Applying Collaborative Design to Spatial Redesign

A Case Study at PostNL Parcels Benelux

"Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand.'' – Confucius, 450 BC.

Guido Veltman
1512420
guidoveltman@gmail.com

June 13th, 2016

Graduation Project for the Master Programme
Systems Engineering, Policy Analysis and Management (SEPAM)
Delft University of Technology

Graduation committee

Chair:	Prof. dr. Frances M.T. Brazier	Systems Engineering & Simulation section
First supervisor:	Dr. Michel Oey	Systems Engineering & Simulation section
Second supervisor:	Dr. Haiko van der Voort	Policy, Organisation, Law & Gaming section
External supervisor:	Dirk Veldt	PostNL Parcels Benelux
External supervisor:	Minke van der Kleij	PostNL Parcels Benelux

Keywords: *collaboration, collaborative design, spatial redesign, case study, PostNL Parcels*

Acknowledgements

This report is the result of a long journey since September last year and the last stage of my master studies Systems Engineering, Policy Analysis and Management at Delft University of Technology. This research has been realized in collaboration with PostNL Parcels Benelux. Hereafter I would like to thank a number of persons who have supported me along the way.

First of all, my graduation committee at the faculty of Technology, Policy and Management. Frances Brazier for her substantive recommendations. During the kick-off meeting you suggested a collaborative research approach by 'just putting the stakeholders together'. In the end that turned out to be the right decision as I have gained much experience in dealing with stakeholders and the collaborative process itself. Secondly, I would like to thank Michel Oey for his suggestions on how to conduct research in general and your open attitude to give feedback. I would also like to thank Haiko van der Voort for providing the right substantive recommendations in a very constructive and friendly manner.

My gratitude is also expressed to PostNL for offering an internship in Hoofddorp. Special thanks go out to Dirk Veldt and Minke van der Kleij and also the team in which I have operated during my time. Dirk, thank you for your constructive and results-oriented approach to provide smart and substantive insights. Minke, I really appreciated and enjoyed your participation during the workshops. Your enthusiasm and commitment was conducive to make the design workshop process even more pleasant and fun to attend. Furthermore, I appreciated my time with colleagues from the Staff Operations department to make my graduation period even more engaging.

Last but not least, I am grateful to all the people I have met during my study period, both in Delft and Sweden. Not to mention, I would like to thank the following persons in particular: my parents, brother and girlfriend. You have supported me through thick and thin.

Delft, June 6th, 2016

Guido Veltman

Executive summary

Nowadays, the global market is becoming increasingly competitive. Globalization has significant impact on how organizations manage their daily operations: companies are faced with systematic problems that are complex, open-ended and ill defined. Such problems need contributions from multiple minds – e.g. stakeholders who are either affected by the new solution or have decision-making power – in order to include relevant perspectives to enhance problem solving capabilities. Collaboration is applied more often in organizations to incorporate diverging views. A specific instinct of collaboration is collaborative design which is used to design artefacts with multiple actors working towards common goals. Within, literature, it has not been researched so far how collaborative design can be applied to resolve lay-out redesign problems. This explorative research aims at providing an answer to the following main research question: ''*how can collaborative design be applied to spatial redesign problems?*''

This research is performed by design-cycle research in which first a conceptual model is develop based on literature insights. Thereafter a case study at PNP - which is a main parcels delivery service provider in the Netherlands - is used to test a conceptual process model to apply collaborative design for spatial redesign problems. The case study is held at PNP which is a parcels delivery service provider in the Netherlands. Nowadays, e-commerce is becoming increasingly popular and this trend has a substantial impact on parcels services which annually increases significantly. In the context of meeting future growth in demand of online shopping and to reduce cost PNP is faced with a layout redesign problem in their distribution facilities. The PNP department Depotbeheer & Ontwerp is responsible to manage and design all procedural standards which serve as guidelines business processes within all 18 depots in the Netherlands mainly on a tactical and operational level. Command & control strategies are applied to ensure that NLI of activities and processes are standardized to ensure an uniform and cost-efficient business. PNP applies lean management to ensure that processes are standardized in order to promote uniformity across the depots, however, in the existing situation layout uniformity is lacking which requires a redesign standard. The selected target area concerns the secured area. Within SA's the following processes take place:

- Registered mail: e.g. passports or confidential letters. Since this service requires a customer signature it is distributed within the parcel service network.
- Chemicals and dangerous goods
- Storage of customer parcels and internal products
- In the planning desk areas (PB) vans are issued mobile administration device and registered mail for the route in the morning before distribution takes place. At the end of the day van drivers hand in non-ordered parcels at the docking stations and hand over the mobile devices at the PB (debrief).

The deliverables from scientific research include the following: a) literature study on collaboration, collaborative design, spatial redesign, participation and decision-making processes. Secondly, b) a conceptual framework on how to organize a generic collaborative design process for spatial redesign, based on the literature insights and field observations. The deliverables from case study at PNP are the following: c) practical roadmap for PNP to apply collaborative design to solve spatial redesign challenges. This roadmap is derived from the conceptual framework which is tested during the case study. Fourth deliverable is d) a case study inventions outcomes: workshop re-designs of the SA interior including a concept design and elicited stakeholder requirements and argumentation.

Within literature there are different views on collaboration. However, this also highlights the essence of collaboration: incorporating different views for problem-solving purposes in which actors interact with each other to work on common goals. Collaboration can have many advantages, such as increased acceptance, enhanced problem-solving capability, organizational learning and better decision-making as multiple viewpoints are accounted for. Additionally, job satisfaction, organizational commitment and performance can be promoted by collaboration. However, just putting together participants does not make it a collaborative

process. Various factors play a role as collaboration is impacted by input factors (on an individual, team and organizational level), process factors and output factors. Addressing these categories of factors will promote successful collaboration. A specific application of collaboration is collaborative design. This concept shares common principles as collaboration. However, during the collaborative process, participants design a specific artefact. Within this research the following definition of collaborative design is established: ''*design approach in which a variety of stakeholders participates in the design process using shared rules aimed at incorporating diverging views, promote mutual learning and working towards a common goal to collectively achieve better organizational outcomes.*''

Spatial redesign is realized by reconfiguration of layout standards and follows the overarching principles of lean management as philosophy to remove waste through continuous improvement by standardization of practices to establish cost efficient systems, both addressing technical factors as social factors. However, there is currently no structured approach which deals with the question how collaborative design is ideally organized for spatial redesign problems in the workplace.

A preliminary conceptual model is constructed based on literature. In this framework, four levels of (collaborative) design are identified which should be considered:

- Object of design: creating a shared understanding concerning the problem and artefact.
- Context of design: the environment in which the artefact is implemented is to be considered.
- Actors who design: stakeholders who participate in the design process are selected adequately.
- Process and methodology: the way the design process is organized including used techniques.

The conceptual model, based on literature insights, has been translated according to the situation at PNP in which the collaborative model starts with consultation of management to seek for support and select relevant acceptors. Thereafter a target area is to be selected by management for which the organization faces a spatial redesign challenge. An appropriate project phase is to be considered to apply collaboration, management conditions and design metrics have to be established and communicated, an appropriate level of participation needs to be determined including the allocation of required resources. Subsequently, relevant organizational stakeholders have to be engaged with in consultation with depot managers and senior process managers. First vertical diversity is addresses by involving depots and engaged employees. Additionally, stakeholders from the supportive staff can be involved to also tackle other perspectives, i.e. finance, management, HSE, IT, facility, construction, security, HR, designers and lean experts. It is important to carefully consider the cooperating depots and what local deviations can be identified. Thereafter an appropriate workshop design needs to be developed. The second phase concerns the actual design workshop in which the process of requirements engineering takes place. This follows a logical structure and the outcome concerns potential designs and the underlying arguments that led to these designs. This may provide valuable insights for management to take future decisions. The third phase relates to the planning of implementation by management. Workshop outcomes have to be evaluated and required soft and hard elements needs to be documented. Thereafter a final decision is to be made including a plan for the actual implementation. Below the research insights are elaborated on which the final conceptual framework is based. The insights are structured according to the four levels of collaborative design:

<u>Object of design:</u> creating a shared understanding is key for facilitating collaborative design for spatial redesign. It does not only relate to the problem definition, also objectives of the design effort, expectations, social norms, vocabulary, the physical scope of the target area (including local deviations), and final deliverables (in terms of the type of standardization and the degree of standardization). A shared understanding regarding these issues is achieved by constructive conflict, transparent communication by management, the use of visualisations and the signing of a group agreement. The latter also promotes trust and ownership. A fixed problem statement by the project team is not desired as participants should perceive

ownership of the scope and involved problem. However, during implementation a clear problem definition is required to establish a sense of urgency to resolve the problem.

Context of design: the design process is an integral part of a broader context. This means that there is a particular project phase in which collaborative design is applied for problem solving purposes. Therefore adequate project planning is recommended to structure the project phases. Collaborative design for spatial redesign is useful to gather requirements and potential constraints and therefore to explore design options and to generate ideas. Furthermore, transparent communication by management is key regarding the collaborative governance and the way how a layout redesign positively contributes to achieve organizational goals. This also includes information on the design of the process, expectations, the way how participants are selected, follow up steps, deliverables, etc. It is also important that stakeholders can think without any restrictions in order to facilitate effective brainstorming. Therefore participants have to collectively define the problem as this also promotes mutual understanding. Also, during implementation a multi-site problem is an extra challenge as these facilities have their own particular views and local deviations. Therefore, stakeholders who have not participated in collaborative design should be informed on the problem and design arguments.

Framing is important during the idea generation process to avoid resistance. This can relate to specific choices of words, but also to the fact that lean does not need to be mentioned explicitly, as long as lean principles are applied. Next to that, collaborative design for spatial redesign is suitable for qualitative complex problems to test feasibility issues and gather relevant requirements. Less suitable are projects which a strong focus on costs or in case of time pressure or restricting regulations.

An important insight is the environment in which the artefact is to be implemented. A spatial redesign is part of a broader context: it is an integrated lean system with both hard and soft elements. Addressing both factors is conducive for successful implementation of a new spatial design.

Actors who design: it is crucial to consider both horizontal and vertical diversity of involved organizational stakeholders. During the workshop there was no perfect balance found between horizontal and vertical diversity. On the one hand, limited horizontal diversity implies a risk of not covering an diverse set of design requirements and thus different functional roles are required to cover multiple perspectives. On the other hand, mainly horizontal diversity increases the risk of politicization. Also, limited vertical diversity restricts a successful process of gathering requirements from all operational levels, and also transferring ownership to all hierarchical levels, especially employees who are perform the actual work in the relevant work area and effected by the final design. Ownership is enhanced through the collaborative design process itself and by signing a group agreement which also promotes trust and shared understanding on norms and expectations.

Process and methodology: interaction can be promoted by organizing sub groups and facilitate feedback sessions and constructive conflict in general (identifying potential conflicting goals and interests beforehand). These discussions are conducive for team and organizational learning. The paradox of participation can be partly resolved to creating a shared understanding on the final deliverables, open communication of the collaborative architecture of the collaborative design process, establishment of trust and perceived ownership of the final deliverables and to hear everybody´s expectation. Also clear follow-up steps should be clear.

This final conceptual framework can be applied to organizations with the following characteristics:

- a relative strong operational and bureaucratic context was identified in which mainly participants from the operating core contribute significantly to develop better solutions for existing spatial problems.
- The framework is both useful for spatial- design and redesign challenges. Application of the framework is limited to an intra-organizational level. This means that only participants from one organization can participate during the design process as involving designers from other organizations requires additional strategies.

- The appropriate project stage in which collaborative design is applied needs to be determined by management. In the context of spatial redesign problems, collaborative design is an appropriate concept for idea generation purposes and to test feasibility issues in which specific organizational stakeholders are only engaged with in the design stage based on stakeholder engagement strategies. Based on the design metrics the best suitable designs are selected for future implementation.
- Furthermore, application of this framework is restricted to complex, qualitative layout-related problems in which an appropriate solution cannot be known in advance and when there are several ways to arrive at a specific solution. This is also known as ill-defined/structured problems.
- However, in case of restricted time or imposed legislation this framework is less suitable as collaborative design is relatively time consuming and needs an extensive planning in order to be employed.

Application of this conceptual framework brings various advantages and potential risks that have to be taken into account. Positive effects are the following: a) increased acceptance and perceived ownership as a number of organizational stakeholders have influence in the process of idea generation and can have their voices heard during collaboration which, in the long term, allows for a more convenient implementation process. Main advantage is that for lay-out redesign their b) specific requirements can be shared which are to be integrated in the final design which leads to better problem-solving. Better problem solving also enhances c) organizational learning as different perspectives and positions are brought together. Another advantage may be that d) the tension between standardization (control) and innovation (freedom/autonomy) can be resolved by allowing organizational stakeholders to participate in the design process. In this way participants can contribute to problem solving processes, innovation and the establishment of specific lean-related standardization. Furthermore, e) feasibility issues can be addressed at an very early stage. By facilitating different perspectives to contribute to the potential designs, financial, technical and social requirements can be checked beforehand which prevents ideas from being blocked in a later stage.

Negative aspects of collaborative design for spatial redesign involves that an insufficiently designed processes of collaboration a) increases the risk of the paradox of participation. If this is the case then collaboration will work counterproductive. Furthermore, b) collaborative design assumes that participants are treated equally, however, different organizational priorities may exists which makes one's argument more urgent than someone's other input. It is unclear how these conflicts can be resolved properly without negatively affecting trust and acceptance. Last, a collaborative design process requires accurate planning and thus this is very time-consuming.

Several recommendations for future research are suggested:

- The role and impact of the workshop facilitator has not been investigated within this research.
- Secondly, psychological aspect have not been considered. Personality traits, religion, assertiveness etc. could not be assessed here due to time restrictions.
- Thirdly, the conceptual framework for application of collaborative design to spatial redesign problems is a first point of departure for research. The framework is not exhaustive and research is to be performed what other factors have influence on the collaborative process.
- Finally, within this research the main focus was on the problem definition and construction phase. Further research should be performed concerning the testing/validation and actual implementation phase to further research appropriate steps for these project phases.

Several practical recommendations for PNP are identified:

- Final deliverables for the secured area a 6S and SWM should be presented to depot managers for further feedback and refinements. The configurations of the final deliverables and standards should be included in the lean scan to secure compliance.

- Secondly, successful realization and implementation of layout redesigns require ownership at all levels of the organization. This starts with depot managers to communicate the necessity of ownership. Thereafter, transferring ownership to subordinate levels of the operational core is recommended.
- Thirdly, lean at PNP is built around three focus areas: processes, management infrastructure and attitude & behaviour. More attention should be paid to the aspect of attitude and behaviour as this element contains the most room for improvement.
- Fourthly, PNP could facilitate knowledge sharing through a platform. Currently local best practices at depots are not formalized, known or implemented.
- When involving the operational core to design sessions, the governance of collaboration (collaborative architecture) and level of participation should be carefully addressed as this determines the degree of participation and the way how organizational stakeholders are engaged with.

Several discussions point are elaborated below:

- It remains difficult to provide guidelines on how to resolve the paradox of participation as the actual implementation is out of scope within this research.
- Secondly, the main focus within this research is on the problem definition and construction phase. Less attention is paid to the testing/validation and actual implementation phase.
- Thirdly, psychological factors are not considered within this research. However, they are important determinants for collaboration processes and provide insights to further improve the framework.
- Lastly, observations are based on a limited number of two workshop and involved participants. This has implications for the generalizability of the conducted research.

Table of contents

List of figures 11
List of tables 12
1. Introduction 13
1.1. Problem description 13
1.1.1. Practical problem at PNP 13
1.1.2. Research problem 13
1.1.3. Research gap 14
1.1.4. Research objective 14
1.1.5. Demarcation 15
1.2. Research questions 15
1.3. Methodology and approach 16
1.3.1. Research methodology 16
1.3.2. Research approach 17
1.3.3. Scientific and managerial relevance 18
1.3.4. Research choices 18
1.3.5. Deliverables 18
1.4. Research design 19
2. Literature study: towards a collaborative lean design process 20
2.1. Towards collaboration and design practices 20
2.2. Facilitation of collaboration and team aspects 26
2.3. The organizational level: participative decision-making 28
2.4. Spatial redesign from a lean perspective 30
2.5. Insights from field research observations and interviews 34
2.6. Insights from literature and field research 34
3. The conceptual framework 37
3.1. Insights from literature 37
3.2. Constructing the conceptual framework with insights from literature 38
3.2. The conceptual framework 38
4. Case study description 42
4.1. Company description 42
4.1.1. Introduction to PNP 42
4.1.2. Strategy, mission and organizational structure 42
4.2. Focus area and processes 43
4.3. Current approach to lean management at PNP 47
4.4. Case study participants 49
4.4.1. Brief introduction of the operating core workforce at PNP 49
4.4.2. Stakeholder analysis for the SA design project 50
4.4.3. Specification of stakeholder perspective divergence 51
5. Design intervention at PNP 53

5.1. Design requirements 53
5.1.1. Business requirements 53
5.1.2. Technical requirements 53
5.1.3. Social requirements 53
5.2. Designing a collaborative design intervention 54
5.2.1. Scope of the intervention 54
5.2.2. Participating stakeholders 55
5.2.3. Workshop design 56
5.3. Intervention results 59
6. Developing a collaborative design approach for PNP 74
6.1. Validation of designs by workshop participants 74
6.2. Outcome validity by management: does this design work better? 75
6.3. Testing the collaborative design approach at PNP 76
6.4. A roadmap for collaborative design at PNP for spatial redesign 77
7. Generic framework for intra-organizational collaborative design 81
7.1. Framework modifications after management consultation 81
7.2. Expert validation of the conceptual framework 81
7.3. Framework for collaborative design as decision-making input 83
7.4. Generalizability, effects and limitations 85
8. Conclusions and recommendations 87
8.1. Conclusions 87
8.1.1. Literature study research 87
8.1.2. Case study research 88
8.1.3. Scientific conclusions after the case study intervention 90
8.2. Recommendations 91
8.2. Discussion 92
9. Reflection 93
Bibliography 95
Interviews 99
Appendices 100
A. Project description PNP 100
B. Brainstorm on facilitating the design workshop process 101
C. Case study research 103
D. First design workshop 105
E. Second design workshop 116
F. Outcome validation at PNP 127
G. Scientific article 131

List of figures

Figure 1. Design Science Research cycles. 16
Figure 2. TIP framework. 17
Figure 3. Research design and structure 19
Figure 4. Dimensions of collaborative architecture 24
Figure 5. The IMOI model. 24
Figure 6. IPO model of team effectiveness 24
Figure 7. Conceptual model of shared mental models. 26
Figure 8. Hierarchy of individual's frame of reference 27
Figure 9. Kaizen framework based on the IPO model 32
Figure 10. TIP framework 34
Figure 11. Theoretical framework based on literature and field research 40
Figure 12. Organizational structure PNP 43
Figure 13. The sorter machine for the sorting and distribution process at PNP. 43
Figure 14. The distribution process during the morning. 44
Figure 15. Secured area snapshot from depot Kolham 44
Figure 16. NLI depot lay-out and zoom-in on the left secured area with PB's on both sides 45
Figure 17. Multi-stakeholder complexity 47
Figure 18. Lean building blocks at PNP 48
Figure 19. 6S method at PNP 49
Figure 20. Hierarchical structure of depots 50
Figure 21. Individual's frame of reference 51
Figure 22. Formal chart organizational configuratio 52
Figure 23. Target areas: two secured areas, including planning desks (PB). 55
Figure 24. Workshop participants at depot Amersfoort: 9th of March 59
Figure 25. Proposed interior design group 1 61
Figure 26. Proposed interior design group 2 61
Figure 27. Workshop participants at depot Ridderkerk: 31st of March 65
Figure 28. Proposed interior design group 1 67
Figure 29. Proposed interior design group 2 68
Figure 30. Concept layout redesign depots+ based on workshop outcome 74
Figure 31. Concept layout redesign standard depots based on workshop outcome 74
Figure 32. PNP roadmap for spatial layout redesign through collaborative design 78
Figure 33. Improved generic framework based on management consultation 81
Figure 34. Project stages for collaborative design 82
Figure 35. Diverging and converging phase during the project 82
Figure 36. Stakeholder engagement matrix 82
Figure 37. Final generic framework 84
Figure 38. Initial conceptual framework 103
Figure 39. Improved conceptual model after first design workshop 116

List of tables

Table 1. Problem solving in collaboration process design. 25
Table 2. Collaboration process design activities for shared understanding 26
Table 3. Constructing the conceptual framework with theoretical concepts 38
Table 4. Identified process within the secured area 45
Table 5. Work process standardization outputs 48
Table 6. PNP stakeholders and interests 50
Table 7. Participants first workshop at depot Amersfoort 55
Table 8. Participants second workshop at depot Ridderkerk 56
Table 9. Storage products per distinguished area 60
Table 10. Framework modifications after first workshop 62
Table 11. Basis functions of target areas 65
Table 12. Strengths and opportunities identification 65
Table 13. Framework modifications after second workshop 69
Table 14. LE@D project structure at PNP 77
Table 15. Case study design first intervention 105
Table 16. First design workshop outcome results 114
Table 17. Improved design for the second design workshop 116
Table 18. Results of the second design workshop 125

1. Introduction

This chapter elaborates on the problem description in which the research problem is defined. Thereafter, the research questions are presented. Subsequently, the methodology and research approach are elaborated. In the last paragraph the research design is provided.

1.1. Problem description

This paragraph first addresses the practical problem and a description of the research problem, subsequently the research gap and thereafter the research objective and demarcation.

