiation position. E.g you want supplier to see a "busy Friday night" because it will be easier to get certain discounts. In return for sharing data, data must be returned. Would be nice to for example connect to automatic ordering system. |

| **Company data – I7** | |
|---|---|
| About 10 employees. | |
| **Topic** | **Summarized answer** |
| Financial/administrative data (Q1, Q7) | Nearly none. Pretty much sends POS data straight to accountant. Little bit of Excel. |
| POS (Q2) | Bork. Not very happy with it, quite old. But easy to connect to laptop and view reports. |
| Performance (Q3) | No data analysis for performance management. Owner is in the venue nearly all the time. Trusted manager for the rest of the time. Personnel is sent home / scheduled based on what owner sees in venue / what is currently happening (busy/calm night). Not really any targets set for revenue / personnel / purchasing. |
| Trends (Q4) | Believes in own concept very much. Does see trend of many lunchrooms opening up in the neighborhood. But this is no reason for changing anything. Only "eetcafe" around and this seems to work very well. |
| Insight wishes (Q6) | Not really anything. Automatic ordering could be a nice to have. However, currently spends only about half an hour each week ordering, so not a big need for any improvements. |
| Inventory (Q10, Q11, Q12, Q13) | Manual ordering by owner based on what is in stock / expected. Main supplier delivers two times a week, so easy to order a little extra / less. Most ordering done manually over the phone. Some food suppliers have an app for easy ordering. |
| Supplier cooperation (Q5) | A few small suppliers for food. Heineken as main beverage supplier. Takes all beverages through Heineken. Real estate owner obliges main beverage to be Heineken, this has a big impact on hectoliter discounts (much lower because real estate owner takes a cut). |
| Data sharing (Q8, Q9, Q14, Q15) | Not really interested in data sharing or viewing any other data. Doesn't really care if others see his data, yet feels very hesitant to share. Discount/money would be best incentive (compared to extra insights), but even in that case probably not easy to convince. |

| **Company data – I8** | |
|---|---|
| +/- 90 employees, 5.5 million revenue annually. Franchise in large hotel/restaurant chain. | |
| **Topic** | **Summarized answer** |
| Financial/administrative data | Accountant does a lot of the work. Delivers monthly reports |

| | |
|---|---|
| (Q1, Q7) | with purchasing cost etc. (bills are sent straight to accountant). Excel for planning / performance management + Eijsink Diflexus (planning software). |
| POS (Q2) | Eijksink + Diflexus planning progam. Spent quite some time + money on setup, now gives all the required data. |
| Performance (Q3) | Eijsink Diflexus is planning software connected to pos system. Contains all reservations and current + historic sales. Based on this data it predicts revenue and calculates required personnel. Predictions are update every half hour. Very happy with this. Feels no need for further (automated) performance improvement -> is job of restaurant owner / manager to do these analyses. |
| Trends (Q4) | Looks at rest of the chain + nearby competitors for trends. Feels it is also job of suppliers to recognize trends in the market and sell products accordingly. -> if trend is missed this is fault of the supplier. |
| Insight wishes (Q6) | None to be honest. Spent large amount of money on pos + planning software and now supplies all the required information. |
| Inventory (Q10, Q11, Q12, Q13) | Chain has central purchasing organization that negotiates deals with preferred suppliers. Ordering is done manually by managers / cooks. Keeping track of stock could be better, but doesn't trust automated / technological solution. Too much loss in broken products / over date. |
| Supplier cooperation (Q5) | Beverage supplier is Bavaria, lots of negotiation power here due to large chain, so prices are relatively low. |
| Data sharing (Q8, Q9, Q14, Q15) | Not really interested in any data sharing. Understands competitive advantage of data, and has no need for data in return. Already much better insight into market due to sharing with rest of the restaurant chain. |

# III. Questions supplier research

**General**

- How much insight do you have in retailer data / supply chain?
- What kind of relationship do you have with retailers?
- Which problems do you perceive in this relationship?

**Analytics**

- What kind of data are you interested in?
- Do you have any insight into data from retailers?
- What kind of analytics solutions do you currently use? Are you ok integrating new solutions into your existing stack, or do you prefer integrations?
- What are you willing to pay /do for retailer data?

**Supply chain**

- How often do you deliver to retailers?
- Are you interested in further optimizations to your supply chain? Is this possible at all?

**Sharing**

- Do you cooperate with third parties / suppliers / retailers / competitors when it comes to data analytics / collection?
- Do you cooperate in any other areas? If so, which/how?

**Own organization**

- Do you perceive any problems/barriers within your own organization to employ new initiatives? What kind?
- How do you deal with this?

# IV. Summaries of supplier meetings

**Summary Heineken consumer & marketing intelligence (S1)**
Heineken is looking for data insights in out-of-home and hospitality market. Most important in this case is:

- Quick recognition of new trends so portfolio can be updated to consumer preference
- Increase share of wallet with regards to hospitality
- Offer relevant added value to hospitality entrepreneur through insights and advice from e.g. the account manager

Right now Heineken gets insight into the market by looking at orders and talking to hospitality entrepreneurs. This is only related to Heineken's own products. Entrepreneurs buy a large amount of products through other channels (supermarket, wholesaler etc) and Heineken wants insight into this data as well.

Besides stimulating sales through the hospitality channel consumers are actively targeted to buy Heineken produce through promotions.

Primary interest right now is data insights. Consumer targeting is a possible next step. Heineken is talking to several parties trying to provide data insights and consumer facing solutions. But none have been able to deliver a fitting solution.

**Summary Vrumona sales manager (S2)**
Vrumona has nearly no insight in sales. They try to retrieve data from the retailer, happens once a year and only shows data regarding Vrumona's products. Vrumona doesn't have its own wholesaler, so most sales go through distributors (Sligro, DeliXL etc.). Wholesalers traditionally don't sell any data. Foodstep is an initiative that tries to do it, but much too expensive.