1.1.1. Practical problem at PNP

PNP is a main player involved in parcels delivery in the Netherlands. Their logistic infrastructure comprises of multiple distribution center (or: depots) from which parcels are collected, handled and distributed (Hermon, 2012). The company can be characterized as a *bureaucracy* in which standardization is key (Mintzberg, 1980): a hierarchical, vertical structure, command and control strategies with centralized decision-making, work is formalized through work instructions and procedures to promote cost-efficiency throughout the organization. For example, the lean philosophy is broadly adopted throughout the company to promote cost-efficiency standardized processes.

In contrast to the depot's main sorting area in which bulk parcels are processed the adjacent secured area – often referred to as SA – does not have an uniform interior standard which leads to debate concerning its basic functions. The SA accommodates handling of special parcels, i.e. valuable, dangerous or fragile parcels and additional storage products. The individual SA handling area interiors differ significantly, each characterized by their best practices and pragmatic solutions due to a lacking spatial configuration standard. An uniform standardized SA interior redesign is beneficial for PNP to realize cost-efficient processes on a domestic level. However, within this specific situation of developing an uniform lean standard, a command and control strategy may not be appropriate since depots and employees have developed their own views and may have diverging perspectives on the problem definition and how the SA should be organized. This makes the situation a wicked problem (Rittel & Webber, 1984). A top-down driven solution may face resistance or non-compliance as there is no one-size-fits-all solution taking into account local issues and differences. In order to deal with this situation a more bottom-up approach is required to deal with diverging perspectives and account for the interested of involved stakeholders and develop a spatial redesign for the SA lay-out interior.

1.1.2. Research problem

Nowadays, the global market is becoming increasingly competitive. Globalization has significant impact on how organizations should manage their daily operations: companies are faced with systematic problems that are complex, open-ended and ill defined (Rittel & Webber, 1984). Such problems need contributions from multiple minds – e.g. stakeholders who are either affected by the new solution or have decision-making power – in order to include relevant perspectives to enhance problem solving capabilities.

Therefore, the importance of shifting decision-making within organizations from rather centralized, top-down driven approaches to more collaborative decision-making with multiple stakeholders or employees has gained recent attention (Stohl & Cheney, 1997). The advantages of such collaborative processes can include: profit increase, cost savings by sharing best practices, promoting better decision-making by incorporating multiple viewpoints and enabling innovation through knowledge sharing (Hansen & Nohria, 2004). Additionally, job satisfaction, organizational commitment and performance are also factors which can benefit from collaborative processes (Black & Gregersen, 1997).

Furthermore, collaborative decision-making with organizational stakeholders also promote a sense of ownership among stakeholder which can enhance compliance towards a shared solution within an inclusive

and participatory settings (Simonsen & Hertzum, 2008). In other words, collaborative processes can result in win-win situations with mutual benefits for all participants involved which positively impacts stakeholder acceptance towards a new solution.

In terms of Burns and Stalker organizations can be characterized as more mechanistic or rather organic organizations (Burns & Stalker, 1961). A mechanistic management system is applicable to stable conditions in hierarchical organizations in which management governs the behavior of employees with strict procedures and instruction by command and control strategies. On the other hand, the organic form is appropriate for other circumstances, e.g. changing environment which cannot be handled with a mechanistic approach. The organic approach has a more network nature which is rather horizontally oriented with employee participation and is consensus-driven. It should be mentioned that the organizational approach is not a choice of either a mechanistic or organic organizational: it is a hybrid structure with elements incorporating both perspectives, depending upon the context.

PNP is – according to the above context – a rather mechanistic, bureaucratic organization with a command and control management approach (Burns & Stalker, 1961). On the one hand, standardization is desirable to be in control of processes and output. However, on the other hand this may restrict innovation, for example through bottom-up initiatives (Lantz, Hansen, & Antoni, 2015). Currently, the lean philosophy is implemented through standardization of processes with fixed procedures. As Boonstra & Gravenhorst put it: ''organizational structures, rules, regulations, procedures, decision-making and negotiation are seen as products and reflections of a struggle for control that puts management in a privileged position'' (Boonstra & Gravenhorst, 1998). Involving employees in collaborative initiatives requires that the mechanistic organizational character slightly adopts organic elements through collaboration between organizational stakeholders. An option can be collaborative design in which employees elicitate design requirements and create an artifact by incorporating their diverging perspectives towards the spatial redesign of the SA area. Eventually, this serves for management decision-making input. A main challenge is how organizational stakeholders can be involved to collectively generate new knowledge and possible solutions for management input, thereby avoiding potential challenges involved in collaborative design practices in relation to spatial redesign. Moreover, the paradox of participation may be faced in which participants experience such participatory processes as rather top-down initiatives from management.

1.1.3. Research gap

Collaborative decision-processes have been applied to a wide range of areas and topics, such as computer systems and infrastructure projects with stakeholder involvement. A new research area is the application of a collaborative design process for spatial redesign challenges. The combination of these research areas has not been researched so far. This provides an opportunity for PNP to apply a collaborative design process for the spatial redesign of the SA to meet organizational goals and thus slightly shift the focus from top-down approaches to collaborative problem solving. This research aims at identifying potential challenges and implications and based on this insight to develop a framework towards a collaborative design process specifically for spatial redesign. The situation at PNP is taken as case study to test the develop this conceptual framework.

1.1.4. Research objective

The main objective is to exploratively research how a collaborative (design) process can be organized specifically for spatial redesign problems. The focus includes an process design which addresses relevant issues to consider when initiating such problem solving challenges. During the actual design process participating employees will collectively generate requirements as part of a case study. Developed requirements and possible designs will be input for top management in order to decide upon a solution for a specific business problem. The process design addresses potential issues which may arise when management engages with organizational stakeholders through collaboration and how new solutions serve stakeholders' interests.

1.1.5. Demarcation

The main focus of this research is applying collaborative design for spatial redesign challenges. This relates to the organizational and team level in which organizational stakeholders participate in a collaborative design process. The aim of collaboration with different organizational stakeholders is to use their specific knowledge in order to generate relevant requirements. In other words, stakeholders have a diverging frame of reference which are reflected upon through collaboration. A frame of reference is constructed based upon individual's position, knowledge and interests. In this manner, participants bring in their specific requirements which should be included in potential solutions. The actual implementation phase is not considered within this research.

It should be noted that the individual level of analysis is not extensively elaborated upon. The individual frame of reference (i.e. position, knowledge and interests) is important for requirements elicitation, however, aspects such as psychological factors (e.g. motivation, personality traits, beliefs and religion) are not considered within this research. Moreover, it should be mentioned that different design phases can be distinguished. Within this research the main focus is on the problem definition and the construction (design) phase. The testing/validation and implementation phase are also addressed in this research, however, are less elaborated upon.

1.2. Research questions

Two main questions have been formulated: the first addressing the theoretical part and the second main question concerns the case study research. The academic questions aim at gaining insight into current knowledge which provides a theoretical basis for the practical research part. A case study at PNP is conducted to provide answers to the research questions of the practical part. The main research question is:

How can collaborative design be applied to spatial redesign problems?

Literature study

CHAPTER 2: LITERATURE STUDY

- What are the characteristics of collaborative processes?
- How does collaboration relate to spatial redesign and how is spatial redesign currently carried out?
- What challenges arise when collaborative design is applied in combination with spatial redesign?
- What (pre-)conditions play a role when facilitating a design process in this context?

CHAPTER 3: CONCEPTUAL FRAMEWORK

- Can a framework be developed to facilitate a collaborative design process for spatial redesign and what are the effects of this approach?

Case study intervention at PNP

CHAPTER 4: CASE STUDY DESIGN

- How can the conceptual framework be translated to the situation at PNP?

CHAPTER 5: DESIGN INTERVENTION

- What conclusions can be drawn from the design interventions to improve the conceptual framework?
- How can collaborative design be used at PNP for spatial redesign challenges?

Synthesis

CHAPTER 6: COLLABORATIVE FRAMEWORK

- How can the generic framework be improved to facilitate intra-organizational collaborative design processes for spatial redesign challenges?

CHAPTER 7: CONCLUSION & RECOMMENDATIONS

- What are other areas to apply this collaborative framework?
- What are the positive and negative effects of this collaborative framework?

1.3. Methodology and approach

This paragraph addresses the methodology and research approach to adequately conduct the research. Furthermore the scientific & managerial relevance, research choices and research deliverables are discussed.

1.3.1. Research methodology

This research will be conducted according to the Design Science Research cycles (Hevner, 2007) in figure 3. This framework aims at guiding a design process by interweaving theory and practice. The conceptual model consists of three cycles. The first loop (relevance) addresses the connection between the designed artifact (process) and the environment in which it will be embedded by meeting the contextual requirements. In this case study the environment is the organizational context of PNP for which a process design is to be developed, taking into account social, organizational and additional requirements as a way of field testing. The second cycle (rigor) is considered as the knowledge base which provides theoretical concepts, methods and expertise on which the design is based. The product of the design cycle provides new theoretical additions to science (artifacts). In this specific case study new theoretical insights can be obtained on how a design process can optimally be designed for organizing collaborative design for spatial redesign. The middle cycle interweaves both cycles which completes the actual design. In this case design workshops are organized as an intervention in order to validate the initial process design and make further refinements.

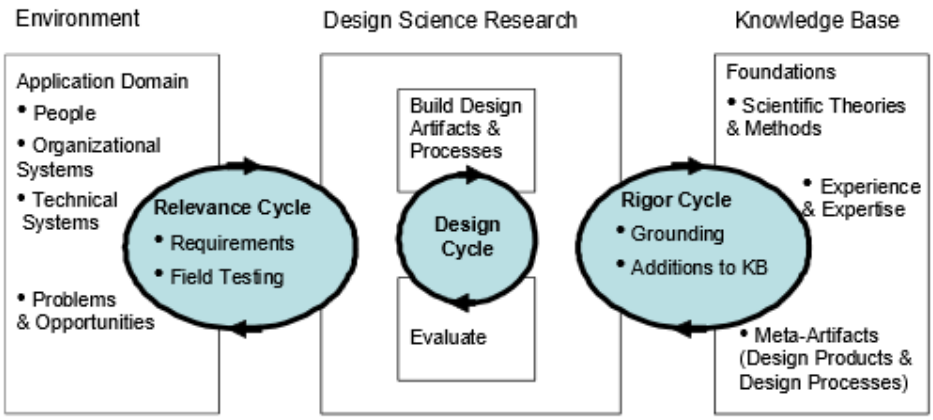


Figure 1. Design Science Research cycles (Hevner, 2007).

Note that in this research the design science framework is used, however, the research through design approach also fits in this situation. Research through design refers to obtaining new knowledge through the design practice of designing an artefact, thus considering design as a way of thinking. In this case, knowledge refers to the designers, the artefact itself and the design process. Design Science research is chosen in this research to better address the link between practice and theory and make this aspect more explicit.

The initial model is based on both literature insights and complemented with field observations. This hybrid model is tested at PNP and improved based on observations and stakeholder inputs during the first workshop intervention. This improved conceptual model is further refined based on insights during the second intervention at PNP. The final model is validated through expert validation. This study includes the following research methods:

1. **Literature study** on relevant topics to construct a conceptual framework: collaborative design processes in a multi-stakeholder context within operational environments. This is done by selecting academic journals (e.g. Science Direct, Google Scholar and Scopus) in the field of *collaborative design, spatial redesign, decision-making, requirements elicitation, design process* & *process design.*

2. **Explorative interviews** to identify relevant stakeholders, their needs, objectives and perspectives. Output from these interviews are used to conduct a stakeholder analysis. These interviews are also used to derive field observations which can be included in the conceptual mode.

3. **Collaborative design workshop** with all stakeholders. This is an explorative method to validate the process design and practically, to elicit stakeholder requirements (requirements engineering) and develop ideas for a lean standard design. A number of two workshops is suggested. The first to validate the initial process design and set design requirements for the lean interior design; the second for validation of the improved process design and to reach consensus on the final technical design of the SA interior. The outcome of this intervention is input for management decision-making.

4. **Internal and expert validation** are carried out to test the final conceptual model. Internal validation is conducted through the organization a workshop at PNP based on the new collaborative design approach. This business problem subject differs from the actual case study topic. Expert validation is performed by consultation an expert at Tata Steel.

1.3.2. Research approach

A socio-technical system view is adopted within this research, taking into account both social and technical factors (Baxter & Sommerville, 2011). The TIP framework by (Koppenjan & Groenewegen, 2005) reflects this socio-technical system view and is applied to integrate different dimensions within this design research (Figure 2). According to the researchers a socio-technical system design process is accomplished by a preceding process design on which this research will focus on. The process design both addresses soft and hard variables, i.e. institutional structures that shapes the behavior of stakeholders (Healey, 1997).

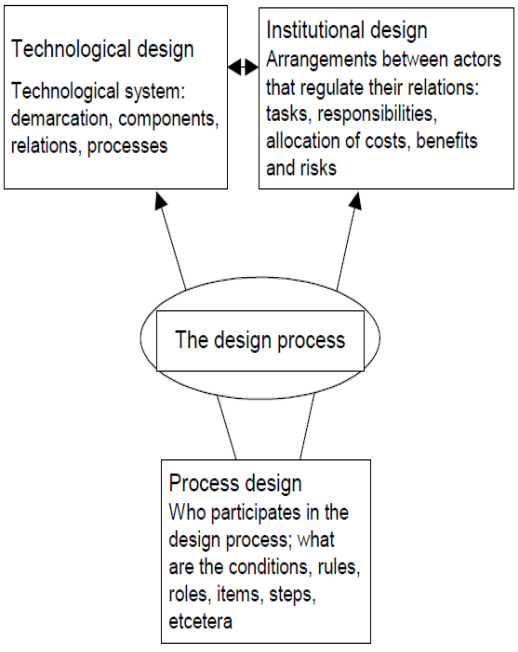


Figure 2. TIP framework. Obtained from Koppenjan & Groenewegen (2005).

Soft factors include how interaction is facilitated, informal rules, discussion styles and the way consensus is formalized. On the other hand hard variables address issues such as formal rules of behavior, tools, techniques and methods. Basically, this is the design structure and mechanisms on how things are done. Additionally, the socio-technical system view is not only applicable to the process design which precedes the design workshop intervention, what is actually designed at the

design workshops – a redesign of the SA interior with lean principles – is also a socio-technical system itself (Shah & Ward, 2007) both focusing on technical and soft factors.

According to de Bruijn et al. a process design includes of the set of agreements and provisions to adequately organize and structure the actual design process (de Bruijn, ten Heuvelhof, & in 't Veld, 2010). The design process itself is about the redesign of a workplace lay-out at PNP. This development of the design process is used to validate and refine the initial process design. Outcomes of these processes include a technical designs: these are actual technical redesigns of the SA at PNP. The second outcome is a set of elicited stakeholder requirements upon which the solutions are based which serve as input for management decision-making.

1.3.3. Scientific and managerial relevance

The scientific relevance includes the application of collaborative design for spatial redesign, a combination which has not been addressed so far. Allowing organizational stakeholder to participate in the design process may provide valuable insights for alternative ways and solutions for spatial redesign business problems. This may not only promote problem solving capabilities and organizational learning, and may also increase acceptance towards new decisions when organized adequately. Obtained insights regarding collaborative design processes may also be applied to similar environments and organizational settings.

Managerial relevance concerns development of a practical roadmap to organize a collaborative (design) processes with organizational stakeholders in which management engages with a diversity of stakeholders to solve layout problems in the workplace. Such an approach can be especially useful in the project definition phase to elicit management and stakeholder requirements.

1.3.4. Research choices

Several choices are made within this research. First of all the research method to combine practical and theoretical knowledge. This is done to close the gap between the act of designing and doing regular research. The case study at PNP is chosen since the fitting problem characteristics, i.e. spatial redesign, and the fact that a collaborative (design) process at PNP has not explicitly been initiated so far. A balance is found between time availability, the number of organized workshops (generalizability issues) and the quality of each workshop. A number of two workshops is held during the research period.

1.3.5. Deliverables

Research deliverables include the following:

Deliverables from academic research

Literature study on collaborative design, spatial redesign, participation and decision-making.
Conceptual framework on how to organize a generic collaborative design process for spatial redesign, based on the literature insights and field observations.

Deliverables from case study at PNP

Practical roadmap for PNP to apply collaborative design to solve spatial redesign challenges. This roadmap is derived from the conceptual framework which is tested during the case study.
Case study inventions outcomes: 1) possible re-designs of the SA interior including a concept design and 2) elicited stakeholder requirements including argumentation by the workshop participants.

1.4. Research design

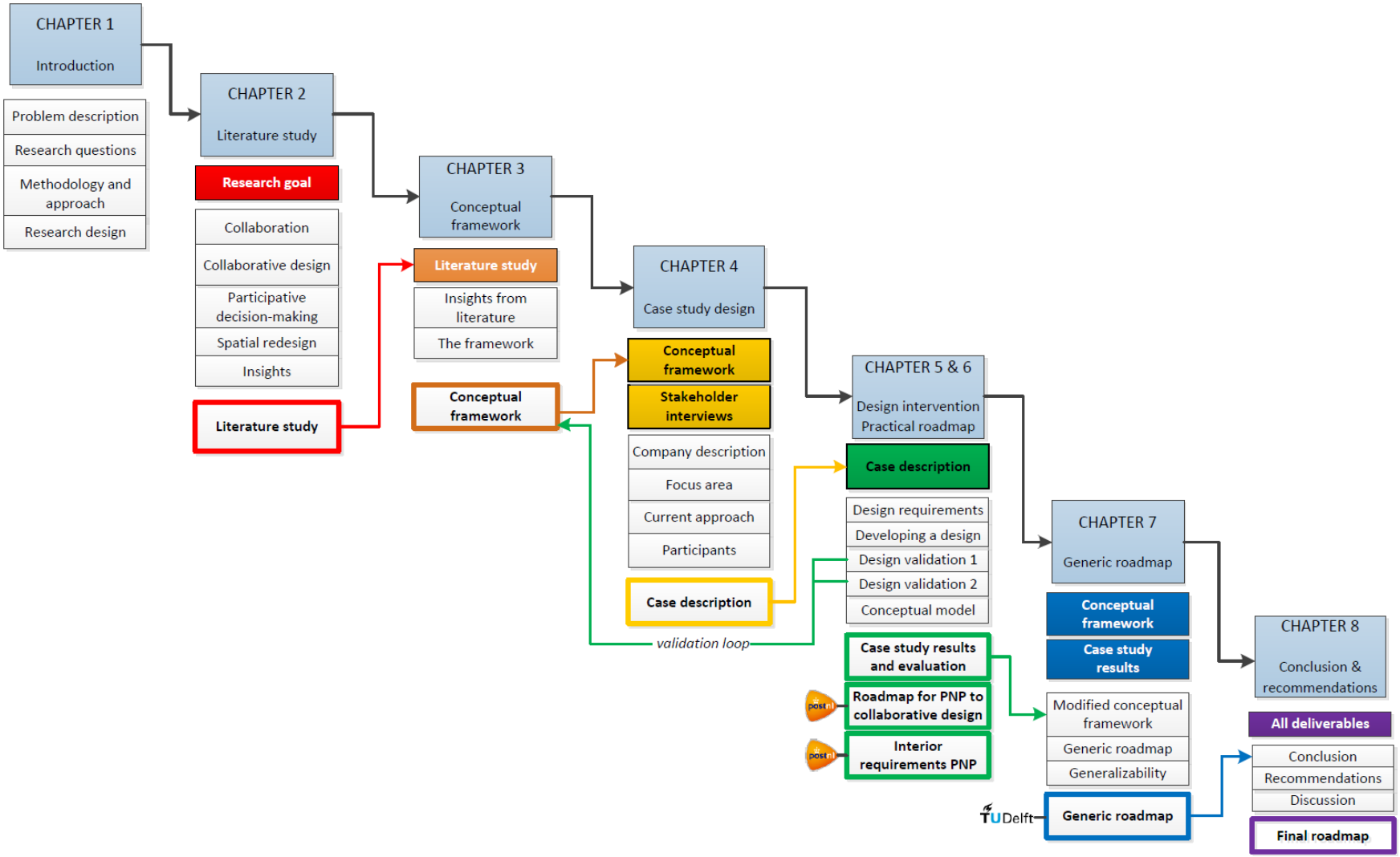


Figure 3. Research design and structure

2. Literature study: towards a collaborative lean design process

This literature study addresses various research fields. These are the following: collaboration, collaborative design, lean management and participative decision-making. Moreover, relevant pitfalls and barriers are addressed to organize such a collaborative design process, including ways to overcome these potential problems. Last, insights from the literature are presented.

2.1. Towards collaboration and design practices

This paragraph discusses the first research area, i.e. collaborative design. First the motivation for collaborative approaches is provided, second the definition of collaboration is explained, the application of collaborative design within this research. Furthermore, an approach towards intra-organizational collaboration is given and this chapter concludes with the team perspective of collaboration and pitfalls & barriers of intra-organizational collaboration with teams.

2.1.1. The motivation for introducing collaborative approaches

Rittel and Webber point out that the problems society face are more and more wicked problems, which are complex, open-ended and ill-defined (Rittel & Webber, 1984). These challenges cannot be solved solely by application of the hierarchical project management approach. Such problems need approaches of collaborative nature with contributions from multiple minds – e.g. stakeholders who are either affected by the new solution or have decision-making power – in order to incorporate relevant perspectives to enhance problem solving capabilities. Additionally, an collaborative approach may foster organizational learning (Boonstra & Gravenhorst, 1998). In such circumstances a process approach is required (de Bruijn et al., 2010). This approach is often applied in network configurations with multiple stakeholders, who rely upon each other and negotiate the problems and solutions to work towards a shared solution.

In terms of Mintzberg, there is a shift involved from coordination through *standardization* towards *mutual adjustment* (Mintzberg, 1980). In other words, there is a tension between having control (standardization) and allow teams to be innovative (Lantz et al., 2015). These researchers argue that: ''paradox between standardized work and innovative teamwork can be dissolved by team participation in the decision regarding work design and inter team collaboration, which foster team communication to clarify and develop a shared understanding of team goals and strategies and stimulate via these team learning processes team proactive behaviour.''

Organizations may also encounter internal (design) challenges which cannot be optimally solved through hierarchical approaches. In case of mechanistic organizations with hierarchical structures of control shifting towards collaborative approaches a couple of challenges arise. These are highlighted in the next paragraph. Addressing the issue of the tension between standardized processes and inviting employees to the design table.

2.1.2. What is collaboration?

Collaboration is often used interchangeably with similar concepts such as coordination, cooperation and teamwork (Bedwell et al., 2012; Kvan, 2000). Therefore, different generic views on collaboration are provided. According to Patel et or al. ''collaboration involves two or more people engaged in interaction with each other, within a single episode series of episodes, working towards common goals'' (Patel, Pettitt, & Wilson, 2012). Another working definition has a similar perspective towards collaboration (Bedwell et al., 2012): ''collaboration is an evolving process whereby two or more social entities actively and reciprocally engage in joint activities aimed at achieving at least one shared goal.'' Bedwell et al. also argue that social entities may include individuals, groups, units, departments or organizations. Furthermore, interactions can take place on many levels of analysis, so between different types of entities or between a combination of entities.

As already pointed out, such processes can have advantageous outcomes for an organization in which social, political, and economic problems can be addressed (Woodland & Hutton, 2012). The advantages in general include: profit increase, cost savings by sharing best practices, promoting better decision-making by incorporating multiple viewpoints and enabling innovation through knowledge sharing (Hansen & Nohria, 2004). Additionally, job satisfaction, organizational commitment and performance are also factors which can benefit from collaborative processes (Black & Gregersen, 1997). Thomson and Perry assume that collaboration is process-oriented in which parties interact over time (Thomson & Perry, 2006). They define collaboration as follows: ''collaboration is a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions.''

Gray introduces the multi-stakeholder view on collaboration (Gray, 1989). He points out that such processes involve participation with multiple parties who have different perspectives towards the problem in which the process is rather ''emergent than a prescribed state in which collaboration represents a longer-term integrated process through which parties who see different aspect of a problem constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible''. However, researchers have seen that ''just putting together participants does not necessarily make a collaborative process collaborative'' (Sudweeks & Allbritton, 1996).

Keyton et al. adopt the view that ''collaboration is both a structure and a process'' fostering the act of doing through which common problems are addresses (Keyton, Stallworth, & Frey, 2003). Four requirements are needed for successful collaboration between stakeholders:

a) Shared goal
b) Member interdependence
c) Equal input of participants (reciprocity)
d) Shared decision-making

Additionally, leadership issues, member motivation, culture (values, norms, assumptions and practices), maturity and diverging perspectives also play a role. Nevertheless, such collaborative processes can also involve possible implications and barriers to collaboration which should be addressed adequately in order to achieve the aforementioned advantages (Patel et al., 2012). Participants may have a specific common goal but could also have conflicting interests which can hinder the collaborative process.

2.1.3. Related concepts

The positioning of collaboration – and its link with requirements elicitation for input of management decisions – in relation to other related concepts is elaborated hereafter. *Teamwork* is an instantiation of collaboration and only takes place on one level of analysis whereas collaboration exists beyond the team level (Bedwell et al., 2012). Additionally, on the one hand, teamwork is related to command & control (project approach), a single joint outcome in which teamwork is the goal and the process is a means. On the other hand collaboration involves creativity, shared & competing goals, trust and the focus is the process itself. A second definition, the concept of *cooperation* should be considered as a predisposition to organize collaboration. Furthermore, in *coordination* reciprocity is not necessarily involved for example with sequential interdependence.

2.1.4. Towards collaborative design

Dym and Little (2009) point out that design is especially useful for problems which are ill-structured and open-ended (Dym & Little, 2009). Ill-structured indicates that a solution cannot developed through mathematical formulas and open-ended means that there are multiple suitable solutions possible. However, several design approaches exist to resolve ill-structured and open-ended design problems. Design approaches have gradually

shifted from classical user-centered approaches to co-designing for collaborative experiences (Sanders & Stappers, 2008). The participatory design approaches has found its roots in Scandinavia allowing users to take part in design processes early on during the design phase. Later on *collaborative design* – often used interchangeably with *participatory design* and *co-design* – has emerged in which design is crafted to more diverse individuals than designer and user. The goal of collaborative design is formulated as follows (Kang, Choo, & Watters, 2015): ''to include all stakeholders in the design process to ensure that the end results meets the needs of all and is usable''.

Other researchers (Iversen & Leong, 2012) argue that collaborative design aims at incorporating stakeholder values in the design. Simonsen and Hertzum point out that collaborative design is conducive to foster ownership among stakeholders, acceptance and develop the best design possible (Simonsen & Hertzum, 2008). It should be mentioned that collaborative design is appropriate method to promote learning, both on a team and on an organizational level. Team learning deals with gaining insights into other viewpoints, opinions and perspectives and to collectively develop a shared solution. An outcome of the collaborative design process is organizational learning which addresses the question what insights from the design workshops can be applied for other purposes in the organization. Generally, collaborative design is often ''a necessity rather than a luxury'' in order to incorporate multiple disciplines and this manner achieve better design solutions (Fischer, 2004), often for ill-structured problems (Rittel & Webber, 1984) which are characterized by changing problem perceptions, instable design requirements, there are multiple acceptable solutions and design problems are complex (Détienne, 2006). Additionally, three factors which characterize collaborative design, i.e. participant's diversity (multi-expertise or in other words a *multi-stakeholder context*), a process which is simultaneous (task interdependencies) and the aim for the best design that includes all views (Rahmawati, Utomo, Anwar, Nurcahyo, & Negoro, 2014). Within this research collaborative design is only considered at an intra-organizational level. The working definition of collaborative design is as follows:

''*design approach in which a variety of stakeholders participates in the design process using shared rules aimed at incorporating diverging views, promote mutual learning and working towards a common goal to collectively achieve better organizational outcomes.*''

Organizational outcomes may refer to the designed artefact itself meeting stakeholder needs, but also factors such as acceptance towards a solution, sense of ownership or organizational learning. Therefore, collaborative design may be an appropriate method to facilitate a collaborative (design) process with multiple stakeholders. Allowing multiple stakeholders to collaboratively design a new artifact for spatial redesign purposes requires a suitable approach to facilitate this process.

Note that terms as collaborative design, participatory design and co-design are often used interchangeably within literature. For example, co-design is ''the collective creativity of collaboration designers. It refers to the creativity of designers and people not trained in design working together in the design development process'' (Sanders & Stappers, 2008). Similar definitions are found for participatory design and collaborative design as noted above. According to Sanders & Stappers ''the existing power structures in companies are built on hierarchy and control. New interdisciplinary design approaches threaten the existing power structures by requiring that control be relinquished and given to potential end-users. It is very difficult for those who have been successful while being in control to give it up now or to imagine a new way of doing business that can also be successful'' (Sanders & Stappers, 2008).

2.1.5. Towards collaborative design

Dorst puts forward four elements which should be considered when performing collaborative design processes (Dorst, 2008). The levels of design are the following:

- Object of design: the intended artefact to be designed;
- Context of design: which deals with the environment in which the artefact is supposed to function;

- Actors who design: concerning the actual designers participating in the design process;
- The design process and methodology used for design.

In other research issues have been addressed which are important to consider when using collaborative design: the politics of design addressing decision-making processes and power relations; the nature of participation & methods; and tools and techniques to facilitate the collaborative process (Kensing & Blomberg, 1998). Other researchers argue that in order to organize successful collaboration processes a coordinator should look after the following steps (Xie et al., 2014):

1. Project management: designing and planning the collaborative process, establish the team and scheduling meetings;
2. Meeting facilitation: promote an participative setting, ensuring that all views are heard, making team decisions and select appropriate tools and methods;
3. Data collection and analysis: gather feedback from stakeholders, interviews, observations; analyzing and preparing data to prepare meetings;
4. Intervention development and testing: design the intervention and revise it based on stakeholder's feedback

These are important elements to consider when designing collaborative processes. For each of these elements specific challenges are involved. Moreover, a distinction can be made per collaborative design phase. Four phases are identified for generic problem solving processes (Ackoff, 1978) and are also used to distinguish between phased in the collaborative design process (Piirainen, Kolfschoten, & Lukosch, 2012):

- Problem definition in which the design objectives and scope are defined, including the process (methodology) and constraints. Main aim in this phase is to develop a shared understanding among the participants, regarding the above issues;
- Construction phase: based on the problem definition an artefact is to be constructed in which a balance is to be find between the stakeholder requirements and to develop a design which is accepted and meets the intended objectives;
- Testing or validation phase which addresses whether or not a develop design is complete and meets stakeholder requirements;
- Implementation: the last phase involves the employment of the new artefact, overcome resistance, create ownership and enhance sustainability of the selected design.

In this research the focus is mainly on the problem definition and construction phase. The testing/validation and implementation phase are also addressed, however, less attention will be paid to these last two phases.

Piirainen et al. have combined the levels of design and the distinguished design stages to categorize specific challenges involved with collaborative design practices (Piirainen et al., 2012). The general challenges involved with collaborative design are the following implications: creating understanding (to create shared understanding and mental models of the objectives, problem, current state and solution); satisfying quality (finding a balance between stakeholder requirements and quality requirements/constraints); balancing rigor and relevance (finding appropriate methods which satisfy stakeholders and objectives); organizing interaction (to facilitate interaction between designers and organize effective collaboration) and ensuring ownership (during the actual implementation phase in which ownership is transferred to stakeholders who will use the designed artefact).

2.1.5. Collaboration design dimensions

According to Pisano & Verganti the *collaborative architecture* is constructed along two dimensions: openness and governance. Openness can refer to closed or open collaboration:

- *Closed* collaboration: participants are chosen by a group leader beforehand with fewer participants
- *Open* collaboration: collaboration is allowed for everyone to participate, often with a large number of participants. Often applied when the problem is not well-defined.

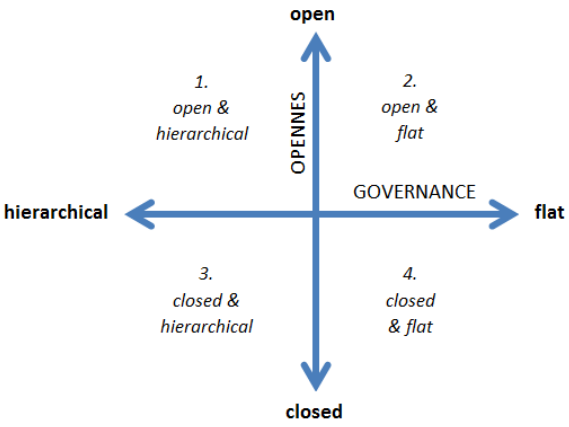


Figure 4. Dimensions of collaborative architecture

The second dimension concerns the governance of collaboration, consisting of flat and hierarchical collaboration:

- *Flat* collaboration: all stakeholders can participate, decisions are made collectively and there is consensus on the project goals.
- *Hierarchical* collaboration: management is in charge of decision-making and the issues are chosen by the decision-maker in which participants can have their specific individual goals.

Basically, four possible configurations can be selected. See figure above. These are:

1. *open & hierarchical: a*nyone can participate and management is in charge of the final decisions
2. *open & flat*: the participants are in charge of the process and final results
3. *closed & hierarchical*: participants are pre-selected and management makes the final decision
4. *closed & flat*: the participants are selected beforehand and develop solutions together

Others put forward a similar framework for collaboration in which various factors are listed influencing collaborative processes (Patel et al., 2012):

2.1.6. Explanation of the collaboration process

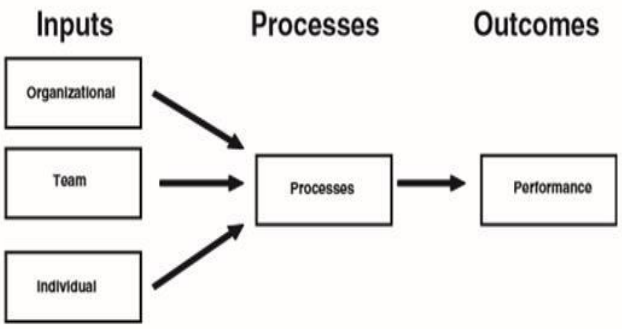


Figure 5. IPO model of team effectiveness (McGrath, 1964)

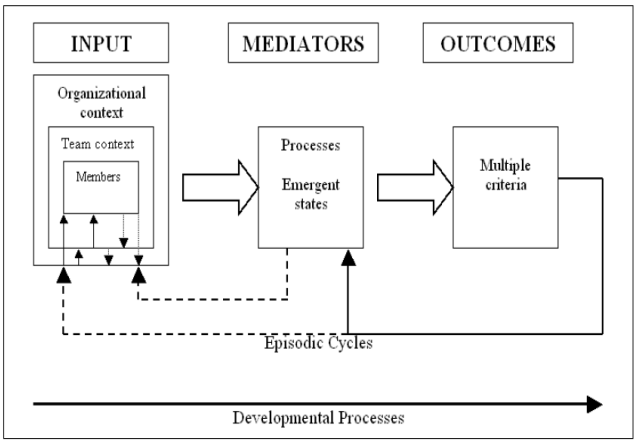


Figure 6. The IMOI model (Ilgen et al., 2005).

Sociotechnical design coordination does not only focus on technical decisions, but also on social decisions (Healey, 1997; Lu & Cai, 2001), so both soft and hard structures are required to facilitate collaboration processes. One often distinguishes between these elements (Koppenjan & Groenewegen, 2005):

- social factors: involving team (learning) processes and behavioural sciences.
- technology: the collaborative infrastructure offering tools and techniques to foster collaboration and;
- process factors through structures: rules, regulations, resources, guidelines and procedures (Stohl & Cheney, 1997)

Different factors influence the process of collaboration. Initially, McGrath has developed a framework for team effectiveness as basis for team dynamics concepts (McGrath, 1964). In this situation a collaborative initiative is preceded by input factors on the organizational, team and individual level. After the collaborative process,

specific outcomes are the result of the collaboration effort.

The above model is a simplification of reality without feedback loops. However, there exist relations from output to input (Ilgen, Hollenbeck, Johnson, & Jundt, 2005). For example, team outcomes can have an impact on input factors in case of follow-up meetings. Therefore, the IMOI-model (input-mediators-outcomes) is introduced to account for feedback loops. Contrary to the IPO-model which considers team performance as a static linear process, the IMOI model addresses team performance rather as a dynamic, developmental process in which a team develops over time and where team outcomes also influence team inputs and *emergent states*. Emergent states are ''*constructs that characterize properties of the team that are typically dynamic in nature and very as a function of team context, inputs, processes and outcomes*'' (Marks, Mathieu, & Zaccaro, 2001). Examples are trust, team efficacy and team solidarity. These factors are first influenced by input variables which relate to organizational and team context and individual factors.

2.1.7. Designing the collaboration process design

According to these researchers, one particular method to apply team collaboration is a design workshop (Boonstra & Gravenhorst, 1998). Within this study the *workshop design approach* is discussed (Kolfschoten & de Vreede, 2009). They distinguish between the regular problem solving process and the activity for a collaborative process.

Table 1. Problem solving activities in collaboration process design (Kolfschoten & de Vreede, 2009).

Problem solving process	Activity for collaboration process design
1. Understand the problem	1. Analysis of task/problem
	2. Analysis of group and context
	3. Define tasks/steps
	4. Define subtasks/steps
2. Develop alternative solutions	5. Explore possible techniques
3. Evaluate alternatives	6. Evaluate possible techniques
4. Choose alternatives	7. Choose techniques
5. Make a plan	8. Create a detailed hour by hour time frame
	9. Create agenda
	10. Document design
	11. Try design on test group
	12. Other aspects

According to Dym & Little the general design process consists of (Dym & Little, 2009):

- Client's problem statement
- Problem definition (objectives, metrics, constraints, revision)
- Conceptual design
- Preliminary design
- Detailed design
- Design communication
- Product (and validation based on problem definition)

In order to facilitate a well-organized collaborative process Gottesdiener put forward three elements which should be addressed (Gottesdiener, 2007). These are the following:

- *Protocols establishment* for team interaction to have a smooth process and clear outcome;
- *Process guidance* through a facilitator to foster communication;
- *Prework for contracting*: to create team competence and commitment

2.2. Facilitation of collaboration and team aspects

The following paragraph elaborates on issues regarding collaboration on the team level. It starts with trust issues. Thereafter, the concept of shared understanding is addressed and subsequently the multi-stakeholder context is highlighted.

2.2.1. Trust and communication-related issues

There are basically three types of trust which should be considered when facilitating collaboration (Reina & Reina, 2005): *contractual trust*: which includes trust concerning goals, roles and responsibilities. *Communication trust*: participants communicate honestly and clearly. *Competence trust* deals with mutual learning, respecting each other and the belief that together they can accomplish the task. Additionally, De Bruijn et al. argue that in process management not only trust in each other is essential (de Bruijn et al., 2010). Trust in the process itself is key to collaborate with stakeholders.

2.2.2. Building shared understanding

Bittner and Leimeister have developed a process design to allow heterogeneous groups to enhance shared understanding and in this way improve effective collaboration (Bittner & Leimeister, 2013). The researchers focus on complex, ill-defined problems which require multiple perspectives to be resolved. They define *shared understanding* as ''the ability of multiple agents to coordinate their behaviours with respect to each other in order to support the realization of common goals or objectives''. Shared understanding relates to knowledge, beliefs and assumptions. Shared understanding is shaped by three main determinants (team learning behaviours), e.g. construction, co-construction and constructive conflict (Bossche, Gijselaers, Segers, Woltjer, & Kirschner, 2010).

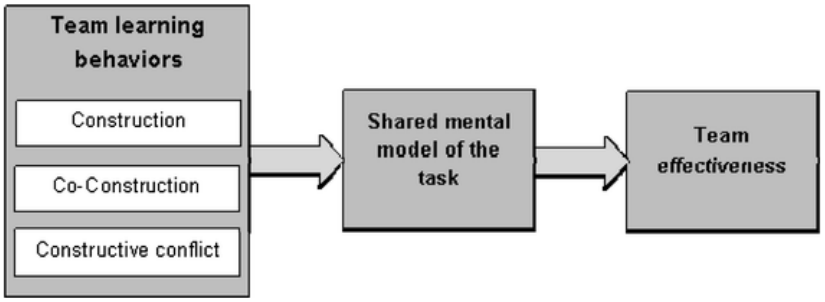


Figure 7. Conceptual model of shared mental models (Bossche et al., 2010).

Construction of meaning relates to the individual's articulation of the problem description and solutions where the other group members actively listen and try to understand someone else's view point. Subsequently, *co-construction of meaning* is often referred to as collaborative construction in which members mutually aim at converging towards shared understanding by refinement, building on, and modifications initial descriptions. Through collaboration a new shared understanding is shaped. However, participant may have diverging perspectives and therefore disagree on certain interpretations and eventually leading to different meanings. Nevertheless *constructive conflict* should be seen a way to gain insights into other viewpoints to enhance problem solving capabilities. Constructive conflict is defined as ''dealing with differences in interpretation between team members by arguments and clarifications''. Bossche et al. have provided a collaboration process design for shared understanding. This framework consists of 7 consecutive activity steps:

Table 2. Collaboration process design activities for shared understanding

Number	Activity	Description
A1	Task presentation	Process leader briefly introduces the group to the task
A2	Construction of meaning	Participants write down their individual task description
A3	Clarify different understandings	Participants read each other's descriptions and a) Ask clarification questions

		b) The original author of the description answers the question c) Participants evaluate the clarity of the descriptions
A4	Awareness for divergent views	Participants read each other's description and a) Evaluate consistency with their own understanding b) Name the differences they can identify
A5	Identify conflicts	Participants classify differences into: conflicting with own understanding and non-conflicting
A6	Solve conflicts (in case of conflicts)	Participants discuss conflicting differences ➔ Agreement on a shared understanding ➔ Negotiation and compromise
A7	Confirm shared understanding	Participants are asked to commit to the shared description

According to Kerzner conflicts can relate to: opinions, interests and desires (Kerzner, 2013). There are five basis strategies to resolve conflicts: avoidance (ignorance); smoothing (accommodating); forcing (command and control); compromise (reconciling) and constructive engagement. The latter one is most desired in which underlying desires of stakeholders are defined and then ways are found to realize them. This requires participants to listen to each other carefully and communicate underlying desired openly.