Accountmanagers are responsible for maintaining client relationship. Visit clients regularly to make sure they are ok + try to sell new innovations. Contracts differ, usually for longer periods of time (1-5 years)

Vrumona makes selection of products for clients depending on client classification (location, type, size etc). Accountmanager tries to sell based on selection.

Most data analytics very general. Lacking in data to make substantial analysis. Most clients (hospitality) expect very little. Only some larger, younger entrepreneurs expect more professional approach. But large part of the market still consists of "fortune-hunters".

Some extra data about general market is through Datlink market research. They visit entire market, but only once or twice a year. So not very recent data. Also quite limited data (e.g. number of crates per week).

For Vrumona to join a project like Checkmetrix it is important to have a high density of retailers. Only when full market is included the data is relevant. In case proposition is really good for all sides, and provides lots of insights for e.g. account managers it might be possible to have account managers promote CM to clients.

**Summary Heineken enterprise architect (S3)**
Heineken seeks to influence consumers on the moment of ordering, programs should also benefit bar-owner.
Data/analytics program is very interesting. Heineken might be a client. Heineken as a program owner could be problematic in some countries due to competition issues. This could be solved if Checkmetrix served as data-broker.
Heineken is very interested in having data on distributor level.
App only programs are not preferred, it proves difficult to have consumers download an app. Solutions should also work via wifi/browser.

**Summary Friesland Campina (Market insights foodservices) (S4)**
Market insights foodservices closely cooperates with sales and marketing. Supply market insights, support sales strategy, dashboards, forecasting etc. Pretty much everything that requires market analytics. Foodservices spans all channels except supermarkets (those are retail).
Currently very limited insights into out-of-home channel. Data is a collection of different sources; wholesalers, Nielsen`, Gfk etc. Data is often incomplete, missing address, competition data, not real time. GFK data is not very reliable en very expensive. Nielsen only has supermarket data.
CRM tool is Datlinq.
Data becomes more useful when its more specific, especially location is important. Needed coverage differs per industry, generally useful when > 30%.
Campina has no contact with consumer, everything goes through wholesaler.
Biggest interest is in analyzing market share, sales impact and resource planning. Following this consumer insights and benchmarks. Eventually there might be some interest in customer interaction through apps.

**Summary Ab InBev (S5)**
AB Inbev wants full data visibility for all customers across Europe. Very strong competition with Heineken. Worried cooperation is just to secure stronger position in negotiation with Heineken -> AB InBev wants exclusivity.
Would like to know what retailers sell besides their products, and from which channels that is retrieved.
No contact with consumer in out-of-home, very interested in getting in touch through that channel as well.
Also looking at CM competitors (weissbeerger) They have full blown offerings (including analytics, data processing etc) and very specific data. Sensoric data -> tap measurements etc. However these require harder negotiations with bar owner.
Main points for comparing alternatives

- Price of data stream
- Price / timeline for convincing bar owner
- Price / timeline of setup of analytics.

# V. User stories

| | **Must-haves** | **Nice-to-haves** |
|---|---|---|
| | As Bas, a manager, | As Bas, a manager |
| **Functional** | 1. I need to get an overview of all the sales in my venues, so that I can check inventory levels<br>2. I need the Checkmetrix system to also integrate with my purchasing and accounting software, so that I don't need to spend any more time collecting all my management data | 3. I want to add extra data (e.g. schedules, purchasing data) to the Checkmetrix dashboards, so that I can make more elaborate analyses<br>4. I want real-time insights, so that I can immediately respond when something goes wrong in one of my bars or restaurants.<br>5. I want to be able to trigger alerts when patterns are out of the ordinary, so that I can better monitor what's going on in all of my venues<br>6. I want to be able to track specific products, so that I can monitor the effect of marketing actions (e.g. discounts) |
| **User** | 7. I need to be able to create my own dashboards, so that I can analyze the data according to my own needs<br>8. I need be able to view multiple of my restaurants in the same dashboards so that I can compare performance<br>9. I need to be able to set my own KPI's, so that I can really see what's going on in my business | 10. I want to be able to manage access to the dashboards, so that I can share some of the data with my managers<br>11. I want to be able to aggregate the results of different restaurants so that I can see how my company as a whole is doing<br>12. I need to view historic data so that I can compare performance with past years. |
| **Context** | 13. I don't want to automatically share all my sales data with my suppliers, because it might decrease my negotiation power | 14. I want to be able to view benchmarks of the market, so that I can better understand my competitive position |

**Table 26 - User stories Bas Verhoeven**

| | **Must-haves** | **Nice-to-haves** |
|---|---|---|
| | As Freek, a manager, | As Freek, a manager |
| **Functional** | 1. I need to include personnel schedules, because this is how I can get the most benefit from analytics | 2. I want to trigger alerts when patterns in the data are diverging from the ordinary, so that I can sooner identify problems in my bar<br>3. I want to connect the sales data to my purchasing system, so that I can automate ordering of products<br>4. I want to predict targets (amount of personnel / purchasing) for specific times, so that I can achieve higher profits |
| **User** | 5. I need the dashboards to give me a simple overview of my sales, so that I can check the performance of the restaurant | |

| | | |
|---|---|---|
| | 6. I need the dashboards to give me weekly overview of sales, so that I can use this to adjust my ordering<br>7. I need fixed dashboards, so that I don't need to spend any time setting up analytics | |
| **Context** | 8. I want to automatically export sales data to my bookkeeping software, so that I need to spend less time on keeping the books up to date | 9. I want to know how I'm doing compared to neighboring restaurants at specific times, so that I can adjust my marketing and personnel to this |