2.2.1. Collaboration and the multi-stakeholder context

Rittel and Webber point out that the problems society face are more and more wicked problems, which are complex, open-ended and ill-defined (Rittel & Webber, 1984). These challenges cannot be solved solely by application of the hierarchical project management approach. Such problems need approaches of collaborative nature with multiple minds – e.g. stakeholders who are either affected by the new solution or have decision-making power and have a certain attitude towards a problem – in order to incorporate relevant perspectives to enhance problem solving capabilities. The various stakeholders may have different organizational roles and responsibilities. In such circumstances a process approach is required (de Bruijn et al., 2010) which is especially useful in configurations with multiple stakeholders, who in some way rely upon each other and negotiate the problems and solutions to work towards a shared solution. A sense of urgency contains to components (de Bruijn et al., 2010): 1) a substantive component: there is an issue which has to be solved; and 2) a process component: the issue can only be solved by participation in a process

Woodhill has elaborated on multi-stakeholder processes and its definition (Woodhill, 2004). Multi-stakeholder processes involve ''*the idea of bringing together different stakeholders (actors) who have an interest in a problem situation and engaging them in processes of dialogue and collective learning that can improve innovation, decision-making and action*''. Such processes are characterized by the following set of elements (Woodhill, 2004):

1. ''Deals with a clearly bounded context and set of problems
2. Involves an explicitly defined and evolving set of stakeholders with common (& conflicting) interests
3. Works across different sectors and scales (disciplines, functional areas & hierarchical layers)
4. Follows an agreed yet dynamic process and time frame
5. Is guided by negotiated and understood rules of interaction
6. Deals consciously with power and conflict among stakeholders and sectors
7. Engages stakeholders in learning processes (not just negotiation over fixed positions)
8. Aims for a balance between of bottom up and top down approaches
9. Aims to contribute towards effective institutional change''

Within multi-stakeholder environments the different parties may differ significantly in terms of characteristics (Corsaro, Cantù, & Tunisini, 2012). Heterogeneity of stakeholders may be required to enhance problem solving capability, however, this

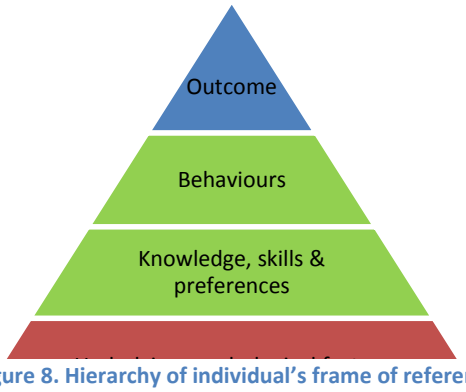


Figure 8. Hierarchy of individual's frame of reference

may also lead to challenges to align stakeholders with diverging characteristics. Stakeholder heterogeneity can be expressed in terms of the following aspects: goals; knowledge; capabilities and competences; perception (viewpoints); power and position and culture.

Participants in collaborative processes interact with each other to their specific frame of reference: ''*a structure of assumptions, ideas and views by means of which an individual or group perceives or evaluates data, communicates ideas and regulates behavior*.'' Put differently, certain factors determine how individuals communicate, behave and interact with each other. Within this study only factors are considered which can be observed. Psychological factors, e.g. values, motivation, beliefs, traits, motives and norms, are not addressed within this study.

2.3. The organizational level: participative decision-making

This next paragraph deals with the concept of participative decision-making and its link with collaboration. Engaging with organizational employees and how their knowledge and expertise can effectively be used for top management to develop appropriate decisions and measures is also addressed in this paragraph.

2.3.1. What entails participative decision-making?

Participative decision-making has gained attention in the last decades (Black & Gregersen, 1997). It has gradually emerged as employees desire perceived engagement to an organization for achieving better results as can be explained by Maslow's hierarchy of needs (Maslow, 1943). Participative decision-making, often referred to as PDM within literature, can be defined as ''the extent to which employers allow or encourage employees to share or participate in organizational decision-making'' (Probst, 2005).

Two main reasons exist why participation in decision-making and innovation is essential (West, Hirst, Richter, & Shipton, 2004): 1) influence over decision-making processes will enhance information exchange and idea sharing and 2) there is less resistance to change as participants have contributed to the development of solutions. One should distinguish between employee participation and employee involvement within participative decision-making.

- Employee participation: fosters a team approach in the workplace with shared decision-making and initiative is a group/co-employee effort where they share the same goal.
- Employee involvement: action-oriented bottom-up process within an organization to enhance performance, serving as an information flow until a management decision is taken in which organizational members collectively participation in problem solving (Shaw & Ward, 2003).

2.3.2. The decision-making change strategy for intra-organizational collaboration

Various types of change management strategies can be identified. Applying collaborative decision-making presumes equal members and different viewpoints. An appropriate change strategy is *normative-reeducative* (Chin & Benne, 1976). This entails involvement of organization members in programme of change who have diverging perspectives and have different problem definitions. Such decision-making is characterized by ''*the involvement of organizational members in programme of change. The way participants see themselves and their problems must become the subject of a dialogue in which different perceptions are exchanged. Such a dialogue makes clear that problems are related to the definition of the situation and the underlying attitudes, values, norms and relationships. Thus, we can learn that alternation and re-education are required as a condition for solutions. According to this strategy, members of organizations must learn to cooperate in problem identification and the formulation of solutions that improve organizational learning*'' (Boonstra & Gravenhorst, 1998). Other research points out that in collaboration projects organizational members throughout all layers of the organization are brought together in order to solve problems by communicating their own viewpoints and learn from other members.

It is also argued that ''*participation of organizational members in the change process has positive effects on the commitment to changes and generates support for the implementation of changes in the organization*'' (Boonstra & Gravenhorst, 1998). They also argue that such an approach ''*enhances acceptance of organizational members to support improved organizational work design by an increased sense of ownership*'' (Simonsen & Hertzum, 2008). West et al. argue that generally, there are two reasons why participative decision-making and team innovation go hand in hand: first, participants will share their thoughts and ideas. Second, since participants have influence over the outcomes, there will be less resistance to change thus enhancing acceptance (West et al., 2004).

2.3.3. Dimensions of intra-organizational participative decision-making

Within literature various characterizations of participative decision-making are distinguished. Cotton et al assert that there are six categorisations of participative decision-making (Cotton, Vollrath, Froggatt, Lengnick-Hall, & Jennings, 1988):

- Participation in work decisions (formal, long-term and direct)
- Consultative participation (same, but lower level of influence in decision-making as previous)
- Short-term participation (formal, short term and direct)
- Informal participation (interpersonal relationships between employer and employee; no fixed rules)
- Employee ownership (formal and indirect participation)
- Representative participation (formal and indirect; representative employee with medium influence)

Additionally, (Black & Gregersen, 1997) put forward six dimensions of participatory decision-making which have to be considered when planning for such decision-making processes:

- *rationale* (motivation): participation is either democratic (it is one's right to participate) or pragmatic of nature (participatory processes for example achieve higher cost efficiency/productivity/problem solving capabilities).
- *structure*: extent to which the process ranges from formal (fixed procedures, agenda, participants) to informal (informal rules, format, content). Informal nature enhances job satisfaction, commitment and motivation (Cotton et al., 1988).
- *form*: extent to which decision-making is direct or indirect. Direct: immediately evolve in DM, present personal opinions. Indirect: representatives are assigned to participate in DM. Direct is more effective than indirect.
- *decision issues*: work & task design, work conditions, strategies and capital distribution (Cotton et al., 1988).
- *degree/level of involvement*: level of involvement leads to differential decision outcomes. Which level of participation is appropriate? Higher involvement leads to more control and thus higher employee satisfaction.
- (range of participation in) *decision process*. Contains five processes: 1) identify problems; 2) solution-generating; 3) select specific solution; 4) planning and implementation ; 5) evaluation. In which processes do you invite employees?

Somech considers participative decision-making as multidimensional construct and also defined dimensions of participative management (Somech, 2002): *decision domain*, *degree of participation*, *structure*, *target of participation* and *rationale* for the process. A similar categorisation of employee participation is provided by Wilkinson et al. (Wilkinson, Gollan, Marchington, & Lewin, 2010; Timming, 2014):

- *degree* of influence: extent to which employees can influence decision-making
- *level* at which it takes place: task; departmental; establishment; corporate HQ (PNP: operational; tactical; strategic)
- *scope/range* of subject matter: trivial versus strategic
- *form* of participation: indirect: through representatives or more direct

- *reach* of participation: extent to which PDM covers all types of organizational stakeholders

Van der Helm has listed several dilemmas which should be considered when designing a participative decision-making process (Van der Helm, 2007):

- participation both as answer and problem. It is a solution but also involves challenges
- participation of stakeholders: why, who, what, when and how will participation take place?
- level of ambition, context and participants
- Representation and legitimization (''*participation works best in a situation where it is not needed, i.e. in an environment in which all interests are taken into consideration*'')
- Knowledge, power and strategic behaviour
- Formalism or freedom (dimensions)
- Entering the debate: between time and perseverance
- Going beyond information: communication and mediation
- Results and non-results
- Appreciating and apprehending success and failure

2.3.4. The participation paradox

There is a paradox involved in participative decision-making where organizational members are engaged with in order to develop solution for business challenges. However, the participation might not be genuine as ''*it allows the powerholders to claim that all sides were considered, but makes it possible for only some of those sides to benefit*'' (Arnstein, 1969). In other words, collaborative efforts as bottom-up approach have to be genuine with open and transparent communication and decision-making. Contrary, when participants do not perceive the approach as anticipated this may harm trust and thus a successful outcome of the collaborative process. This is also stressed by Stohl and Cheney (Stohl & Cheney, 1997).

2.4. Spatial redesign from a lean perspective

This paragraph first addresses the concept of lean management and its integration in business operations. Subsequently, spatial layout redesign is elaborated upon. Thereafter, insights are provided concerning the participation of organizational members in lean practices. Last, possible pitfalls and barriers are listed an how these issues should be overcome.

2.4.1. Introduction to the overarching theme: lean management

The practices of Henry Ford and the scientific management school formed the basis for the current lean philosophy. Lean management has originally its roots at the Toyota Motor Company in Japan (Womack, Jones, & Roos, 1990). Its main objective is to remove any slack within the system (value stream) in order to make production and manufacturing processes more efficient and thus reducing cost. In this manner a competitive advantage to outperform competitors. Waste within the system can refer to seven categories, e.g. overproduction, inventory, waiting, transportation, defects, movement and unnecessary processing.

Lean management is based on five principles: value identification from a customer viewpoint; activity (value stream) mapping for each product and their waste; making the product flow continuously and standardise best practices; only supply upon demand (pull); and strive for perfection as lean management is considered as *continuous improvement*.

2.4.2. Spatial layout redesign

Spatial redesign is concerned with the reorganisation of a workplace layout and is an arrangement of required products, items and materials to carry out specific processes. The objective of new layout configurations is to make involved processes more efficient by elimination of the seven categories of waste in the value stream from the perspective of lean management. Waste is also considered as non-value adding activities. Other

activities identified within the workplace may also be non-value adding, however, are required. The third type of activity are the value-adding processes. These are to be incorporated within a new layout design. Note that layout planning can relate to different levels. The focus in this study concerns the layout of departments or cell layouts. Several steps can be distinguished in order to develop new designs of a facility layout: a) map the current state of the target area (as is state); b) waste elimination and the identification of alternative solutions; c) representation of the future state map; and d) design of the new facility layout.

A workplace organization techniques is the 5S method. This is a structured way to facilitate layout improvements and is often applied at lean kaizen sessions with employees.

- Sort: distinguish between non-value adding and value adding products. Note that required non-value adding products also have to be included in the new design;
- Set in order: make an arrangement of the required products to increase workflow effectiveness;
- Shine: clean the target workplace area;
- Standardize: develop standards to maintain consistency and provide clarity;
- Sustain: secure that standards are conformed to by employees

Note that spatial redesign is different from regular spatial/layout design as in a redesign situation the current target area is already arranged in a particular manner. For this reason the layout has to change which may cause resistance, especially when the as-is situation is satisfactory for specific employees.

2.4.4. The socio-technical systems perspective

In recent years the importance of socio-technical systems application to system development has widely been acknowledged (Baxter & Sommerville, 2011). Socio-technical systems integrate human, social, organisational and technical factors in system design in order to develop systems that have more acceptance and create better stakeholder value. Increasingly, lean manufacturing practices – and thus also spatial redesign challenges – have incorporated a socio-technical system view to deal with soft values in technical environments (Shah & Ward, 2007; Iqbal Raja, 2011; Niepcel, 1998; Clegg, 2000 & Bortolotti et al., 2015). The social subsystem addresses factors such as trust, both on an individual and team level. On the other hand, the technical system shapes the behaviour of involved actors by artefacts, e.g. methods, techniques, tools and procedures. According to Shah and Ward lean can be defined as follows (Shah & Ward, 2007): ''l*ean is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability*.'' Adequately addressing human aspect of lean management promotes the successful implementation of lean initiatives on the long term. This leads to better decisions which are better accepted by employees. An effective way is when employees participate in lean initiatives and thus in spatial redesign design processes.

2.4.5. The current lean approach and shared decision-making

Literature points out that human resource practices are of utmost importance to accomplish successful lean outcomes, e.g. participation of employees in lean improvement projects (Shah & Ward, 2007). Nowadays, standardization is an important tool to work according to efficient best practices which are developed by participative work organization. In a desired situation lean is implemented from the floor in which management facilitates continuous improvement. Floor workers are encouraged to have real influence which requires a collaborative management culture.

Facilitating an kaizen event with employees is an example of allowing employees to participate in developing improvement projects for a specific targeted work area (Liker, 2004). Kaizen follows a bottom-up approach and focuses on step-by-step team-based improvements through standardization of work processes and lay-out planning. A new standard serves as a basis for follow up improvements (lean is seen as a continuous improvement philosophy). Kaizen is process-oriented, rather than results oriented, i.e. ''the process focus on the decision-making approach is more valuable than the actual outcome of the decision-making process (Liker,

2004). Farris et al. have researched what factors influence the outcomes of kaizen events in which they studied kaizen in the context of team effectiveness (Farris, Van Aken, Doolen, & Worley, 2009). A kaizen event is defined as ''*a focused and structured continuous improvement project, using a dedicated cross functional team to address a targeted work area, to achieve specific goals in an accelerated timeframe*''. This concept is used to improve a specific work area and facilitate the process of team learning, problems solving and participation. In addition to the general framework of the input-process-output model for collaboration and team effectiveness (Guzzo & Shea, 1992; McGrath, 1964; Ilgen et al., 2005) other researchers have adapted this basic framework for lean kaizen purposes (Farris et al., 2009). These framework contains five elements: *kaizen event design antecedents* or input factors; *organizational and work area antecedents* describing context, enablers and disablers; *kaizen event process factors* involving group process characteristics; *social system outcomes*; and *technical system outcomes* which describes work area related results (Farris et al., 2009). All of aforementioned factors can be decomposed into sub factors as presented in the below Figure 9.

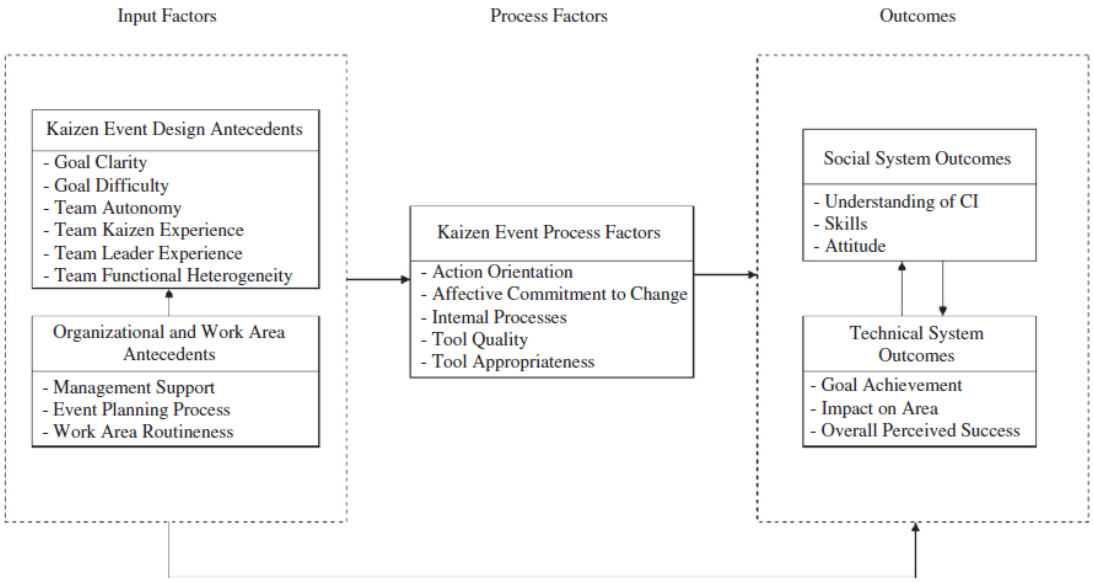


Figure 9. Kaizen framework based on the IPO model (Farris et al., 2009)

2.4.6. Managing both standardisation and innovative teams

Lean management is based on continuous improvement in which processes are constantly improved through standardisation (Niepce & Molleman, 1996). However, standardisation of processes may restrict innovation or employee participation to enhance creative thinking (Lantz et al., 2015; Monden, 2011). On the one hand standardization of processes and practices are required to ensure efficient processes. On the other hand, lean principles stress that employees should be creative and come up with ideas to develop innovative ideas by teamwork.

The paradox between standardized work and innovative teamwork can be dissolved by standardizing how teams collaborate (Lantz et al., 2015). They argue that ''the paradox between standardized work and innovative teamwork can be dissolved by team participation in the decision regarding work design and inter team collaboration, which foster team communication to clarify and develop a shared understanding of team goals and strategies and stimulate via these team learning processes team proactive behaviour.'' Furthermore, activities to reduce waste by standardisation of work is a continuous effort in which employees participate and collaborate and thus not a fixed standard imposed unilaterally. Making these continuous improvements does not only enhance performance but also facilitates a learning process by which attitudes and behaviours are

changed. Lantz et al. propose three recommendations for managers to facilitate participation and collaboration:

- Identify all relevant stakeholders in lean standardisation processes and seek for acceptance, and participative decision-making platforms.
- Management should initiate participative decision-making processes and develop a shared understanding for the need of collaborative efforts.
- Managers should have an agreement stating how and when they initiate collaboration and participative decision-making which serves as strategic decision for future improvements.

Mcbride identifies key steps in implementing kaizen steps (Mcbride, 2005):

1. Define goals for research area, reasons and stating state how the outcomes will serve individual's and organizational interests (Farris et al., 2009). Note that the performance goals need to be linked to organizational goals, which originates from organizational values (Dransfield, 2000).
2. Select cross functional team
3. Training the team on the process at first meeting
    a. Lean management
    b. Tools (5S: sort; straighten; shine; standardise; sustain)
4. Current state: reaching problem consensus
5. Create problem statement
6. Create solutions
7. Select solutions
8. Establish success indicators
9. Plan & implement
10. Standardize
11. Report results
12. Celebrate results

2.5. Insights from field research observations and interviews

Potential challenges have been identified from field research with a great diversity of stakeholders at PNP:

- Ensure that *power relations* are managed carefully: agreements are required to deal with the issue of line managers and their subordinates.
- Engaging with diverging disciplines may cause *conflicts* between participants, either the perspective or a specific workplace-related issue
- Determine a certain *degree of participation* of stakeholders. To what extent is it desired to involve with organizational stakeholders?
- *Management of expectations* is crucial to clearly communicate what is expected from each other: make sure that participant are not dissatisfied when the outcome of the process does not meet their requirements and expectations? This can affect acceptance towards a future solution.
- One should be aware of different *organizational priorities*. Make sure that these priorities are communicated well.
- There is a *trade-off* involved between a well-structured collaborative process and the extent to which this process is informal (with relative high levels of autonomy). Make sure to achieve a smooth process with as less rules as possible.
- *Degree of standardization*: to what extent is standardization desired? This is trade-off between control (standardization) and freedom (autonomy).
- Make sure that *participants are committed* to the process beforehand and during the
- What about *incentives* to participate? How to deal with '*what's in for me'*?
- *Top management support* is crucial for successful future implementation of change initiatives. Make sure management is locked-in and supports the collaborative process
- *Stakeholder ownership* is essential for acceptance of future solutions. This holds for both the process as substance.

2.6. Insights from literature and field research

Based on the conceptual framework as formulated in the previous chapter, initiating a collaborative design effort in a spatial redesign context for management input decision-making several aspects have to be considered. A possible intervention design starts with socio-technical system view in which soft and hard variables fulfil an important role. Central aspect is the design process activity in which participants actually design a new interior solution based on their requirements. Outputs is the technological design (interior standard) and an institutional design in which arrangements between management and participants are elaborated upon. A preceding aspect concerns the process design. This process design is to be designed and tested within this chapter. In this paragraph the requirements for the process design are provided. In other words: who participates and applicable pre-conditions.

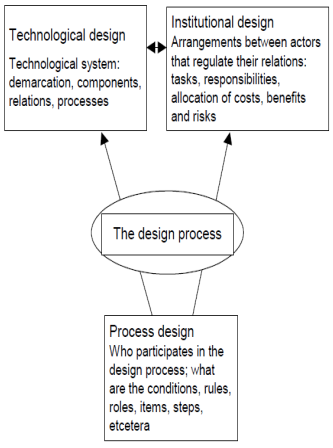


Figure 10. TIP framework

2.6.1. Structuring the design intervention

Initiating a collaborative design interventions entails more than solely facilitating a design process. A preceding planning process is important to design the collaborative process itself. Thereafter the actual design workshop takes place in which requirements and suggestions for a new artefact are proposed by the participants in the design intervention. The third phase addresses the evaluation phase in which the output from the design process serves as input for management decision-making.

2.6.2. Getting management support

PNP management is faced with the diverging secured area layouts of depots throughout the Netherlands. Creating uniformity on a domestic level is priority for management to promote cost-efficient processes. Since the existing challenge is difficult to resolve as a results of local differences and diverging perspectives. Management has given approval and support to organize a collaborative approach in order to resolve this lay-out challenge. Additionally, management have to communicate certain pre-conditions, create a sense of urgency and to facilitate a first problem analysis.

2.6.3. Collaborative architecture

The collaborative architecture depends upon the existing organizational structure, culture, pre-conditions from management and past collaborative experiences. Within this case study, the organizational structure is hierarchical and there is a limited experience with collaboration or collaborative design. Management has that they will take a final decision, however, collaboration with multiple organizational stakeholders was encouraged to find best practices for the aforementioned business problem. The collaborative architecture can be described as hierarchical (management sets conditions for collaboration and takes the final decision) and a closed set of participants selected by the facilitator. Note that the collaboration process itself is not considered to be hierarchical as participants have to feel free should not be restricted in their way of thinking.

2.6.4. Collaboration requirements

The collaboration requirements are: interdependence, shared goal, member equality and shared decision-making. Participants are selected in such a way that they rely upon each other (*interdependence*) in order to fulfil organizational goals. Furthermore, during the intervention participants should have a shared goal which is to be achieved during the workshop session (*designing a provisional secured area lay-out*). Member equality is a challenging element as supervisors and subordinates are selected. However, through a group agreement member equality can be maintained. This group agreement is based on participant's input and enhances both commitment to the process as trust in each other. In this manner participants have to collectively design a new artefact. Constructive conflict is a manner to deal with multiple perspectives. This concept encourages conflicts as a dispute will provide new insights for team members to learn from each other

2.6.5. Collaborative design

Collaborative design is applied to develop new lay-out solutions for the secured area. Within collaborative design four levels of design have to be considered for each of the design stages. The levels are a) the *object of design*; b) *context of design*; c) *actors who design*; and d) *design process and methodology*. Concerning the design phases the following stages can be identified in which the levels of design each have their specific characteristics: a) *problem definition*; b) *construction*; c) *testing/validation*; and d) *implementation*.

It is crucial that participants use the same language as diversity is both the solution as a problem. Clarifying the goal and objectives will increase this shared understanding, also by using constructing conflict and resolve conflicts in an appropriate manner. Additionally, a shared identity is created through a group agreement in which participants formulate a individual *code of conduct*. Last, team learning is promoted through presentations and facilitation of feedback. Also organizational learning can be enhanced as a diverse set of organizational stakeholders is selected.

2.6.6. Management of expectations

Management of expectations is not only important during the workshop sessions. During the planning phase expectations should already be communicated, two-directional between management and participants. This also holds for the evaluation phase in which expectations are fulfilled.

2.6.7. Ownership & acceptance

Ownership is promoted through involvement of organizational stakeholders. During the design intervention ownership is also promoted through signing the group agreement. Obviously, participants should feel that the ideas expresses are their results. However, in the evaluation phase management has to make a final decision on the interior design and should be in accordance with the input from the participants to foster ownership.

2.6.8. Multi-stakeholder representation

Stakeholder diversity is both the solution as a problem in this specific situation. Multiple perspectives is expected to enhance problem-solving capability under the right conditions. Therefore, the right set of participants should be selected to have all relevant perspectives and expertise represented. These are both employees from distribution centres and supportive staff members and also from different hierarchical layers (strategic-tactical-operational representation).

2.6.9. Trust

Trust is a key element in performing collaborative initiatives. There are several instances of trust: contractual, communication and competence trust. Contractual concerns trust in the process itself, transparency and open communication promotes trust and participants should feel that the process and other participants sufficiently capable of functioning well during collaboration.

2.6.10. Form of lean standardization

The form of lean standardization deals with what actually is standardized. Here, the new lay-out for the secured area is (partly) to be standardized. However, this optimal level cannot be known in advance. Therefore, it is recommended to address this deliverable issue openly, clarify expectations from both management and participants.

2.6.11. Other relevant issues

Other identified issues concern generic aspects. One is framing in general. One should not address *problems* but *opportunities* to maintain positivity and avoid resistance of participants. The same holders for the concept of *lean* as this is often experienced as 'something to promote cost-efficient processes and imposed by management'. Therefore, it is recommended to not explicitly address lean as a concept with *standardization* as main tool for continuous improvement. This is likely to prevent resistance from stakeholders. Furthermore, possible design dilemmas (also potential conflicts between individual stakeholder requirements) should be identified beforehand and introduced during the workshop intervention to facilitate a good discussion.

3. The conceptual framework

This chapter provides the developed conceptual framework which entails the theoretical model for a collaborative design process to elicitate stakeholder requirements for spatial redesign issues. In the previous chapter a comprehensive literature study is provided. In paragraph 3.1 relevant notions are described which are used for the conceptual framework. In paragraph 3.2. an overview is provided how the conceptual framework is constructed based on the literature insights as described in chapter 2. The conceptual framework is tested in chapter 4 as part of a case study intervention at PNP.

3.1. Insights from literature

In this paragraph literature insights are summarized. These notions are categorized into three aspects: collaboration (including collaborative design), participative decision-making and thereafter lean management.

3.1.1. Collaboration and collaborative design

The objective of collaboration is to integrate multiple perspectives, working towards common goals to enhance problem-solving capability. Collaboration can be applied at multiple levels of analysis. Within this study intra-organizational collaboration is considered. The concept of collaboration is characterized by a multi-stakeholder view to incorporate diverging viewpoints within the collaborative process. The process itself takes place in three parts: first input factors (on an organizational, team and individual level) determine how participants are set together and under which conditions. Subsequently, the collaborative process takes place. Third is the process outcome which influences the input factors as part of a feedback loop. For collaboration the following requirements are applicable: interdependence, shared goals, member equality and shared decision-making.

A specific application of collaboration is collaborative design: this approach deals with creating artefacts through the integration of multiple minds to reach better organizational outcomes and organizational learning. However, just putting participants or designers together does not guarantee a successful process outcome. Power relations, conflicts, promoting an informal setting, commitment, incentives and trust issues should be addressed adequately to foster proper collaborative outcomes as part of requirements elicitation upon which design solutions are based. Collaborative design can be carried out by a design workshop in which four levels of design have to be considered beforehand: a) the *object of design*; b) *context of design*; c) *actors who design*; and d) *design process and methodology*. Furthermore, important aspect to consider are: creating a shared understanding, team identify, constructive conflict and promoting organizational learning. The collaborative architecture structures how the collaborative process should be designed to promote successful outcomes. There are two architecture dimensions: governance (hierarchical/flat) and openness (closed/open). A collaborative design process consists of four phases: a) *problem definition*; b) *construction*; c) *testing/validation*; and finally the d) *implementation* phase.

3.1.2. Participative decision-making within organizations

Participation and involvement of employees in decision-making processes starts with top management support. Thus management has to create a collaboration environment in which organizational stakeholders participate. Alignment with organizational goals is key for shared decision-making. Subsequently, objectives and expectations from both sides have to be communicated clearly. One should consider the degree or nature of participation. The extent to which participation is required should be determined beforehand, without harming ownership issues of employees. Above aspects lower the risk of the paradox of participation in which employees involvement is not perceived as genuine according to participating organizational stakeholders.

3.1.3. Spatial redesign from a lean perspective

Lean management is a continuous improvement philosophy in which standardization is key to improve workplace processes and increase efficiency. Management support is required to implement lean practices

throughout the organization and lean is ideally implemented bottom-up to increase ownership and acceptance at the workplace level. A clear distinction is made between technical and human factors within lean practices to promote successful outcomes. Kaizen events have been put forward to facilitate a design process for spatial redesign. For restructuring workplace area configurations one should distinguish between value adding and non-value adding activities. Once value adding and necessary non-value adding units have been assigned these units have to be arranged.

3.2. Constructing the conceptual framework with insights from literature

In this paragraph the construction of the conceptual framework is clarified. The literature study in chapter 2 provides insights how collaborative design is to be applied for spatial redesign problems within organizations. These literature notions form the input for the conceptual model to organize such collaborative design initiatives. Below each of the literature concepts are listed according to the four levels of design, including reference and how this is included within the framework.

Table 3. Constructing the conceptual framework with theoretical concepts

LEVEL OF DESIGN	THEORETICAL CONCEPT	APPLICATION WIHTIN FRAMEWORK
Object of design	Shared understanding	Create understanding on problem, goals and expectations
	Constructive conflict	Resolve conflicts in a constructive manner
	Target area system	Identifying hard and soft characteristics
Context of design	Management consultation	Getting management support (resources) and formulate constraints
	Collaborative architecture	Determine governance structure and openness. This relates to the degree of involvement and selection of participants
	Organizational antecedents	Strategic goals, culture, structure and collaborative experience
Actors who design	Individual factors	Select participants based on their individual frame of reference (goals, position/role and interests)
	Team composition	Determine number of participants and degree of diversity (multi-stakeholder representation)
	Trust building and ownership	Enhance both trust in process and each other through a group agreement. Also relates to ownership
Process & methodology	Input-process-output model.	Organizational, team and individual level factors are considered. The collaboration process is structured according to three main phases: planning (plan collaboration), designing (do collaboration) and testing/validating (and implementing)
	Design workshop organization and facilitation	Create an agenda including tools, techniques and methods to facilitate the collaborative design process.

3.2. The conceptual framework

The conceptual framework is highlighted in the following figure below and is structured according to the levels of collaborative design in order to provide a comprehensive overview of relevant design aspects. It contains

building blocks to design intra-organizational collaboration for spatial redesign and the outcome of this process serves as input for future decision-making by management. The building blocks are based upon literature study insights and field research. Subsequently, the theoretical framework is tested in the case study at PNP in which collaborative design was applied for organizational stakeholders to participate in problem-solving as input for management to make decisions upon what is discussed during the collaborative design sessions. Note that the theoretical framework below is a result from improvement iteration steps based on observations during the case study intervention and feedback from management and participants.

In total two collaborative design workshops are held. A larger number of workshops was not possible due to time restrictions. The first workshop was facilitated according to the initial framework as based on a literature study and in field observations. This model is improved based on observations and input from participants at the first design workshop. Subsequently, the improved framework served as basis for the second collaborative design meeting. Documentation of both design workshops, including preceding frameworks underlying the final framework below are included in appendices D and E. The framework comprise of four main building blocks of collaborative design as states within literature. These are the following themes: *object of design*; *context of design*; *actors who design*; and *process & methodology*.

3.2.1. Object of design

First, the object of design should be considered. Important factors is shared understanding on the problem, objectives, scope and expectations. Shared understanding can be enhanced through creating shared mental models which is realized by application of constructive conflict. In this way conflicts are resolved in a constructive manner and leads to a better shared understanding. Furthermore, the actual artefact to be designed, the target area, is considered. Target area antecedents comprises of scope and stakeholder factors. The scope concerns the physical scope, involved processes and relevant hard and soft variables. Additionally, stakeholders with decision-making power, involved and possible affected actors need to be engaged with.

3.2.2. Context of design

The context of design deals with the environment in which the design process takes place. It starts with organizational input antecedents. Important is the *role of management* to support collaboration, agree on deliverables and allocated resources. Furthermore, organizational characteristics have an impact on how collaboration should be designed. The organizational characteristics needs to be considered, e.g. organizational culture, structure and past collaborative experience of the organization. Based on this management consultation and the organizational aspects, the collaborative architecture needs to be assessed. There are two main dimensions: governance (hierarchical versus flat) which determines the degree of employee involvement; the second dimension is openness of collaboration (closed versus open) which determines how participants are selected.

3.2.3. Actors who design

A third aspect is the actors who actually design. Individual input antecedents structure how collaboration takes place between individual actors. Designers have a particular frame of reference based on which they view the problem and thus express their requirements. The frame of reference consists of the individual position/role, their goals and interests. Additionally, team input antecedents concerns variables on the team level. Four elements of collaborative design on a team level are identified. Diversity is desired. This can be horizontal (specific disciplines

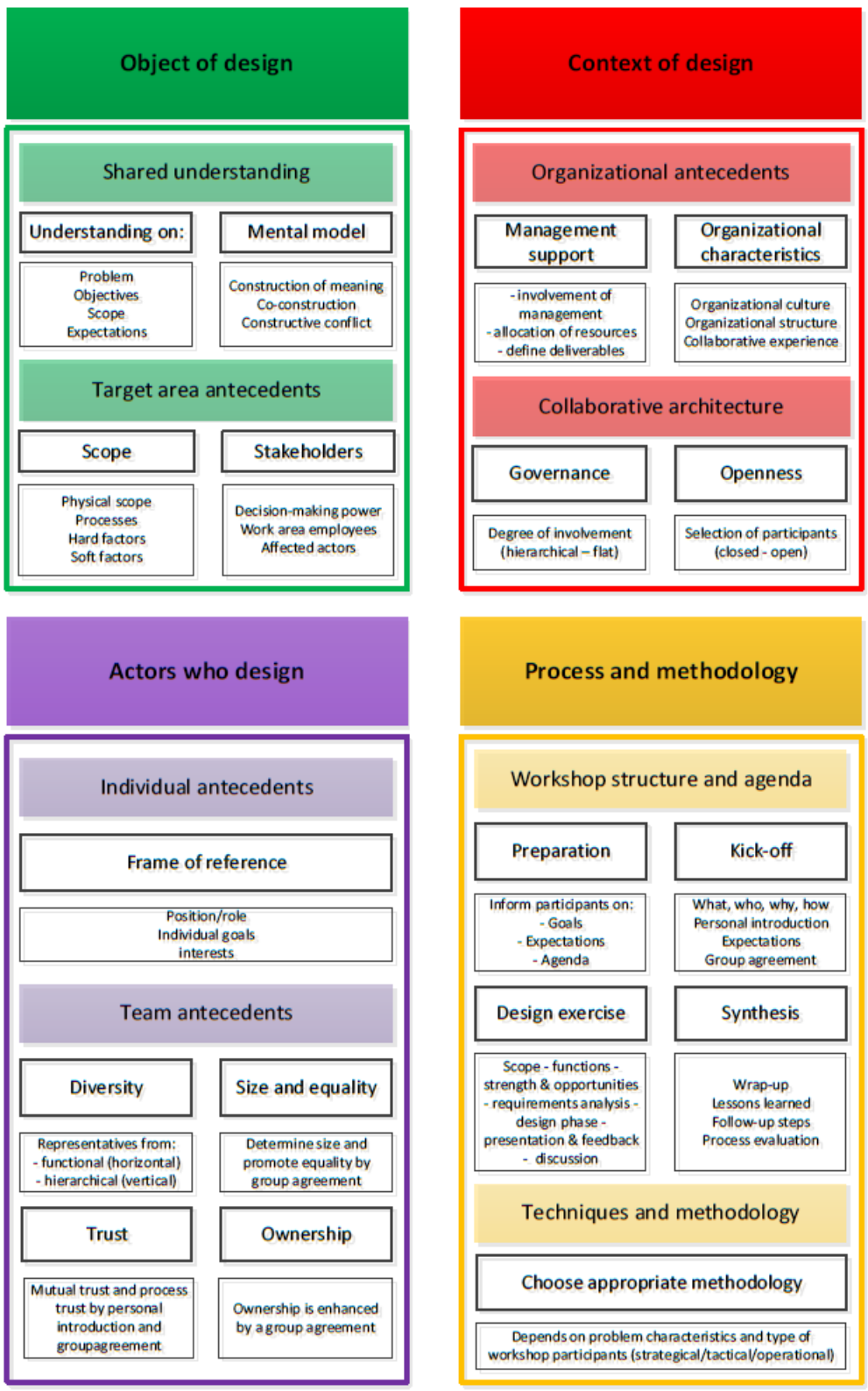


Figure 11. Theoretical framework based on literature and field research

and functional roles) and vertical diversity (hierarchical relations among participants) ranging from strategic, tactical and operational employees. Second element concerns the group size and member equality. The third and fourth element are soft factors: trust and ownership. Both trust in the process and in others participants is required for effective collaboration. Furthermore, designers should perceive the design process and outcome as their results (ownership) in order to create sustainable solutions which are accepted.

3.2.4. Process and methodology

The collaborative workshop should be well-prepared in order to engage with stakeholder participants, create commitment and create an attractive collaborative setting. Beforehand, participants should be informed on goals, expectations and the workshop agenda. The meeting starts with a kick-off in which the reasons, deliverables, involved stakeholders and approach is elaborated upon. Commitment and trust are established by sharing participants' expectations and by making a group agreement with a shared code of conduct. Thereafter the actual requirements elicitation takes place upon which the designs will be based. In the wrap-up the discussion issues are summarized and follow-up steps are communicated. A plausible structure of the design workshop is:

a) kick-off; b) defining the physical scope; c) analysis of the target area's basic functions; d) a strength-opportunity analysis; e) the actual requirements analysis; f) addressed hard and soft system factors; g) comparison with preliminary analysis; h) actual design assignment; i) presentation and feedback; j) further discussion

4. Case study description

This chapter addresses the general problem description and other characteristics of the case study. First, relevant information with regard to the company is elaborated. Thereafter, the involved focus area of study including processes are discussed. Consequently, the participating focus groups are listed and described. The last to paragraphs are concerned with design requirements of the collaborative design case study and the actual development of this design.

4.1. Company description

In this paragraph a brief company description is provided, elaborating upon and introduction to the company, the PNP core business, context, their strategy and mission statements and subsequently the organizational structure.

4.1.1. Introduction to PNP

PostNL is a Dutch service provider for mail and parcels with almost 60.000 employees responsible for the collection, sorting and delivery (PostNL, 2015a) and a total revenue in 2014 of 4.000 million euros. Its main activities consist of three business segments: mail, parcels and international which can be found in the Netherlands, Belgium, Italy, the United Kingdom and Germany. The business environment of PostNL is subject to constant change. Liberalization of the market in 2009, technological innovation and governmental legislation, i.e. the *Postweg 2009* and legislation for *independent contractors*, forces PostNL to continuously be aware of the market environment.

Nowadays, e-commerce is becoming increasingly popular and this trend has a substantial impact on parcels services which annually increases with a growth rate of 8,8% in 2014 (PostNL, 2015a). On average, PNP delivers approximately 500.000 parcels every day and peak moments are reached during the Christmas period with a recent record of a total number of parcels of 1,4 million on December 22nd in 2015 (PostNL, 2015b). In order to meet future growth in demand of online shopping and to reduce cost, PNP has recently introduced their New Logistics Infrastructure network or NLI (Hermon, 2012). This hub-and-spoke network consists of 18 distribution centers – often referred to as depots – and among them three cross-dock depots (also called *depots+* or *hub*) and 15 hinterland distribution facilities or *spokes*). Distribution to customers is performed at all 18 depots.

4.1.2. Strategy, mission and organizational structure

The PNP department *Depot Management & Design* (DMD or in Dutch: *Depotbeheer & Ontwerp*) has the responsibility to manage and design all procedural standards which serve as guidelines business processes within all 18 depots in the Netherlands mainly on a tactical and operational level. Operational activities outside depots such as inter-depot logistics are facilitated by another department. In terms of Mintzberg, command & control strategies are applied to ensure that NLI of activities and processes are standardized to ensure an uniform and cost-efficient business (Mintzberg, 1980). PNP applies lean management to ensure that processes are standardized in order to promote uniformity across the depots. This philosophy is introduced and implemented based on the overarching organizational strategy. Based on the strategy, relevant processes and procedures are optimized according to lean practices. A detailed description of the current lean management system at PNP is provided in paragraph 4.3.

PNP can be seen as a *bureaucracy* according to the definitions of Mintzberg (Mintzberg, 1980). The organization is hierarchical with command & control strategies. As already stated before, the main coordination mechanism is *standardization of work processes* through developing work instructions, routines and procedures which depots have to comply with at the operational level.

In the figure below a generic organizational structure is depicted in which the five basic parts of the organization are situated. On top the *strategic apex*, or top management who develop strategy. On the right

the *support structure* is highlighted which involves human resource and other supportive functions. The *Middle line management* main task is to translate strategy to operational goals to operational goals at the *operating core*. At PNP the middle line management are managers of multiple departments at the PNP headquarters. Subsequently, the operating core at PNP involves in this research only the processes and activities within the depots, but actually covers all logistical processes, e.g. inter-depot transport and parcel delivery to customers thus delivering output. The final part is the *technostructure* on the left which task is accomplished by DMD. Their main activity is to streamline the organization, specifically the standardization of work processes at PNP. For the sake of simplicity, DMD can also be considered as middle management in this case.

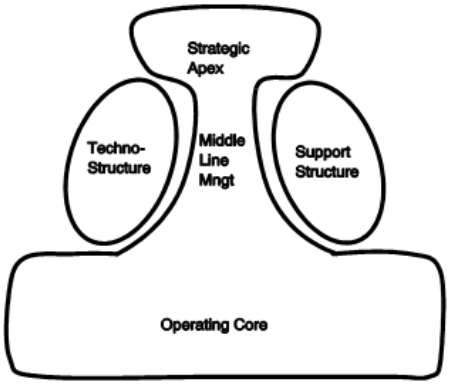


Figure 12. Organizational structure PNP (Mintzberg, 1980)

4.2. Focus area and processes

In this paragraph the case study target area is discussed. An brief introduction to the SA, a description of the process flows, the current situation of the SA, including stakeholder complexity, and subsequently the reasons for change.

4.2.1. Introduction to the target area

The 18 NLI depots have an uniform interior in which parcels are processed on a daily basis. These facilities accommodate two different processes in the logistical operation of PNP. During the day and evening hours parcels are collected throughout the Netherlands, e.g. from individuals, service points or e-commerce clients.