**Table 27 - User stories Freek Janssen**

| | **Must-haves** | **Nice-to-haves** |
|---|---|---|
| | As Loes, an entrepreneur, | As Loes, an entrepreneur |
| **Functional** | | 1. I want to see how I am doing compared to my competition, so that I can learn from them.<br>2. I need to get an overview of trends in the market, so that I don't miss out on any new products |
| **User** | 3. I need the dashboards to be very simple, so that I don't need to spend any time learning how to use them | |
| **Context** | | |

**Table 28 - User stories Loes de Jong**

# VI. Evaluation interviews

**I1 - Café de Beierd**

| Question | Answer | Open code |
|---|---|---|
| General | +/- 700.000 revenue, 34 employees. Owner has one other bar. Creates an Excel file on weekly basis to do little bit of performance management. | • 700.000 revenue<br>• 2 venues |
| | **Formative** | |
| 1. | Have something like this in Excel. Most work is needed for data entry. Missing connection from cash register is annoying. | • Would use<br>• Has similar |
| 2. | Very interesting. Would like to have it, but too much work to create this. Very clear, also to look back for a couple of weeks. Only makes daily analysis otherwise hour – hour entry must be done. CM solution could be helpful for tablets etc. as well. Because they often miss back office | • Would use<br>• Too costly to create himself |
| 3. | Interesting chart. Could for example be used for looking at popular products. However, popular products analysis is done based in purchase data. Brewer keeps track if it as well and shares the data. Automatic ordering based on this as well. (Charts look pretty much the same as designed chart). Could be interesting to look at market averages. Is doing this right now, but more based on feeling. Could be helpful to identify trends sooner. Might not do all the fine-tuning himself, would listen to customers and brewer sales. Brands etc. don't really matter, only for the brewer. Customers will just choose from what's available | • Would use<br>• Has similar<br>• May be add market average<br>• Brewer creates product analysis<br>• Does based on purchase data |
| 4. | Very clear graph. Not sure if he would use it. Not really need for this kind of insight | • Won't use |
| 5. | Multiple axes are confusing. Could be "funny" to know this. But most of this data is pretty logical for owner of the bar. Not really much news there. | • Might use<br>• Remove third axis |
| 6. | Revenue per table is very interesting. Can do analysis on what tables are most profitable. Could be helpful for redesigning layout / decision to split up large table into multiple small. E.g. group tables perform worse if not filled by full group but multiple groups. | • Would use |
| 7. | Very useful for larger venues. But not necessary here, usually not more than 1 or 2 employees in the venue | • Won't use<br>• Not needed |
| 8. | Yes very interesting insights. Might not be necessary in venue this size | • Yes<br>• Not all needed |
| 9. | Yeah, could be useful to look at multiple venues / possibly even rest of the market in city | • Yes<br>• Useful to get overview of multiple venues |
| 10. | Yes, more than enough | • Yes |
| 11. | No, cannot send personnel home based on current sales. Just plans personnel + one backup in case its really busy. And usually busy, so no need for fine-tuning | • No<br>• Planning is set<br>• No room for optimization |
| 12. | No, purchasing is already automated with brewer | • No<br>• Automated purchasing |

| | | |
|---|---|---|
| 13. | Yes, very clear. | • Yes |
| 14. | Yes | • Yes |
| **Summative** | | |
| 1. | Would use this on a regular basis. Has some of this stuff in Excel, so is already doing it to some extent | • Weekly |
| 2. | Saves about an hour per week. Connecting to accounting software would also be very useful. Because accountant does entry right now as well. | • 1 hour per week<br>• Possibly more for accountant |
| 3. | Depends on whether it's recurring or one off fee. Prefers one off fee. But understands most profitable recurring. Expects 100 – 200 / month. Looking for actual cost savings (not just time), because that's how hospitality works | • Not sure<br>• Prefers one-off<br>• Expects cost to be 100 – 200 / month |
| 4. | Could be interesting, but not really sure what else is needed. Very fun/interesting to look at the market data. Delft municipality actually had an initiative collecting data from all hospitality/shops in the city center. Also combined with e.g. parking garage etc. | • Market data |
| 5. | Nothing specifically | - |
| 6. | Yes. Bar joined in this as well. Unfortunately didn't really take of because other bars felt uncomfortable sharing data and people were slow / inconsistent with data entry. | • Yes<br>• Similar initiative in Delft |

**I2 - Café de V**

| **Question** | **Answer** | **Code** |
|---|---|---|
| General | Café/Restaurant, 92 seats. Just over 1 million revenue. Creates spreadsheet with products groups every week. (beer, sodas, wines, condiments, food etc. related to percentage of revenue). Spends about 1 hour per week on this. | • 1 restaurant<br>• 1 million revenue |
| **Formative** | | |
| 1. | Thinks average revenue is only relevant after a year. Revenue per week varies a lot depending on what time of the year. Also differs per city. E.g. February all students in Delft are on winter sport, so pretty much empty venue then. Also not interested in this data when correcting for these issues. Because days per week also differs. E.g. around Christmas two closed days, events (liberation day, sports events) etc. all influence data. E.g. average revenue on Friday / Saturday is 3000 - 5000. But if king's day is on Wednesday this heavily influences the entire week. Market average could be interesting, but very important to use same types of venues. Hard to make the distinction. Revenue per client (dining) would be very interesting. What are the reasons why average per client differs per day? | • Would use on conditions<br>• Correct for events/activities<br>• Include revenue per client |
| 2. | Has something like this. Not per hour, but per shift. Has a lot of set employee schedules (cooks, cleaning etc.). Uses total revenue + employee cost as percentage of this to monitor performance in his own spreadsheet. Thinks this is especially useful in larger company, or catering | • Might use<br>• Has similar<br>• Show per shift<br>• Include employee cost |
| 3. | Very interesting, but easy to manipulate. Also very dependent on personnel actions. E.g. training employees on specialty drafts heavily influences beer sales. This could be very useful to monitor effects of hit training (selling specific products). Hit trainings are done to | • Might use<br>• Useful for hit training<br>• Interest in product combinations |