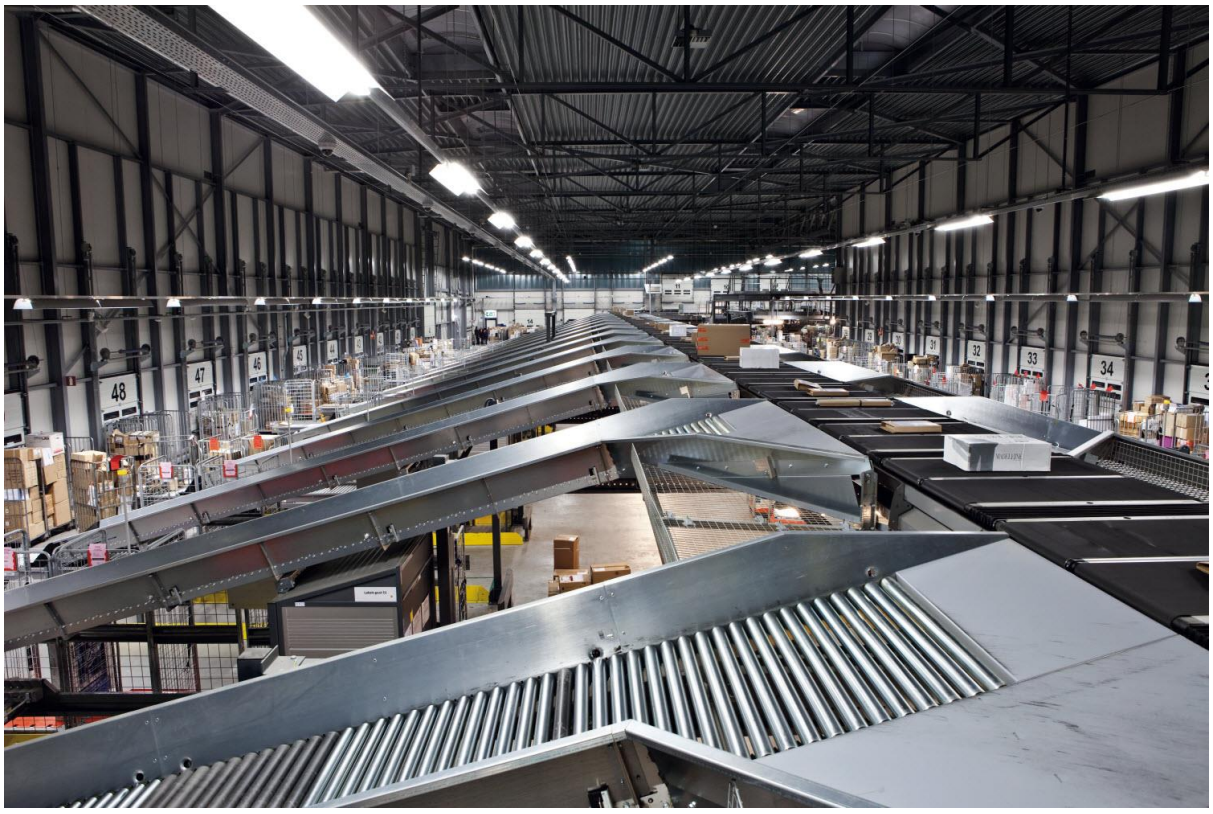


Figure 13. The sorter machine for the sorting and distribution process at PNP (PostNL, 2016).

Figure 14. The distribution process during the morning (PostNL, 2016).

Collected parcels are transported to nearby depots where they are sorted according to the right end-destination. The depot destination is determined based on the postal code label. Specifically, trolleys are stacked with parcels with common hinterland destinations where inter-depot transportation is facilitated by cross-dock depots. This is the *sorting process* and takes place during the afternoon (collection) and night period (sorting and inter-depot transport) to make sure that collected parcels reach the depot from where the hinterland is served. The follow-up *distribution process* starts at a depot when all parcels for a specific hinterland are collected from other depots at this particular depot and need to be sorted according to postal codes. Van drivers can park their car at the end of a sorting link to load their trucks and carry out 'the last mile' to consumers as is depicted on the left.

A depot has a U-shaped building in which the sorter machine is basically a rectangle with different links at the right side for collection of parcels in trolleys (evening process) and distribution of parcels (morning process). The upper short side of the rectangle is used for night trucks to unload their trucks and subsequently to put parcels on the sorter machine to sort parcels based on the right postal code. The horizontal areas of the depot lay-out are secured areas (SA) where supportive processes take place. Note that the sorter machine conveyer belt does not enter the secured area but passes this area along the top.

Figure 15. Secured area snapshot from depot Kolham

Within SA's the following processes take place:

- Registered mail: e.g. passports or confidential letters. Since this service requires a customer signature it is distributed within the parcel service network.
- Chemicals and dangerous goods
- Storage of customer parcels and internal products
- In Planbalies (PB) vans are issued mobile administration device and registered mail for the route in the morning before distribution takes place. At the end of the day van drivers hand in non-ordered parcels at the docking stations and hand over the mobile devices at the PB (debrief).

One should distinguish between two basic different SA configurations:

I. Only in *depots+* or *crossdock* facilities there is an large *registered mail* process within the SA. In hinterland SA's this process is facilitated on a smaller scale.

II. Standard hinterland depots (except for Den Hoorn) are regular facilities with ordinary processes. Not that Den Hoorn (hinterland depot) is a regular depot but offers an

undeliverable parcel service in the SA (OnBeStelBaar: OBSB). These parcels deliveries are made orderable to deliver them to either the customer or the sender. In case neither the customer nor the sender can be identified, the specific parcel is temporarily stored in Rijswijk and after three weeks destroyed.

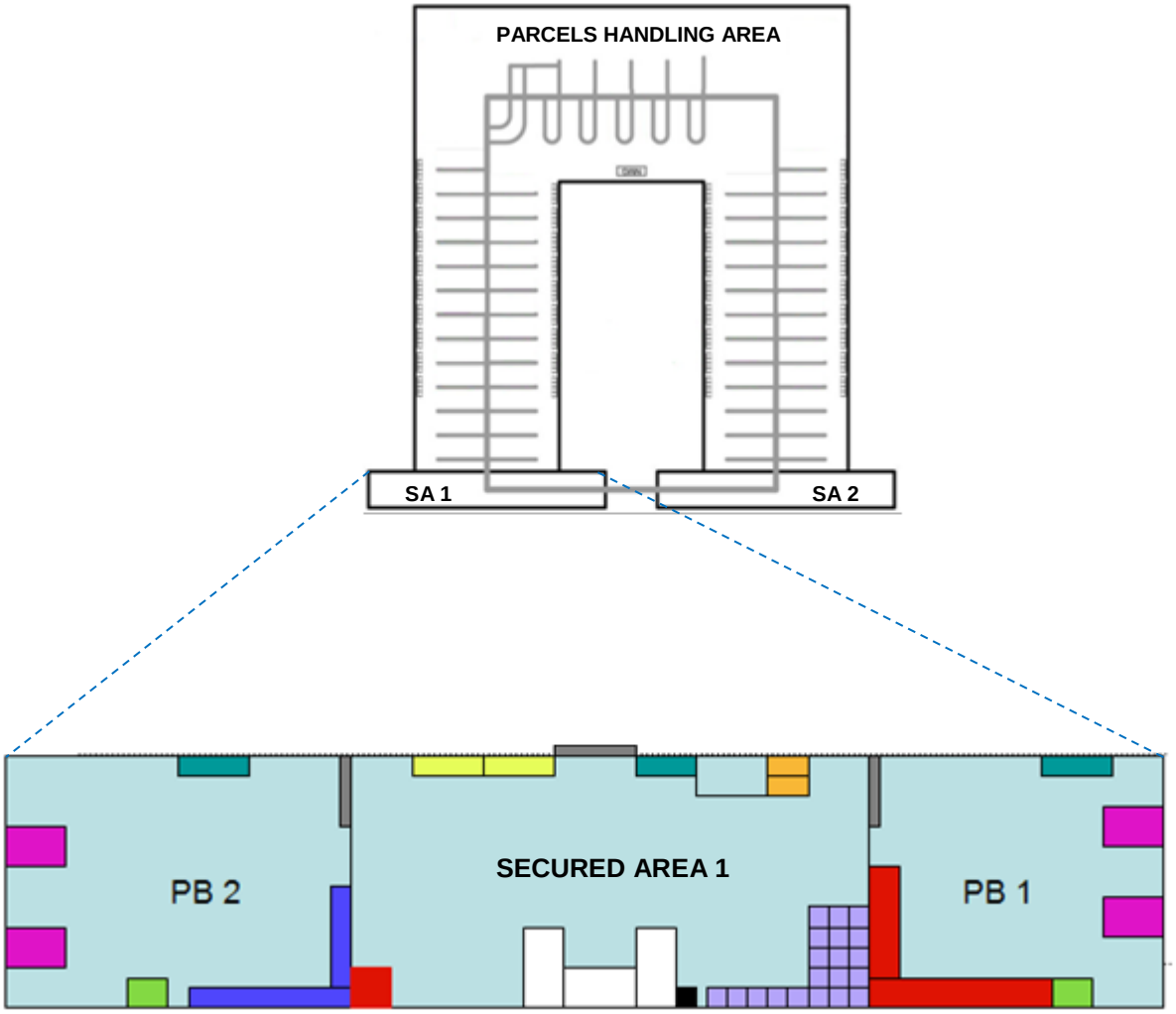


Figure 16. NLI depot lay-out and zoom-in on the left secured area with PB's on both sides

4.2.2. Process flows in the secured area

Basically, two main processes can be distinguished in the secured area: the sorting process during the evening to transport parcels to a specified hinterland and the distribution process during the morning to carry out the delivery to end-customers.

Table 4. Identified process within the secured area

Sorting process (evening)	Distribution process (morning)
Arrival of registered mail	Bundling of registered mail, blue trays and hand terminals
Sorting of registered mail with SASKIA according to specified destination	Issuing hand terminal and blue trays with registered mail to drivers
Collecting damages packages with drip tray	Collecting damages packages with drip tray

Recovering damaged packages	Recovering damaged packages (recovery or disposal)
Debrief (arrival of unordered registered mail, collect hand terminals and blue trays)	

4.2.3. Current situation at the SA

Currently, each of the 18 individual depots run their SA process in different ways (left out site-specific processes, such as OBSB and registered mail), according to individual approaches and best practices, so there is high heterogeneity individual among depots. In other words, there are no clear standards pointing out how to facilitate the SA processes, regarding layout, storage (of future products, e.g. foodboxes for perishables) and other relevant processes that take place within the SA. Note that work standards for the processes within the SA (i.e. sorting registered mail, recovery of damaged products, drip tray and OBSB) are already provided and available to everyone in the operating core, however, an optimal lay-out configuration to facilitate these processes has not been design yet.

The current SA situation at the can be considered as a *multi-site problem* in which the 18 depots have their specific characteristics influencing the lay-out configuration of the SA. This makes it difficult to design one standard blue print which applies to all depots. The specific characteristics are either physical aspects or perceived best practices.

Physical characteristics

The different physical characteristics are decomposed into six categories: depot type, site-specific processes, lay-out mirroring, debrief location, construction-related exceptions and type of hand terminals.

1. The first physical characteristic that impacts how the SA organisation is the *depot type*: this can be either a depot+ in which one SA accommodates the registered mail process or a standard depot with a regular configuration;
2. Another physical factor involves the presence of *site-specific processes*. This is the OBSB process in Den Hoorn which is located in one side of the SA;
3. The third physical factor concerns whether or not *lay-out mirroring* has taken place. Basically, every depot is built according to a blue print. However, the local traffic infrastructure (e.g. roads, water and fences) imposes constraints how the depot is mirrored and thus where the SA is situated;
4. Similar to mirroring, the *debrief location* also influences how the interior of the SA is shaped;
5. The fifth factors are *construction-related exceptions* such as the situation at the depot+ of Waddinxveen in which an escape route (additional fences) passes through the SA at both sides
6. Usually, hand terminals are located in the PB for handing out these devices to drivers or for collection during the debrief. However, a particular number of depots prefer to accommodate the terminals in the SA to reduce transportation flows. It should be noted that this is only possible with the most recent *type of hand terminals*.

Besides physical characteristics, every depot has their own developed best practices and preferences, e.g. the availability of water, location of trolley stickers and notification letters, where in the SA the workbench is situated and what types of process-supporting materials are stored in the SA. However, best practices are not only developed on a depot level, but multiple organizational layers (strategic/tactical/operational) and functional departments should be distinguished, i.e. management (DMD), supportive bodies (ARBO, LCC) and the operating core at depots consisting of depot managers, senior process managers, process managers and PB employees. These involved heterogeneous organizational parties have different perspectives on how the SA should be organised. The organizational diversity is shaped along two axes:

- An vertical hierarchical axis with different organizational layers at PNP, differing from strategic, tactic and operational and the multiple functional roles (supporting roles, e.g. ARBO, Lean Competence Centre, facility service) within PNP which brings multiple stakeholders who have diverging perspectives on a design problem.

- The other axis concerns the horizontal axis which involves the different depots of PNP which all have their unique physical characteristics and local best practices. Subsequently, within a depot there is also vertical heterogeneity involved, i.e. depot manager; (senior) process manager and PB employees).

See the figure below for a vertical and horizontal dimension of organizational stakeholder complexity at PNP.

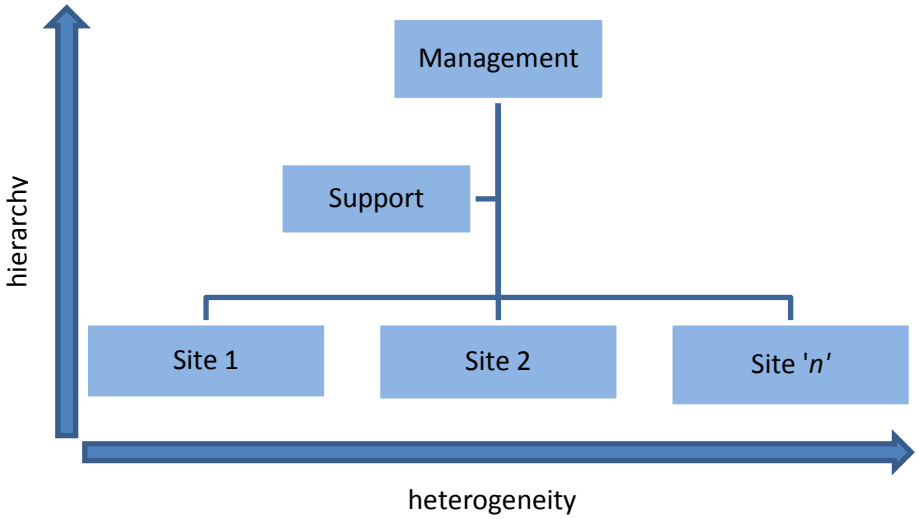


Figure 17. Multi-stakeholder complexity

4.2.4. Reasons for change

The reason for this project is the need to establish SA interior standards as there is currently a limited uniformity in the facilitation of these processes. Therefore deviations arise across the depots (and thus relatively high heterogeneity). Developing a redesign with standards to accommodate the SA processes and ultimately establish standards for these practices and organization is beneficial for the following reasons:

a) Standardization to facilitate the SA process and layout arrangement could generate process cost efficiency gains since a more uniform approach will optimize the organization and usage SA on an organizational level instead of sub optimization on a distribution facility level (in terms of communication, time and costs);
b) Increased safety: standardisation of business process facilitation may have a positive effect on overall safety as a more structured standard approach aims at minimizing improvisation by operations employees and create a new way of SA arrangement according to existing best practices;
c) Quality is improved by establishing an uniform approach of SA organization. In this way PNP will anticipate for future changes, e.g. new processes, modifications or a redesign of the layout. Changes are easier to implement with common SA arrangement and common standards across the distribution facilities of PNP than with non-uniform processes (increased flexibility). Different characteristics and local practices within SA's make implementation of an one-size-fits-all solution increasingly complicated;
d) Improving internal customer focus (relevant stakeholders within this research).

4.3. Current approach to lean management at PNP

The lean management approach is key at PNP – as part of Operational Excellence – to reduces waste with regards to process flows and to ensure cost-efficient work processes at all involved parcels facilities. The Lean Competence Center (LCC) at PNP is a supportive body at PNP to develop new lean strategies and facilitate successful lean implementation projects. At PNP the lean philosophy is decomposed into three building blocks.

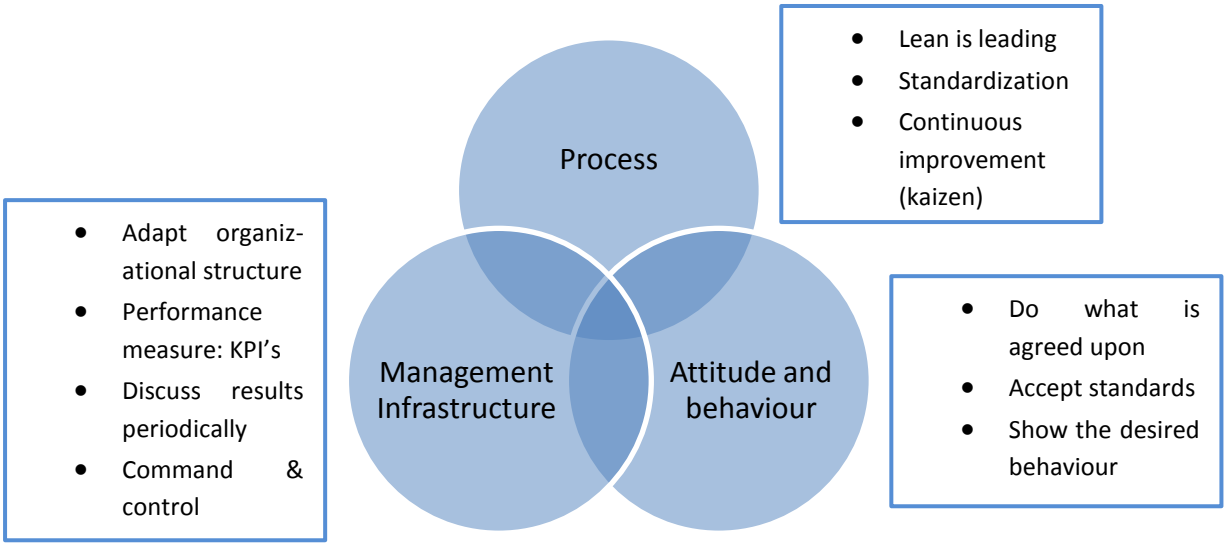


Figure 18. Lean building blocks at PNP

Work processes are standardised through delivering four output products which depots have to comply to. In the below table these four outputs are listed and discussed. The end product is provided, subsequently a description is given and the required input for the end product. The end products are: *standard work method, 6S, flow and management infrastructure.*

Table 5. Work process standardization outputs

End product	Description	Required input
SWM: standard work method	Detailed description how activities should be carried out and by whom.	Work instructions (process design) & existing SWM's
6S: a safe, ordered work environment	Lay-out plans indicating where all materials and means are located to perform an activity	Depot lay-out maps
FLOW: allocation scenario's	*Value stream map* including required flow data: volumes, times and staff deployment	Standard times, measurements, volumes, VSM's
MI: management infrastructure	Required info to control processes. Output: work meeting structure, info boards & lean scans	Information flows

All lean initiatives are developed through the DMAIC and PDCA (Plan-Do-Check-Act) cycles. At PNP either a DMAIC or PDCA cycle is applied. The PDCA cycle is often used for short term projects and where the desired future state can be known in advance. Running through these steps could systematically create a ordered and clean environment for the secured area. In order to create a clean and safe working

environment the 6S method is applied which consists of:

S1: Sort: separate non-value-adding materials from required materials (clearing)
S2: Set in order: visually identify and arrange the right materials in the right place (configure)
S3: Shine: clean the workplace and keep it that way (check)
S4: Standardize: make interior standards continually (conformity)
S5: Sustain: ensure that the right behaviour is shown (consensus)
S6: Safety: in every step safety is considered

Figure 19. 6S method at PNP

However, such 6S approaches with employees are not carried out broadly. Commonly, the supporting staff (*Depotbeheer & Ontwerp*) design work instructions, lay-outs and procedures which the depots have to adhere to. Notwithstanding, formalization and implementation of such work instructions does not always lead to compliance of depots on a local level. As some employees assert:

[Employee 1]: *''Sticking to new standards is the biggest challenge at PNP. A reason might be the fact that projects are started at the top and lean decisions are imposed unilaterally. I would suggest a pyramid structure in which management facilitates operational processes. the current approach to develop SWM's and 6S's is carried out centrally for management to have a feeling of 'control'. Employees from the operating core could be involved during this activity more frequently since resistance is often caused because certain stakeholders are not engaged with and thus leading to non-compliance as a result of lacking trust''. Thus management should facilitate (not: control) processes at the operating core through work instructions. Solution: give freedom. However, this requires trust. Joking: the standard work method here is to impose measures unilaterally''.*

[Employee 2]: *''One reason of non-compliance are local physical differences at depots. Another argument concerns a mental aspect: depots think that they are efficient, sometimes you will have to show them a more efficient way''*

[Employee 3]: *''It's really important to determine to what extent standardisation desired and required? Too much standardization does not promote acceptance and could even be counterproductive. Especially address the soft elements of lean management. Sometimes focus is too much on costs (KPI's) instead of human aspects here.*

[Employee 4]: *''Involving operating core employees does not only promote acceptance and compliance, but is also an opportunity to use their specific operating knowledge how things really work at a depot. This awareness should be improved at PNP: engaging with operating core employees is key to develop and implement lean projects successfully''*

4.4. Case study participants

This paragraph addresses the potential organizational employees who can be involved during case study. This sections starts with a brief introduction to the PNP workforce of the operating core in general. Subsequently, a stakeholder analysis is carried out to identify relevant stakeholders who play a potential role during the case study.

4.4.1. Brief introduction of the operating core workforce at PNP

In addition to supportive staff at PNP, e.g. facility service, ARBO, LCC, NLI experts and process designers from DMD, the processes in the operating core mainly take place in the depots. For the sake of simplicity, logistics flows and operational processes outside the depots have not been considered within this research study.

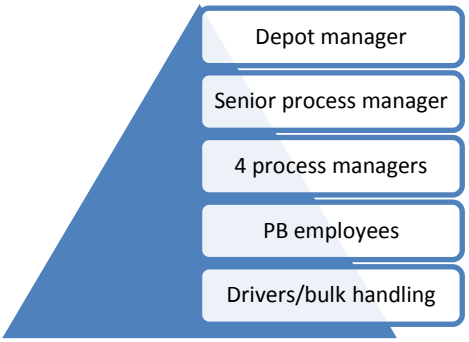


Figure 20. Hierarchical structure of depots

Within the PNP depot network the collection, sorting and distribution of parcels is carried out. A great variety of personnel is involved in this process of parcels handling. A brief overview of the organizational structure wihtin depots is provided below in figure 26. At every depot a depot manager has command of a particular depot and who is responsible for th overall depot performance. This person communicates with overarching management layers, i.e. DMD's process designers and with other depot managers to discuss operational issues. Subsequently, the senior process managers is an extension of the depot manager and serves as mediator between depot managers and four process managers. Process managers are in charge of daily operations and function as supervisors, e.g. the sorting process during the morning or the distribution process during evening hours. Their main task is to ensure that sorting errors are minimalised, to allocate resources (time and labour). PB employees have a variety of task responsiblities. They are responsible for all SA-related work processes, which includes sorting of registered mail, issuing and collecting hand termanal devices, gathering and recovering of damaged parcels, disposal of hazardous substances and, stocking of process-supporting materials, such as trolley cards, notification letters and packaging products. Finally, drivers and other bulk handing employees are distinghuised within depots. Since such employees are not directly linked SA-related work processes they are not elaborated upon here.

4.4.2. Stakeholder analysis for the SA design project

Stakeholders are selected according to two criteria. Relevant stakeholders are either affected (positively or negatively) by a SA interior decision or have decision-power. Below relevant stakeholders are listed concerning the redesign of the SA interior:

Table 6. PNP stakeholders and interests

Organizational unit	Stakeholder name	Description	Interest
Depots AMF/WVN & RDK	Depot manager & (senior) process managers	In charge of resource allocation and daily operations at depot	Cost-efficient operations in PB and SA areas
	Planning desk employees	Responsible for PB & SA operations	Clean, safe workplace, autonomy
Staff & Operations	Manager depots	In charge of all depots	Cost-efficient and uniform processes
	Manager Staff Operations	In charge of all operational processes	Cost-efficient and uniform processes
	Process designer (DMD)	Design of processes and standards	Efficient and uniform processes
LCC	Lean expert (Greenbelt)	Coaching during lean initiatives	Lean adoption and employee commitment
Wilbert de Vries	Facility advisor	Dealing with legal requirements	Workplace that meets legal requirements
Rob Simmers	NLI project leader	NLI	Standardization

Frank van Muiden	ARBO coordinator/safety advisor	Working conditions legislation	Safe and healthy work conditions
Michiel/Peter	Ownership consultants	Creating homogeneity among the depots+	Clear work instructions and uniformity

Below the formal chart of these stakeholders and configuration with hierarchical relations is provided.

4.4.3. Specification of stakeholder perspective divergence

Engaging with a variety of organizational stakeholders can enhance problem solving capabilities as individuals have different perspectives and viewpoints on a specific problem or situation. Within this study it is assumed that stakeholder diversity is characterized by three categories which can be considered as lenses through which individuals act and behave. These are the following:

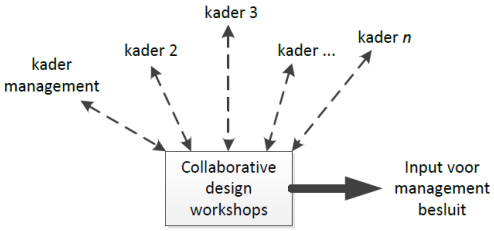


Figure 21. Individual's frame of reference

- Stakeholders have specific knowledge as a result of a discipline and their expertise should be used for solving organizational challenges.
- Individuals have different positions throughout the company. They are either part of the supporting staff, other functional roles or hierarchical relations (manager-supervisor-subordinates). They all depend upon each other in order to reach organizational goals.
- As part of their particular position and knowledge, organizational stakeholders can have different goals. These can be sub goals or conflicting goals.

Putting together these organizational stakeholders thus creates opportunities for problem solving. However, an appropriate process is to be designed to deal with stakeholder diversity as their differences are both possible solutions as potential problems to problem-solving.

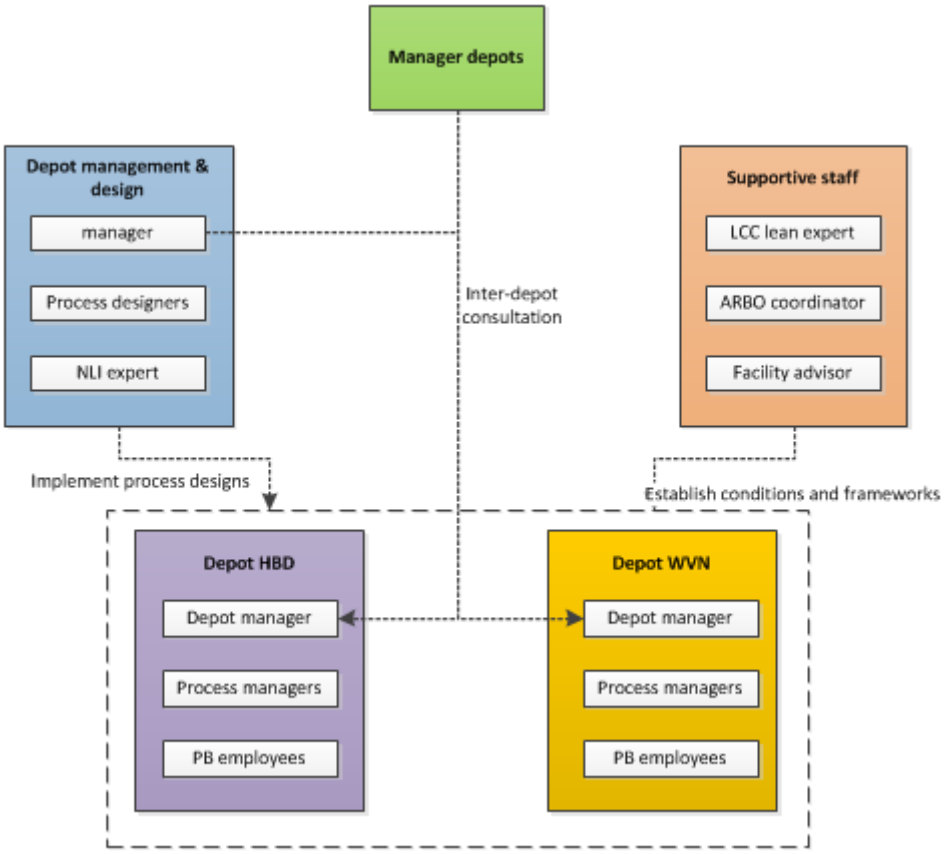


Figure 22. Formal chart organizational configuration (here with two possible participating depots)

5. Design intervention at PNP

This chapter discusses the case study in which the developed theoretical framework from chapter 2 is applied to a specific problem at PNP. First design requirements are considered. Thereafter a case study design is provided. Consequently, the intervention results are described. This intervention aims at providing insights on how the theoretical framework can be improved. The initial framework is improved based on the intervention results and thereafter a generic roadmap for intra-organizational collaboration at PNP is developed. Subsequently, this generic roadmap is validated at PNP.

5.1. Design requirements

This section addresses the conditions an intervention design should meet from the perspective of PNP. These requirements and conditions are provided by Dirk Veldt (2015), manager Depotbeheer & Ontwerp. A categorisation can be made into three types of design requirements:

5.1.1. Business requirements

The standard procedure for developing standards to which depots have to comply to is unilateral design by the supportive staff. In this situation the supportive staff gathers information and develops a standard procedure according to their own insights. However, collaborative design differs significantly from this existing approach in which various organizational stakeholders participate in the idea-generation process. Therefore, a collaborative initiative should take into account organizational goals and should be aligned with key-performance indicators accordingly. The KPI's of PNP are costs, time and (internal) customer satisfaction. Costs and time relate to cost-efficient business processes and implementation. Customer satisfaction is associated with external clients but also internal customers, e.g. depots and their employees who can be considered as clients of the design department Depotbeheer & Ontwerp.

Furthermore, organizational priorities have to be taken into account. As participants of the design intervention are treated equally, one's interests may have more priority than one other from the perspective of management. Therefore, it is recommended to identify potential conflicts in interests in advance in order to anticipate for this.

Last, an important management condition is that mmanagement is in charge of the final decision regarding the interior lay-out redesign. This means that no final decision is taken during the design intervention. In a later stage all input from the design workshop and participants is gathered and thereafter a final decision is to be made by management.

5.1.2. Technical requirements

Technical requirements deal with the physical demarcation of the target area. The area 'secured area' on itself only comprises the area between the planning desks. However, many interactions between these areas can be distinguished. Therefore, consensus on an appropriate physical demarcation is important as a first point of departure.

Additionally, the current depot network design of PNP aims at creating uniformity on a domestic level to ensure cost-efficient processes. However, depots have their specific customer- and construction related deviations which have to be considered beforehand. Not taking into account these local differences may cause resistance (''*not-invented-here* discussion) during implementation of a secured area lay-out redesign.

5.1.3. Social requirements

The output of the collaborative initiative is a technical redesign of the secured area lay-out. However, next to technical requirements of the interior redesign, also human aspects, e.g. soft factors such as attitudes & behavior should be considered. Main reason for this is the fact that these factors are often not addressed in

current designs which leads to non-compliance to specific standards. Thus, collaboration with stakeholders from depots can provide insights into such factors. Moreover, their technical expertise and knowledge can be used which may promote acceptance towards a future solution.

A last crucial aspect is acceptance during the intervention. Involvement of organizational stakeholders from different depots should be carried out in consultation with depot managers as they are important for a sense of urgency and involvement of other depot employees. Acceptance issues also apply to workshop participants. They are engaged with to share their specific knowledge to collectively solve an organizational problem. However, it is important to manage expectations until a final management decision is taken.

5.2. Designing a collaborative design intervention

This paragraph describes a design for the case study intervention. This starts off with scoping issues. Subsequently, an overview is provided of participating stakeholders and involved depots. Thereafter, the actual workshop design is

5.2.1. Scope of the intervention

The scope of this intervention is subdivided into two components:

Timeframe

The collaborative workshop is a way to gather design requirements for the secured area lay-out. However, the intervention also comprises a preceding planning phase and the period between the design workshops and the time by which management make a final decision. Therefore, this intervention is structured in time according three phases: the planning, design workshop and evaluation stage.

Planning

November 2015 – February2016 (4 months)

The planning phase consist of seeking management support for intra-organizational collaboration, carrying out an initial problem analysis, to perform a stakeholder analysis, to engage with depots in order to find participants for the collaborative workshop, to find an appropriate collaborative architecture (dimensions: governance & openness) and finally to design the collaborative workshop for the actual design phase.

Design workshop

9 & 31 March 2016 (1 day per workshop)

During the design workshop the actual requirements engineering process takes place in which participants interact with each other to collectively develop solutions for the secured area lay-out redesign. The output from this workshop intervention is twofold: on the one hand technical requirements are gathered which serve as input for management to take future decision. On the other hand, observations during the workshops are made regarding the collaborative process and the follow-up after workshop sessions. This input is used to make improvements on the collaborative design framework.

Evaluation

April 2016 – May 2016 (2 months)

Participants develop several solutions together which serves as input for management decision-making. However, participants are communicated with the documentation of the design workshops and should be informed on the developments regarding a management decision.

Target area

The target area concerns the area as depicted in figure 29. The above picture reflects the lay-out of the entire distribution centre or depot. The specific area is the secured area which needs a lay-out redesign. Note that there are actually two secured areas, both at the bottom of the lay-out. However, the planbalies (PB 1, 2, 3 & 4) are adjacent to the secured area on both sides and have may interactions with this area. Before the workshop only the secured area itself is chosen as target area.

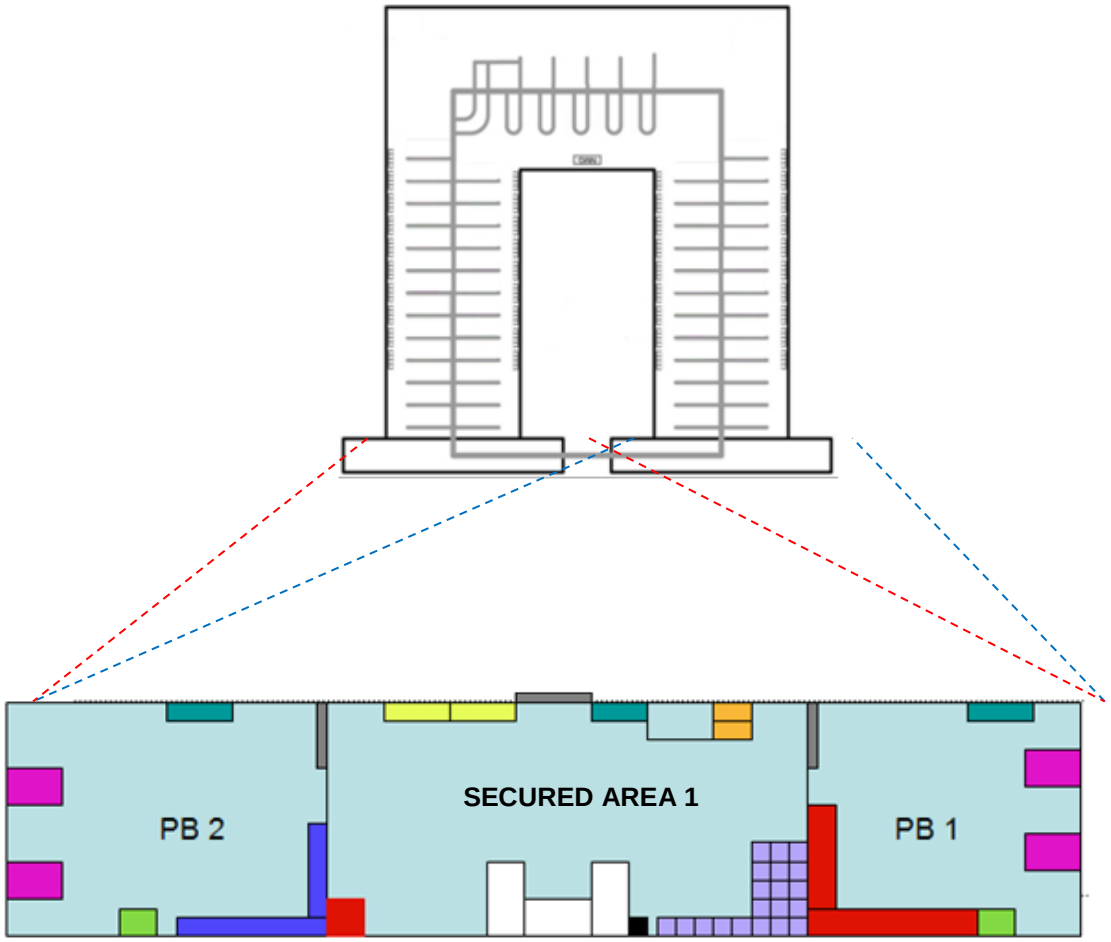


Figure 23. Target areas: two secured areas, including planning desks (PB).

5.2.2. Participating stakeholders

An overview of the selected participating stakeholders is provided in this paragraph. For all involved stakeholders during the design workshops a name is given, including position or role. These participants are selected through consultation with management, designers and depot managers, but also subordinates and their supervisors. Distinction is made between the first and second design workshop.

First design workshop

The first workshop is to be held at depot Amersfoort (abbreviation: AMF) on March 9th 2016 09:00 – 11:30 and concerns a discussion specifically for the cross dock depots. Note that there are representatives from both depot Amersfoort as depot Waddinxveen with their own specific local characteristics and viewpoints. In other words, this workshop mainly focuses on cross dock depots' secured area and their involved employees.

Table 7. Participants first workshop at depot Amersfoort

Name	Position/role

Guido Veltman	Facilitator
Minke van der Kleij	Designer DB&O (StafOps)
Johan ten Brinke	Depot manager AMF
Rob Sypkens	Planning desk (PB) employee depot AMF
Wim Nijenhuis	Senior process manager depot AMF
Gert-Jan Gerrits	Planning desk (PB) employee depot AMF
Marcel Ravenschot	Senior process manager depot WVN
Ad de Beer	Planning desk (PB) employee depot WVN
Peter Oostveen	Co-project leader 'Eigenaar van Resultaat'

Second design workshop

The second workshop is to be held at depot Ridderkerk (abbreviation: RDK) on March 31st 2016 13:00 – 15:30. This collaborative workshop focuses on the standard depots (other than cross docks). Contrary to the first workshop with representatives from different depots, here only one depot is represented. However, various relevant stakeholders from supporting units are involved: the depot network project managers, a facility advisor and the OHS coordinator. In other words, this workshop focuses on the standard depot with multiple distinguished functional roles.

Table 8. Participants second workshop at depot Ridderkerk

Name	Position/role
Guido Veltman	Facilitator
Minke van der Kleij	Designer DB&O (StafOps)
Eelke Stegehuis	Depot manager Ridderkerk
Alex de Groot	Senior process manager depot Ridderkerk
Louis Stellenaar	Procesmanager depot Ridderkerk (lean focus)
Rob Simmers	Project manager NLI
Wilbert de Vries	Facility advisor
Frank van Muiden	OHS coordinator

5.2.3. Workshop design

The main purpose of facilitating a collaborative design workshop is to involve relevant internal stakeholders, elicit design requirements (as part of the requirements-engineering process) which the new secured area lay-out redesign should meet and as a result of collaboration, create acceptance among participants for future implementation of measures. However, just putting together participants does not make collaboration work. Therefore an appropriate workshop design should be developed.

The workshop is based upon the principles of collaboration in general, collaborative design practices, spatial redesign practices and soft factors i.e. such as ownership, trust and management of expectations. Additionally, general brainstorm practices are identified with Lise de Laat (Logistiek Ontwerper, 2015) who is currently a designer at Depotbeheer & Ontwerp. These recommendations can be found in appendix B. Hereafter, relevant concepts and principles are listed which are incorporated within the case study workshop design. The used workshop slides of the documentation including agenda and structure are included in appendices D and E.

Collaboration is shaped according to three requirements: (Keyton et al., 2003): shared goal, member interdependence, member equality and shared decisions.

- *Interdependence*: members are dependent upon each other in order to reach organizational goals. In this case study all parties rely upon each other.
- *Shared goal*: the goal is to collectively contribute to organizational key-performance indicators as the collaborative design intervention is aligned with organizational goals.
- *Member equality*: in collaboration all designers are considered equally by a signed group agreement.
- *Shared decisions*: participants collectively develop new solutions for a redesign of the secured area lay-out. However, they do not decide upon the final interior standard.

A specific instance of collaboration is collaborative design in which participants with diverging perspective collaboratively design a new artefact. The adopted definition of collaborative design in this context is: ''*design approach in which a variety of stakeholders participates in the design process using shared rules aimed at incorporating diverging views, promote mutual learning and working towards a common goal to collectively achieve better organizational outcomes.''.* The principles of collaborative design in this context are the four levels of collaborative design: object of design, context of design, actors who design and the process & methodology.

Object of design:

Since participants have different backgrounds and functional roles, it is important that they share a common language in their communication. This concerns the problem, goal of the workshop, physical scope, technical terms and expectations. Therefore, these issues should be explicitly addressed to create a shared understanding. *Constructive conflict* is important to deal with diverging views. As aforementioned, diverging perspectives is both a solution as a problem. Inevitably, participants will disagree on each other. However, it is necessary to organize conflict in such a way that conflicts are resolved immediately.

Spatial (re)design is often performed through kaizen with multiple employees from the shop floor. For this purpose, there are several lean tools and techniques to facilitate kaizen sessions. For example one is 5S which uses different steps to structure a redesign challenge. The workshop is based upon these steps: *sort, set in order, shine, standardize and systematize.* Note that only the first two steps are performed as the collaborative design workshops only aim at generating ideas for further improvement.

Context of design

The environment in which the artefact is employed is important to consider. An important aspect of lean systems is the adopted socio-technical system view with hard and soft factors. In other words, a lay-out redesign should not only consider hard factors, such as technical aspects, but also human factors as a successful lean system needs an integration of both hard and soft factors. Three main soft factors are considered here: ownership, trust and management of expectations. Ownership is promoted through the collaborative design workshop itself. Furthermore, a group agreement is signed with contributions from the participants themselves. The idea generation phase is also carried out by the participants. The agenda and structure of the meeting is design in advance by the facilitator.

Actors who design

Participants are selected across multiple depots including participants from various functional roles and hierarchical layers (strategic, tactical, operational) throughout the organization. Important are two concepts: shared identity and team- and organizational learning. *Shared identity*: participants form a team and should experience that the team is capable of dealing with the design challenge. Shared identity is promoted through a group agreement in which participants share their personal behavioural rules and expectations. This creates commitment to the process and the team itself. *Team- and organizational learning* is promoted through subdividing the group in half and facilitate presentation and feedback possibilities. Note that collaboration on itself is a way to enhance organizational learning.

Process & methodology

Requirements engineering techniques are methods to elicitate design requirements from participants. For example posting particular requirements on a wall and make categorisations based on existing objects which are desired/undesired and present/not present. Another important technique is framing. One should talk about opportunities instead of problems, thereby avoiding resistance. Also, lean management may be considered as a top management initiative and therefore lean terms are not explicitly mentioned during the workshop. However, its principles are broadly applied.