| | | |
|---|---|---|
| | increase revenue (train employee in understanding wines etc.) or getting rid of some products. Not very interested in trend analysis, sales are very much season dependent. And doesn't really go with hypes (e.g. not doing gin tonics because clients don't ask for it, and not promoting it). | |
| 4. | Is especially interesting when full day business type. So when also offering breakfast and coffee etc. Not here, because kitchen opens at 1800 and closes at 2200. So revenue distribution is pretty much the same every day. Except for end of September Saturdays because bar has live music then. | • Won't use<br>• Interesting for full day restaurants |
| 5. | This one is actually pretty much what he creates himself. Adding margin could be interesting, but average per product group might not be useful. Calculates cost/benefit of entire menu, corrects low margin on some products with high margin on different products. | • Would use<br>• Has similar<br>• Include margin |
| 6. | 6.1 very interesting. For example to look at difference in product sales (e.g. same amount of sales for dinner throughout week and weekend, but more wines/beers during weekend). Could be reason to do hit training on wines in the weekend. This way personnel can better advise clients (and sell more expensive wines / get better, returning clients). Revenue per table is not useful per se. Some customers want specific table, but that is usually not related to what they order (might sometimes be a coffee, sometimes full dinner). Could be useful to e.g. check if you sell toasted sandwiches to see if tables next to the toaster sell more sandwiches. | • Would use revenue distribution<br>• Useful for hit training<br>• Would not use revenue per table |
| 7. | Could be interesting. But very important to see in perspective. E.g. if its really busy on the terrace you can't really be mad on someone who is serving in the back. Important measure is tip. If there is a lot of tip customers are happy. So if the averages tip is low on an evening this is a measure of personnel effectiveness. | • Might use<br>• Probably for larger enterprises<br>• Needs interpretation |
| 8. | Yes, most of the insights are useful. Not sure if all would be used | • Some |
| 9. | Not for me, just one venue. | • No |
| 10. | Yes, but very important to also include events/festivities etc. | • Yes |
| 11. | Not really. Schedules are pretty much ok. Will know if personnel needs to be send home. | • No<br>• Not needed |
| 12. | Not really. Deliveries are made regularly, nothing wrong with ordering. Some charts are useful to help run out of old products (combine with hit training) | • No<br>• Not needed |
| 13. | Yes, very helpful. Just like I have it right now | • Yes<br>• Has similar |
| 14. | Yes, some of the dashboards are very useful for spotting patterns. In the bar most of the time, so not really a need for this though. | • Yes<br>• No real need |
| **Summative** | | |
| 1. | I would use it as a guiding tool. Not so much as main steering device. Could be add-on on the Excel. But would be important to also include personnel schedules (and costs). | • Weekly |
| 2. | Yes, would save about an hour per week. | • 1 hour / week |
| 3. | No. I would need to make cost benefit analysis. I expect my hour spent to be much cheaper. (estimates himself | • Time savings is about 100 |

| | | |
|---|---|---|
| | 100 euro per hour, so dashboards should cost less). Thinks this is especially useful in larger venues. I already know most stuff, so dashboards not as necessary. I just started, so definitely prefer to do it myself. Even if costs are only 20/30 euros per month. | euro/week<br>• Hesitant to pay anything |
| 4. | Personnel schedules must definitely be included. | • Personnel schedules + cost |
| 5. | Add tip if possible. (may be add manually). | • Employee tips |
| 6. | Only if I receive money in return, not just for dashboards. Also perception, doesn't feel right that data is "out in the open". Not sure what data is worth specifically. | • No<br>• Wants money |

**I3 - Joost van Maarschalkerweerd**

| **Question** | **Answer** | **Code** |
|---|---|---|
| **General** | 5 businesses. Ranging from small restaurant to large beachclub. | • 5 restaurants<br>• 1 – 5 million |
| **Formative** | | |
| 1. | Revenue very important. Comparing with average is interesting, but shouldn't require too much attention. Differences from average are usually easy to explain (weather, season etc.). Especially interesting to see how revenue is build up, and what productivity is needed for this. Comparing different businesses is hard. Uses Nostradamus (reservation system) to get some insights Revenue per employee hour is most important. | • Would use<br>• Average not very important<br>• Add revenue per employee |
| 2. | Very useful. Personnel are not proactive. This might be a way to check of work is done efficiently. Managers should use these chart to manage personnel. Makes organization efficient. Hourly division is fine. | • Would use<br>• Hourly scale is ok |
| 3. | Very interesting. Should connect this to purchasing. Lots of mistakes are made in this. Connect to minimal order quantity and create purchasing order from this. Could also be useful for pricing adjustments and assortment. Trend watching also very useful. The sooner you jump on it, the better. Same for testing marketing and sales effectiveness. | • Would use<br>• Connect to purchasing<br>• |
| 4. | Not convinced by this one. Leaves a lot to interpretation. Very dependent on personnel / management. Revenue distribution is a feeling. | • Won't use<br>• Too much room for interpretation<br>• No need for revenue distribution |
| 5. | Not very interesting in my type of restaurants. Very set concepts / homogenous. This is the easiest way to make a lot of money. Something like this could be especially useful in broader concepts or for events. | • Won't use<br>• Might be useful in different type of restaurant |
| 6. | Understands the value, but wouldn't use it. Really just looks at his concepts. Feels when planning (and on the floor) what it should be like. Management also won't like this, too complicated. Should only use a few charts, or it becomes too complex. | • Won't use<br>• Too complicated for management |
| 7. | Very useful. Currently no way to see employee productivity and fluctuations in this. Chart like this also creates sense of social control and competiton. | • Would use |
| 8. | Yes very much. Not all though | • Yes<br>• Not all |

| | | |
|---|---|---|
| 9. | Aggreggating multiple venues is not very useful, always looking at specific business at specific time | • No<br>• No need for organizational overview |
| 10. | Yes, more than enough flexibility | • Yes |
| 11. | Yes, if there aren't too many dashboards | • Yes |
| 12. | Yes, especially if system automatically creates ordering charts. | • Yes |
| 13. | Yes, gives very good overview | • Yes |
| 14. | Yeah, would be very useful for recognizing differing patterns. | • Yes |
| **Summative** | | |
| 1. | Yes, would use them weekly | • Weekly |
| 2. | Hard to estimate extra time savings, because organization is already using reservation/planning system | • Not sure<br>• Already has planning system |
| 3. | Pays 50 / month for current package. Definitely willing to pay something like this, or even more if CM is more effective. | • 50 euro / month |
| 4. | Personnel planning and purchasing connection would be very useful | • Personnel schedules + costs<br>• Purchasing data |
| 5. | Nothing really | - |
| 6. | Anonymous sharing is not a problem. Especially if dashboards are effective he doesn't care | • No problem at all |

**I4 - Jos**

| **Question** | **Answer** | **Code** |
|---|---|---|
| General | Very large beach pavilion, 60-80 employees, 800 seats. Do a lot of data analytics using data pro. Restaurant management system, continuously provides feedback on revenue, personnel cost, purchasing etc. Integrates pos, personnel and purchasing. | • > 3 million revenue<br>• 1 business |
| **Formative** | | |
| 1. | We use something like this. Not in chart form though, just overview in a table. Could probably get a chart if necessary. Existing system also shows personnel and purchasing as percentage of revenue. Very helpful when managing (current personnel cost are 25% of revenue). | • Would use<br>• Has similar (in table form)<br>• Include personnel and purchase cost |
| 2. | Also use something like this, just not in chart form. Can even get it on his phone etc. | • Would use<br>• Has similar |
| 3. | Also have something like this. Existing system keeps track of stock so shows all this data. As well as margin per product etc. Trend watching etc. (stijgers/dalers) isn't really used. Stock list is used for ordering. Trend watching using system is probably not useful | • Would use products sold<br>• Has similar<br>• Would not use stijgers/dalers |
| 4. | This is interesting. Actually don't have something like this in existing system. Could be useful to monitor hit training results. Not sure if system is necessary for this, because most of this stuff is easy to see on the floor. Must be careful to not create too much distance between management and employees. Its important to still be on the floor. | • Might use<br>• Personal touch is important |
| 5. | Revenue per product group is definitely something we | • Might use |

| | | |
|---|---|---|
| | look at. However not sure if we would actively use it to e.g. make changes to how business is done. | |
| 6. | Very interesting this. Could be very helpful to check if tables are performing as expected (and what employees are related to this). Also very interesting to see over time. Not very useful to for example change table setting. Can currently get table performance in a specific year. But characteristics of table decide performance (out of runway, away from toilet, not in the wind etc.), this won't change because of numbers | • Would use<br>• Combine with specific employees<br>• Not used for table setting |
| 7. | Interesting to see employee performance. Currently employees have their own wallets. So end of the day all wallets are counted, and this is a good indicator of performance. Usually you can find out the reason for lower performance, but most of the time you can't really do anything about it. And usually also no reason to take action, as long as it happens occasionally. Viewing over time (multiple weeks) could be useful though. Also helps to make a division of what part of the terrace to schedule people. | • Would use over time<br>• Not needed for operational management |
| 8. | Yes. It would especially be useful if charts are automatically generated on weekly/monthly basis. Helps to compare with previous months. Current system doesn't allow this. | • Useful for long term analysis |
| 9. | N/A (only one venue) | |
| 10. | Yes, daily/weekly/monthly is more than enough | • Yes |
| 11. | No not really, scheduling is already done using existing systems. Not very happy with this though. Reason is that schedules are sent over mail and a lot of employees don't open their email regularly enough. | • No<br>• Has solution |
| 12. | No, is already automated using existing system. | • No<br>• Has solution |
| 13. | Yes, but this is not something new. | • Yes<br>• Not needed |
| 14. | Yeah, pattern recognition is much easier. Especially if you can view multiple weeks | • Yes |
| **Summative** | | |
| 1. | Yes, probably on a weekly or monthly basis to look for patterns and as an extra tool. Definitely use it during the monthly meetings. | • Monthly |
| 2. | Not really, but they would be helpful to may be motivate personnel and view teams in a different manner. (E.g. show who's doing well, may be challenge them to improve). | • No<br>• Helps to motivate<br>• Improves understanding |
| 3. | Hard to say. Not sure what existing system costs. Was developed in cooperation with developer, so had a large discount there (have been using it for 4 years). | • Don't know |
| 4. | Can't think of anything right now | - |
| 5. | Nothing really. Existing system includes a lot of stuff already | - |
| 6. | Yes, definitely. Brewer (Grolsch) is already a partner for us, and they have a big share in the success. So I'm fine if they get this data. They already have their own insights anyway. | • Yes<br>• No problem at all |

**I5 - Krik**

| Question | Answer | Code |
|---|---|---|
| General | Owns 10 bars/restaurants. All generate over 1 million in revenue. | • 10 restaurants<br>• 1 – 5 million |

| | | |
|---|---|---|
| | | revenue each |
| **Formative** | | |
| 1. | Dashboard is clear. Very interesting. Especially helpful to look for reasons why performance is of. Looking at external factors like weather, festivities etc. But those don't need to show in the chart. We know them ourselves. And often it will be internal factors, like organized drinks or barbeques. Also not really possible to keep track of those events, it will become too administrative / scientific. Could be a good idea to add the same week last year, that's often a good indicator | • Would use<br>• Include last year's data,<br>• Do not include extra factors/events |
| 2. | We sort of do this, not by the hour though. Very useful to plan employees. Hourly detail is fine for this. Will get Eijsink personnel planner in a week. That helps to match personnel cost and revenue (contains salaries and planning etc). Data in there is presented in a table, so a chart like this could be beneficial for easily understanding what's going on. Average in this chart is also very useful to include. Especially useful operational. Managers always find it hard to make decisions on sending employees home, because there is a risk that it might become busier later. From an organizational perspective we find it hard to pinpoint when and why managers make mistakes in this. A chart like this would be very useful. | • Would use<br>• Uses similar<br>• Include average<br>• Use hourly detail level |
| 3. | This is especially useful for food, not so much beverages. For example when introducing new menus it can be used to test what products are working. In this setting also very useful to check what combinations are being sold (main course + sides, or also starter?) Looking at market average could be interesting if you can look at specific venues (local). We don't really look to the market anyway. Comparing is hard, because there are so many different concepts. Biggest drivers for doing well are continuity in quality and sales. | • Would use<br>• Only for food<br>• Interest in product combinations |
| 4. | Not immediately clear what this dashboard conveys. Not sure if it would be very useful. Probably change axis to show weekly. We generally analyze per week. It is interesting, but we probably wouldn't use it continuously. | • Won't use<br>• Change time axis |
| 5. | Not very clear this one. Third axis makes it hard to understand. Would definitely recommend to only use single axis. In case using multiple axis, probably a good idea to relate the color of the line to the color of the axis. Revenue per product group is very clear. Would like to see it per week as well (instead of days). Would use it. We set targets for margins on food, drink and employees. Would again be very useful to see what combinations are being sold. | • Remove third axis (price)<br>• Would use |
| 6. | This one is very clear. Really conveys the size of the different product groups and how they relate. E.g. interesting to see when breakfast is doing well, when lunch etc. Table is interesting to see, but we don't really make any changes to adjustments in seating. Generally make it once, and then leave it at that. But this differs per entrepreneur. It is interesting to see which neighborhood is doing well. Especially for some | • Would use<br>• Show neighborhoods in tables chart<br>• Not used for table setting |

| | | |
|---|---|---|
| | of the larger venues. | |
| 7. | Very interesting. Would especially be used in a positive manner. See why certain employees are doing well, and see if this can be taught to other employees. Might be interesting to relate to the previous (table) overview. That way may be correct for busy neighborhoods. Could be useful to relate it to average spending per client. That way you can check if someone is doing well because he is in a busy are, or actually selling relatively more products. | • Would use<br>• Getting similar (Eijsink planner)<br>• Relate to tables<br>• Relate to average spending per client |
| 8. | Yes, they offer very useful insights. | • Yes |
| 9. | Could be useful. Interesting to see an overview of the entire organization. | • Entire organization is useful<br>• Single venue is useful |
| 10. | Yes, changing to this precision is more than sufficient. Most analysis is done on weekly basis | • Yes<br>• Mainly weekly |
| 11. | Yes, I think its useful to schedule personnel. Especially dashboard 2 is useful for this. | • Yes |
| 12. | Theoretically yes, but in practice probably not. We just have a set amount of stock (based on average revenue). This is just re ordered when it gets lower. We pretty much never run out of stock, and if it happens it's restored the next day. Most suppliers deliver 6 days a week. Only way to may be do it with a prefilled ordering list based on sales. But only for beverage in that way. Food is harder, because you also need to keep track of ingredients etc. | • Not practically<br>• No need for better purchasing |
| 13. | Yes very useful | • Yes |
| 14. | Yes, it's very useful for spotting diverging patterns. Especially when (weekly) averages are included. | • Yes<br>• Include more averages |
| **Summative evaluation** | | |
| 1. | Talk with managers on a weekly basis. These charts would be very useful in conveying what's going on, and where adjustments need to be made. Would definitely use it regularly. | • Weekly |
| 2. | Yes it would save some time. But the biggest benefit is extra insight, not so much time savings. Right now we also spend time filling bills etc., so if that could also be automated it would be a time saver. | • Not much timesaving<br>• Include more functionality |
| 3. | Would probably be a monthly fee. It depends a little bit on what extra functionality is added, but probably somewhere between 10 – 30 euros per month. If bills etc. are added it would be worth a lot more. That would save about 4 hours per week. And if we add more locations this time only increases further. Working on pilot with accountant to get complete insights, this will cost 50 euros per location per month. | • 10 – 30 euro / month<br>• Up to 500 / month depending on added functionality |
| 4. | Personnel schedules are important to have, as well as personnel costs. | • Personnel schedules<br>• Personnel costs |
| 5. | Including supplier's bills would be very useful. That way a complete overview of the business can be created | • Purchasing bills |
| 6. | Yes sharing the data in return for the dashboards is absolutely no problem. I don't really think someone | • Willing to share |

| | | |
|---|---|---|
| | can really use our bar's data. Especially not when it's anonymous. | |

**I6 - Barbarossa**

| Question | Answer | Code |
|---|---|---|
| General | Single beach club (two until last year). Annual revenue +/- 1.5 million. 6 full time employees, 70/80 part-time. Has waiter pro POS. | • 1 venue<br>• 1.5 million revenue |
| **Formative** | | |
| 1. | Is the average revenue last year's revenue? I think it could be useful if you have an all year round business. Here everything is pretty much dependent on weather and holidays, you basically have to get all your revenue in three weeks time. So this might not be very useful. Currently wouldn't use it. | • Would not use<br>• Almost all revenue dependent on external influences |
| 2. | This is useful. In current system it also shows personnel as a percentage of revenue. But I would definitely use this as well. | • Would use<br>• Include personnel cost<br>• Has similar |
| 3. | This is interesting. Actually miss something like this in current system. Right now all stocking is manual. Something like this could be very useful. Especially if you do a base count, and than automatically create new ordering lists. Increase/decrease in products not really relevant. You can infer this from the top products chart. I would use that. | • Would use<br>• Add automatic ordering |
| 4. | I'm not really sure what this chart shows. This is sort of a global overview, instead of specific? Could help to see distribution in the blink of an eye. If I had it in the cash register or in an app I would probably use it. May be to check if specific product sales are as expected. If they are too low instruct personnel to focus more on those sales | • Would use<br>• Use for hit training |
| 5. | Third axis is not very useful. Average price per product group is not very interesting. So I wouldn't use this. I wouldn't really use the second one either. In an ordinary bar pattern recognition could be interesting, but here it depends on the weather. Not really necessary to go into it. | • Would not use<br>• Third axis unclear |
| 6. | Could be useful to check table setup. A lot of this is dependent on where the wind is coming from etc. But using a chart like this could help to check if planning was right. May be see if moving around at the beginning of the year impact sales. Also useful to check if personnel working specific tables is underachieving. | • Would use<br>• Table resetting<br>• Employee performance |
| 7. | Is in fact quite a lot like the previous one right? Except that it's directly connected to the employee. I would probably use this one even sooner to check employee performance. Also very useful if you're not in the restaurant all the time as an entrepreneur | • Would use |
| 8. | N/A | • Single venue |
| 9. | Yes, definitely don't need more. You only need to look at June, July, August anyway | • Yes |
| 10. | Yeah, would have to discuss it with managers. Discuss with them where the problems are. Could work I think. | • Yes |
| 11. | Yes, especially if you add the automatic ordering lists. In that case system would also map products to ordering quantities (e.g. 24 bottles of wine in a box -> | • Yes<br>• Add automatic ordering |

| | | |
|---|---|---|
| | order a box). | |
| 12. | Yes, very clear | • Yes |
| 13. | Yeah I think it could be useful for this. But we have no need for it. Because I know the reason why sales are up or down, and we only work such a small part of the year that there is no need for recognizing diverging patterns (and acting accordingly). | • Yes<br>• Not needed |
| **Summative evaluation** | | |
| 1. | Yeah, I think daily some of them. The top products, or employee performance e.g. But not all of them. | • Yes<br>• Daily/weekly |
| 2. | Yes, eventually. If you sit down with the managers it could save time to communicate what's going on in the business. It's important that managers pick it up as well though. Hard to say how much time will be saved exactly | • Yes<br>• Not sure how much |
| 3. | Yes. But not sure how much. My partner set up the current POS, and he likes this kind of stuff. I'm not sure how much this is worth. I don't even know the price of the current POS. | • Yes<br>• Not sure how much |
| 4. | 1. Not really. Is managed by current POS<br>2. Current/incoming inventory for sure<br>3. Not really. I think current system has this.<br>4. Market average is not important. Would only make me very happy or very sad. Not useful, and hard to compare. Even with beach clubs some focus on youth and partying where we focus on dining and wines. | • Personnel costs<br>• Inventory |
| 5. | Nothing specific. | - |
| 6. | Yeah sure. I don't really care about it. | • Yes<br>• No problem |

**I7 – Soomers**

| **Question** | **Answer** | **Code** |
|---|---|---|
| General | Single beach club. Annual revenue +/- .8 million. Old POS (not sure which). Not much data | • 1 venue<br>• .8 million euro revenue |
| **Formative** | | |
| 1. | Nice chart. Clearly shows what happens day by day. Average not very useful, very much depended on weather. Average is interesting, but wouldn't use it day by day | • Might use<br>• Much dependent on weather |
| 2. | Very interesting. Especially if distribution turns out to differ significantly per day. In case there are certain peaks at specific times you can really use it to plan personnel accordingly | • Would use<br>• Interesting to recognize reoccurring peaks |
| 3. | Especially useful for specialty products. These kinds of products don't get ordered as often, so this way you can track them more easily. Products like beer are always in stock anyway / ordered regularly based on revenue. | • Would use<br>• Especially for specialty products |
| 4. | Revenue distribution is only relevant on a weekly basis. Of course you know kind of what it's like. But this helps to see the actual distribution. Scale must be per week though. | • Would use<br>• Create weekly scale |
| 5. | Third axis is very unclear. Not sure what this chart conveys, would not use it. Table could be helpful to get specific revenue distribution, but a chart like on the previous page conveys the information much easier. | • Would not use |
| 6. | Tables are especially useful to check personnel | • Would use |

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| | performance. Current pos does not have data like this, so I would definitely use it. Also very helpful in communication to employee. E.g. show why certain employees are doing better than others. Could be useful to display the revenue distribution per employee, that way it becomes clear that focusing on specialty (high margin) products results in higher profit | • May be show revenue distribution per employee |
| 7. | Would use as well. Problem that must be noted is that afternoon shift bills are often paid in the evening. Because of this percentage of revenue is relatively larger in the evening. Chart needs to correct for this by keeping track of ordering time. | • Would use<br>• Make sure to monitor by ordering time |
| 8. | Yes, might be useful. Could be more useful to compare different venues, see why some are excelling compared to others. | • Yes<br>• May be compare instead of aggregate |
| 9. | Depends on the dashboard. Some are relevant per week, others per day. Switching between day/month/week should offer more than enough flexibility | • Yes |
| 10. | Yes, could be very useful. Especially employee effectiveness helps to know who to put on busy parts of terrace etc. | • Yes |
| 11. | Yes, ideally it's fully automated. However, current system is already very useful for keeping track of specialty (lower turnover) products. Probably never possible to automate completely due to product loss etc. | • Yes<br>• Full automation not possible |
| 12. | Yes, absolutely | • Yes |
| 13. | Yes especially personnel related dashboards. Those help to monitor if someone is consistently underachieving. In practice you might have a suspicion, but it's really hard to know for sure. | • Yes |
| **Summative evaluation** | | |
| 1. | Yes, probably every few days. Depends a little on how busy it is | • Weekly |
| 2. | No. You get higher quality within the same time. But I think you have to spend a basic time on management activities any way, result is just better now | • No |
| 3. | Hard to say. Not sure what magnitude to think. Depends on things like scheduling and automated ordering etc. If that's included along the lines of a POS, otherwise 40 -60 monthly | • Yes<br>• 40 – 60 monthly |
| 4. | 1. Yes absolutely. Scheduling is were most benefit can be achieved<br>2. Ordering would be nice. But not necessary<br>3. Tuning some of the dashboards to fit specific situation would be nice, no need for full dashboards<br>4. Not really. Would be funny to look at once a month, but not really useful | • Personnel schedules + cost |
| 5. | Tip would be interesting. Is a good indicator of employee performance + might be nice for employees to know how much they collected | • Tip |
| 6. | Yes. Absolutely no problem with this kind of stuff. If people are happy with my data I'm fine. | • Yes |

**I8 - Bosco**

| Question | Answer | Code |
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| General | 20 employees, half kitchen, half service. +/- 750,000 revenue. | • 750.000 revenue |
| **Formative** | | |
| 1. | Not immediately clear what dashboard conveys. Test data is not as expected (slightly different from reality). Thinks she can get something like this from accounting (per month). Would be nice to compare several weeks together. Useful to include weather, because this is often big influence. Would be nice to know if this relation is actually true. The more data you add, the more relevant it becomes. Would also be nice to separate between specific product groups, or just between food and beverages. | • Would use<br>• Add weather<br>• Add same week last year |
| 2. | Very nice, very interesting. Weather influences this again. Also very interesting to compare multiple weeks. If revenue is down several weeks in row personnel can be adjusted. May be also use it to adjust opening hours on certain days. Would be very useful to add personnel costs. | • Would use<br>• Add average<br>• Add personnel costs |
| 3. | This is only interesting in the long term. So may be even more than monthly. E.g. if wines are increasing this might last throughout November and December and January, and than people change again. Also needs to correct for menu. Top products should also be displayed over a week or month, to be able to recognize trends. No need for ordering because pos exports this, and in bar 4 days a week so quite good in control. Ordering can't be automated because also adjusting for factors like events and expected weather | • Would not use<br>• In the bar often enough |
| 4. | Not very clear what is being conveyed. Fake product groups + distribution are confusing (not in tune with reality). Could be useful over a longer period as well. Would be nice to recognize changes in distribution. E.g. if people are drinking more beer, or if an IPA is doing well, at the cost of what other beer is that? | • Data is useful<br>• Not very clear<br>• Might use<br>• Track changes in distribution over longer period |
| 5. | Very unclear, needs to think a very long time. Would be better if margin was used instead of price in top chart. Add day of week to bottom chart. Bottom chart color-coding is useful to recognize patterns and see if everything is ok. | • Would not use<br>• Might use bottom chart |
| 6. | This is exactly what I meant with the first chart when I said to include product group differentiation. Is useful for purchasing. Making sure to have enough products when they are always needed in weekends e.g.. Or knowing that cocktails are never sold on Monday, means you can schedule less personnel. Differentiate between lunch and dinner; this is very useful for kitchen scheduling. Bottom chart not very useful. May be if it differentiates between inside and outside table. May be add relation between long taken tables, and revenue. To see if employees should sell more products (e.g. window tables are always taken, but are people ordering enough) | • Would use<br>• Diff between lunch and dinner. |
| 7. | We don't use employee keys, so hard to track this. Also people in kitchen, or people behind the bar might have huge influence on effectiveness of waiter. So hard to track this. It could be nice to see what someone sells, | • Would not use<br>• Dashboard is good, just not useful here (too small) |

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| | but I'm a little bit afraid of becoming to "American"-driving by numbers and waiters competing for certain tables (e.g. with large group of friends). | |
| 8. | N/A | • |
| 9. | Yes, that's enough flexibility. Yearly overview also important | • Yes<br>• Add yearly |
| 10. | Yes. Looking at patterns helps to decide how much personnel is needed | • Yes |
| 11. | No. I think it could be the case in large businesses. Also for check if there is theft etc. But not relevant in this business | • Yes |
| 12. | Yes, absolutely | • Yes |
| 13. | Yes, Absolutely | • Yes |
| **Summative evaluation** | | |
| 1. | Yes, I would LIKE to use them regularly. If its part of the accounting system (e.g. exact) I would use it regular. Separate login is fine. But connection cash register is important. | • Yes<br>• Monthly |
| 2. | If it's connected to personnel as well. That would save up to half a day per week (data entry etc.) Might actually save money (like less people scheduling). In the beginning I expect it to cost a little bit extra time | • Yes<br>• Up to 4 hours / week |
| 3. | If its part of an existing system, e.g. Linda (scheduling) or Exact or Eijsink I would be willing to pay more for that specific system. Very hard to say how much it's worth. On the condition everything is synchronized I would probably pay about 20e / month. 50 absolute maximum. | • Yes<br>• 20euro/month |
| 4. | 1. Yes would be extremely useful<br>2. Not very interesting for me<br>3. No, but tuning current dashboards would be nice. E.g. deciding product groups myself, add extra tags (lunch/dinner) etc.<br>4. No, don't look at other businesses | • Add personnel schedules + cost<br>• Allow tuning of current dashboards |
| 5. | Separate between cash/pin payments. Could be nice to test if cash is still needed. | • Separate pin/cash |
| 6. | Yes. Absolutely no problem | • Yes |