5.3. Intervention results

This paragraph provides an overview of the case study results. The first two paragraphs address the first workshop, the last two sections are concerned with the second design workshop. Workshop results comprise of substantive and process-related outcomes. On the one hand *substance* refers to what is discussed during the workshop, i.e. the arguments and individual requirements underlying the proposed interior design or *what* is actually discussed. On the other hand, *process*-related aspects are associated with *how* the collaborative design intervention is facilitated. Process variables are important as insight into these factors can improve the conceptual framework as formulated in chapter 3. Additionally, after each workshop documentation the changes to the framework used are described.

Design workshop 1: depot Amersfoort

Figure 24. Workshop participants at depot Amersfoort: 9th of March

5.3.1. Substantive results first workshop

- Participants confirmed that a redesign is necessary as the current situation is not perceived as cost-efficient and well-organized.
- Secured area cannot be seen independently from the planning desks (PB)
- At depots+ the main challenge lies within the non-AGT secured area
- It is important to distinguish between desired and undesired products in the secured area
- Many depots have their own best practices, however, they are not marked as such
- Change of the interior lay-out does not only require technical modifications, but also human aspects, such as role modeling, ownership (informally), responsibility and liability.
- An secured area 'keeper' should be assigned as responsible head of the secured area (planning desk employee)
- Recovery of damages parcels should be moved out of the secured area as a result of malodor, the risk of dangerous substances and lacking ventilation
- Not evident what accessories are needed/desired for recovery of damaged parcels and OHC issues, including storage of these products.
- There is a need for a water installation (tap water) for recovery of damaged parcels.
- The planning desk area should be used for communication between planning desk employees (kick-off, sharing KPI's, to do's and kick-down)
- The aesthetics of the planning desk area should be improved to make this are more comfortable to work
- Valid Express should be removed from the planning desk area to create more space
- The storage area above the sorting machine should be used more intensively with non-daily usage products.
- Storage contentions should be standardized (brand, type, dimensions), including the workbench for recovery of damaged parcels and the carts for the blue AGT bins

- Lean information should be developed and made visible (lines, lay-outs, standard work methods and Kanban visualizations)
- The drain barrel should be placed outside and should only be used for parcels which are dangerous and unrecoverable.
- Overview of storage products per area:

Table 9. Storage products per distinguished area

Planning desk area	Secured area 2	Space sorter machine	Shipping container
notifications	Trolley Wijnbeurs	Cardboard stock	Archive documents
kick-off area	Rerouting	Paper stock	
stickers (daily)	Scanners	Stickers stock	
Paper (daily)	Bottle bank		
No Valid	Workbench + acces.		
	Cleaning attributes		
	Blue AGT bins		
	Mobile plan desks		
	Trolley labels		

Proposal group 1

- Workbench is preferably removed from the secured area due to malodor and lacking ventilation. However, this still depends on the availability of a water installation.
- Communication board should be integrated within the planning desk area with chairs to facilitate kick-off/kick-down meetings (discussing to do's and potential issues, etc.).
- Actually, trolley (RC) labels should not be stored in the SA.
- Parcels for evening delivery often fill 6 trolleys. Therefore, create space for these parcels.
- Amersfoort and Waddinxveen have two different approaches for replenishment of non-delivery notifications (*kennisgevingen*). In Amersfoort this is performed during the evening after the debrief process. On the other hand, in Waddinxveen these notifications are replenished during shift departure in the morning by a counter assistant. Both depots agree to centrally store notifications in the planning desk area to avoid covering large walking distances.
- Both depots argue to place a shipping container outside to store non-daily products. In this way only the basic and required materials can be stored in the secured area. Depots+ have to cope with a limited space compared to standard depots because of the AGT process. Basically, they can only use one secured area instead of two.
- According to the participants, de secured area should only be used for its intended function: storage of parcels during the night in a safe and secured place. However, the SA is now used as 'storage shed'.
- Additionally, a secured area 'owner/administrator' should be assigned to monitor the extent to which the area is 'filled'. This person also functions as a contact between the involved employees and client needs. Suggested task responsibilities: procurement; stock management; internal contact person.

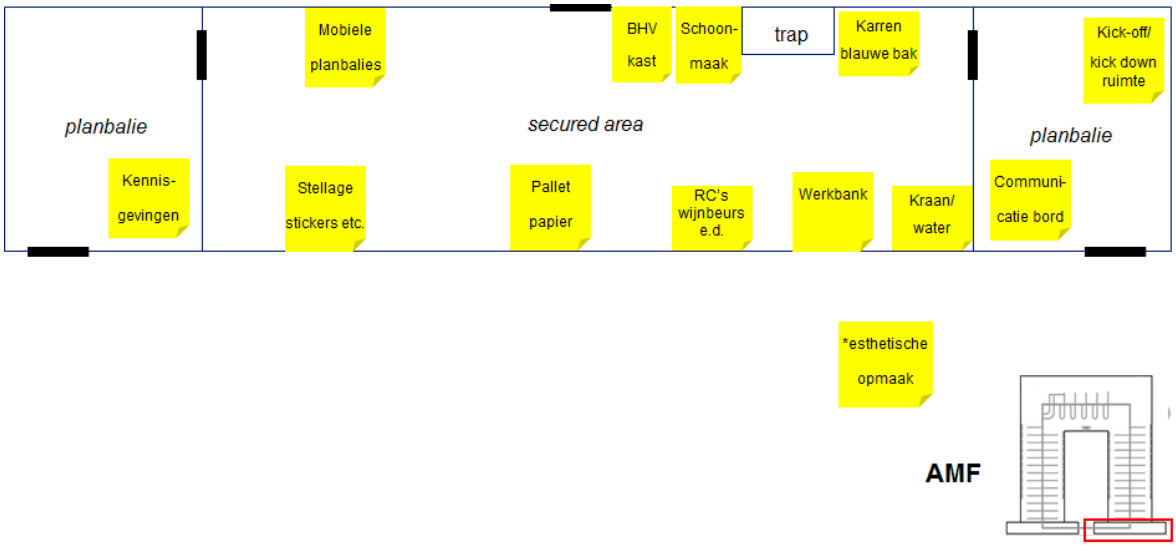


Figure 25. Proposed interior design group 1

Proposal group 2

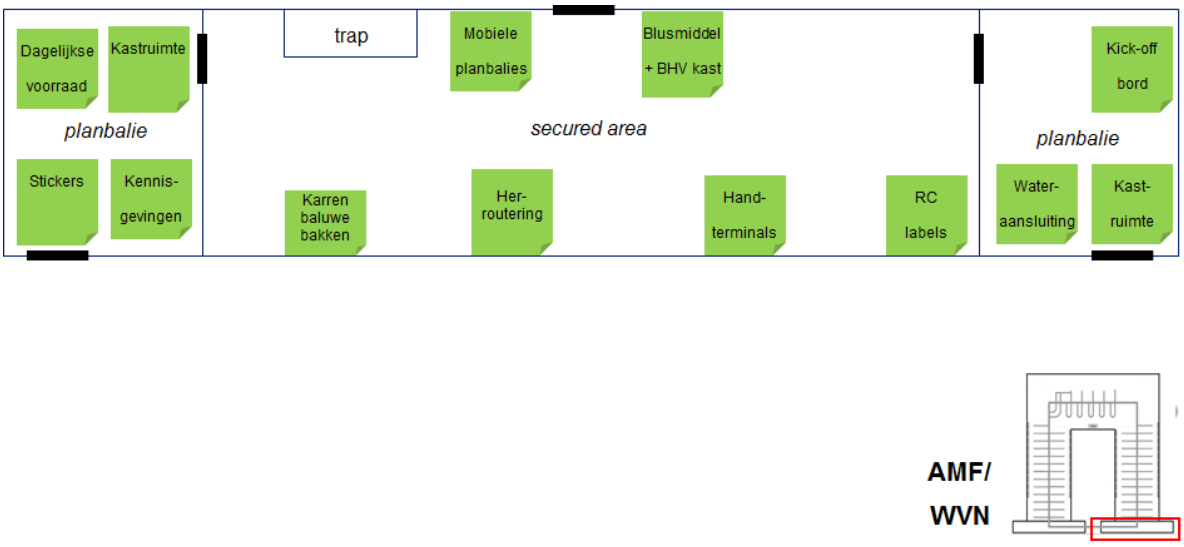


Figure 26. Proposed interior design group 2

- Non-daily products and materials should be removed from the secured area and placed in either the planning desk area or the space above the sorting machine to keep the secured area empthy from non-functional materials and storage.
- What should be stored in the secured area: night storage parcels and AGT storage; scanners (terminals hang on the wall); trolley labels and rerouting trolleys; first aid cabinet and clustering blue trays and scanners to efficiently bundle these process flows.
- The workbench is removed from the secured area. However, with water and ventilation the workbench can be situated in the area.

5.3.2. Process-related results first workshop

- Collaboration should be aligned with organizational goals and resource allocation
- Unclear about follow-up steps (who, when, how is a decision made?). Possible ideas and solutions should be categorized in an effort-impact matrix.

- Participants should be unrestricted in their thinking
- Also get a shared understanding regarding the target area. Now, there was a conflict regarding the physical scope
- Group agreement was helpful to promote commitment and ownership (did not affect the informal setting)
- Visualisations, facilitation of feedback and multiple perspectives foster team learning
- Expectations should be communicated two-directional
- Ownership at all levels is important for a redesign to be successful
- Explicitly address the fact that different depots, perspectives and all layers are heard in the initial problem analysis face
- Unclear about individual goals
- Transparent communication an decision-making is really important during the evaluation phase
- Representation off all layers of depots and also two different depots was conducive for sharing the right knowledge and enhancing ownership
- An extensive preparation beforehand was conducive for a good brainstorm process
- Framing was extremely important for establishing trust and commitment
- The group agreement led to honest and open communication
- Expectations should be communicated more extensively as this can affect trust and thus the risk of the paradox of participation.
- Important to hear everybody's voice. Explicitly address someone's expertise
- The limited time scope of 2,5 hours was not sufficient to cover all relevant issues.
- Local deviations at depots should be made clear in advance to avoid unnecessary discussions.

5.3.3. Changes to the initial conceptual framework

The first workshop process gained insight into some relevant issues concerning possible improvements to the conceptual model. A number of notions are removed, reformulated or added to improve the model.

Table 10. Framework modifications after first workshop

Level of design	Framework element	Changed aspect	Description
OBJECT OF DESIGN	Shared understanding	Problem	The problem was not clear for everyone and thus there was no consensus
		Objectives	
		Scope	Diverging views on the physical scope. This should be addressed first.
		Expectations	Also deals with norms and vocabulary
		Deliverables	Important is to decide upon an appropriate design of final deliverables. Thus, the type of standard and degree of standardization.
	Shared mental model	Construction of meaning	This was not conducted intensively. Defining the scope was helpful for creating a shared understanding.
		Co-construction	
		Constructive conflict	Conflicts were resolved immediately without further disagreement.
	Target area antecedents	Physical scope	See above. The physical scope was not clear.
		Processes (hard factors)	The newly defined scope had impact on the involved processes.

		Soft factors	Soft factors as ownership and role playing were found to be extremely important.
		Employees	All relevant work area employees were engaged with.
CONTEXT OF DESIGN	Organizational antecedents	Management support: - Management involvement - Organizational goals - Resources - deliverables	Management involvement: transparent decision making is key and role of local managers is crucial Organizational goals: collaboration should be aligned with organizational goals (KPI's) Deliverables: it should be clear what type of standardization is appropriate.
		Organizational characteristics: culture, structure and collaborative experience	
	Collaborative architecture	Governance	Follow up steps were unclear. Collaborative governance should be communicated more clearly. Irrespective of the governance type, participants have to think without any constraints or limitations.
		Openness	Stakeholder selected was transparent and clear.
ACTORS WHO DESIGN	Individual antecedents: frame of reference	Position-role	Only participants from depots were invited (managers, supervisors and subordinates). This led to a very substantive discussion. Explicitly address someone's expertise
		goals	Individual goals were communicated openly
		interests	Interests were aligned as participants were mainly from depots
	Team antecedents	Diversity	A lot of vertical diversity. Limited horizontal diversity.
		Size and equality	The number of participants was 9. Account for group size (trade-off between perspectives and input). Equality was promoted by a group agreement
		trust	Mutual and process trust were established through collaborative design and group agreement. The group agreement led to honest and open communication
		ownership	Ownership was enhanced through collaborative design and group agreement. During implementation ownership should be transferred to operational employees.
PROCESS AND METHOD-OLOGY	Workshop structure and agenda	Preparation	Expectations should be clear beforehand.
		Kick off	
		Design exercise	Involvement of multiple sites starts with clarifying local deviations
		Synthesis	Formulate clear follow-up steps to avoid paradox of participation
	Techniques and methodology	Selection of methods	Promote team learning through interaction (facilitate feedback through presentations)

5.3.4. Conclusions after first workshop

In this paragraph preliminary conclusions are drawn concerning collaborative design for spatial redesign.

Object of design

Shared understanding does not only concern vocabulary and consensus on expectations and objectives, but also covers factors as norms, the physical scope, local physical and process deviations (multi-site) and the desired form of deliverable, i.e. what is standardized an to what extent. To promote shared understanding more extensively, constructive conflict should also be used for other factors for which a shared understanding is required for effective collaboration. As mentioned within literature, soft factors are as important as hard factors for a spatial redesign.

Context of design

It is important to align the collaborative design process or initiative according to organizational goals. The governance of collaborative design should be communicated openly. This implies information on the design of the process, expectations, how participants are selected, follow up steps, deliverables etc. It is also important that stakeholders can think without any restrictions in order to facilitate effective brainstorming.

Actors who design

There was mainly vertical diversity as members from different depots were among the participants and thus limited horizontal diversity. Functional roles were not present. This led to a very constructive and substantive discussing with aligned individual goals. Ownership is enhance through the collaborative design process itself. Furthermore, ownership is to be transferred to all hierarchical levels at the operational core in order to organize a successful collaboration.

Process and methodology

Interaction can be promoted by organizing sub groups, let do presentations and facilitate feedback. These discussions are conducive for team and organizational learning.

Design workshop 2: depot Ridderkerk

Figure 27. Workshop participants at depot Ridderkerk: 31st of March

5.3.5. Substantive results second workshop

In this paragraph the substantive insights from the second workshop are presented. This overview is comprised of four building blocks: demarcation, basis functions, strengths & opportunities and other issues.

Demarcation

- The project name 'secured area' is confusing according to the participants since resolving this problem also covers the planning desk areas and the storage area above the sorting machine. The reason is ingoing and outgoing flows between these areas.
- In Ridderkerk the area above the sorting machine is used for non-daily products, e.g. files, order to cash (OTC), ride lists, storage bills of lading, debrief cabinets including necessities, sticker products, seasonal decorations and packaging materials (foil).

Basis functions of the target area

Table 11. Basis functions of target areas

Secured area	Planning desk area	Space area sorter machine
AGT sorting process	Debrief process	Storage Beumer
Safe storage of not-distributed parcels	Storage of old type scanners	Storage of non-daily products
Recovery of damaged parcels	Kick-off/kick-down	
Netlink scanners		
Passage between planning desk & floor		
Storage & charge of mobile planning desks		

Identification of strengths and opportunities

Below strengths and opportunities apply to depot Ridderkerk.

Table 12. Strengths and opportunities identification

Strengths	Planning desk area	
	Not present & desired	Present & undesired
Usage of two concentrated planning desks areas (instead of 4)	Water supply & drain	Non-daily storage materials in the secured area (e.g.

		spare tyres) and distinction non-daily versus daily.
Functional configuration of the secured area	Water closet (urinal))	Optimal stocks of trolley labels
Daily management through evident task responsibilities	Ventilation for vapor extraction (above workbench)	Drain barrel for dangerous and damaged parcels (function + location)
Planning desk area is a central place for planning desk employees (debrief)	Standardization of workplace recovery of damaged parcels (drip bin, instructions, accessories, cleaning, fixed locations)	Storage of cleaning attributes
Storage of daily products	Stand section for not-distributed parcels (night)	
Application of lean	Product storage for an unknown period	
	Kick-off/kick-down facilitation in planning desk area	
	Central procurement of secured area materials, i.e. notifications and trolley labels.	
	Creation of a homey atmosphere planning desks	

Other issues

- The secured area and planning desks are currently not covered in the lean scan
- Currently, there are wine and paint vapors/malodors since a ventilation is lacking. Also, there should be a water supply to support the process of damaged parcel recovery as employees are in contact with dangerous substances. Additionally, the drip tray should be organized in a different manner. Currently, all damaged parcels are collected in one drip tray, however, mixing of dangerous products can cause chemical reactions. This is dangerous, especially without water and ventilation.
- Local deviations are extremely important during implementation and should be accounted for (location debrief, stairway, specific customers, notification replenishment method, OBSB, Valid, depots+, etc.).

Proposal group 1

- Planning desk 4 is the main planning desk area and occupied any time. Also the room for kick-off/kick-down and the debrief process.
- Storage of paper in planning desk area
- The new scanners type are preferably stored and charged in the secured area around the corner. As a results, notifications are stored in the planning desk area. Main advantage is easy replenishment during the debrief process and during the hand out process in the morning. Moreover, scanners in the secured area is convenient because the flows of the SASKIA, blue AGT bins and scanners can be bundled immediately.
- Mobile planning desks are stored in the upper SA, thus, in the AGT (SASKIA) secured area, also considered as *delivery/distribution* secured area.
- This makes the other secured area a *debrief/evening* secured area. This is also an area for storage of parcels which have to be distributed, Netlink attributes and storage contentions for trolley labels.

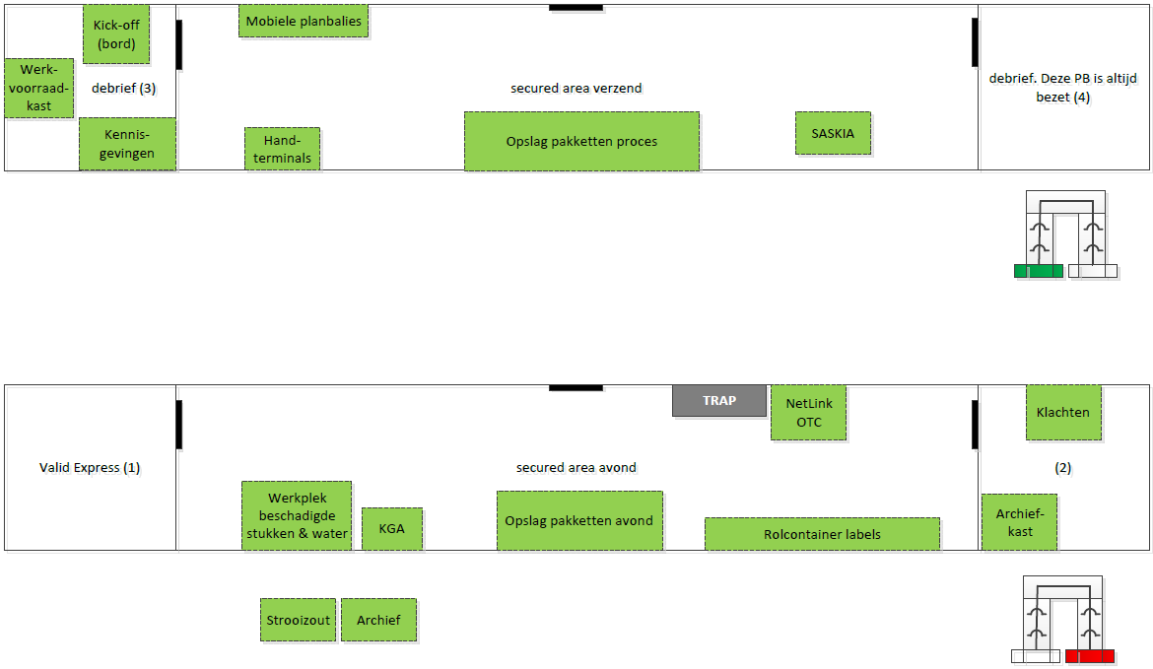


Figure 28. Proposed interior design group 1

- In the *evening/debrief* secured area also the workplace for recovery of damaged goods is accommodated, including all required supporting resources, such as recovery accessories, water supply, absorption grains, small dangerous garbage and packaging materials (foil and cardboard.
- Removed from the secured area is salt and long term archive. These are stored in the area above the sorting machine.
- Complaints are facilitated in the right lower planning desk area.
- Attitude and behavior: role of management is crucial to keep the secured area safe and clean. Give freedom and delegate responsibility. When local management does not care about a safe an clean working environment, that one should not expect the secured area to be well-organized.

Proposal group 2

- The scanners should be positions in the AGT secured area. This has an advantage of convenient bundling of SASKIA flows, blue bins and scanners. The same holds for the notifications which can be replenished right away after the debrief process when the blue AGT bins are returned.
- However, this only works for a procedure in which a driver notifies the planning desk employee to replenish their notifications stock for the next morning. When a depot has the morning replenishment alternative then notifications should be stored in the planning desk area.
- In the upper secured area two stand sections are created. One for parcels which have to be distributed with on the right a note board (ownership, etc., info on stored parcels and destinations, contact person). The other stand section is for drown sorted parcels stored in trolleys (*verzuip*).
- Below: trolley labels in the lower secured area. In case of decentral procurement placement in the secured area, otherwise below the floor gutters.
- Workplace for recovery of damaged parcels should be situation close to the daily-stock, cardboard nearby and bottle bank, drip bin and absorption grains. Salt is situated on the bottom left-side since salt is not functional at the right side and the same holds for paper storage. It is also possible to remove salt from the secured area and place it outside. Ideally, the floor is coated to conveniently clean this workplace. This also provides a safer feeling and the perception of responsibility. However, this may be relatively expensive. On the other hand, no damage will occur to the current floor.

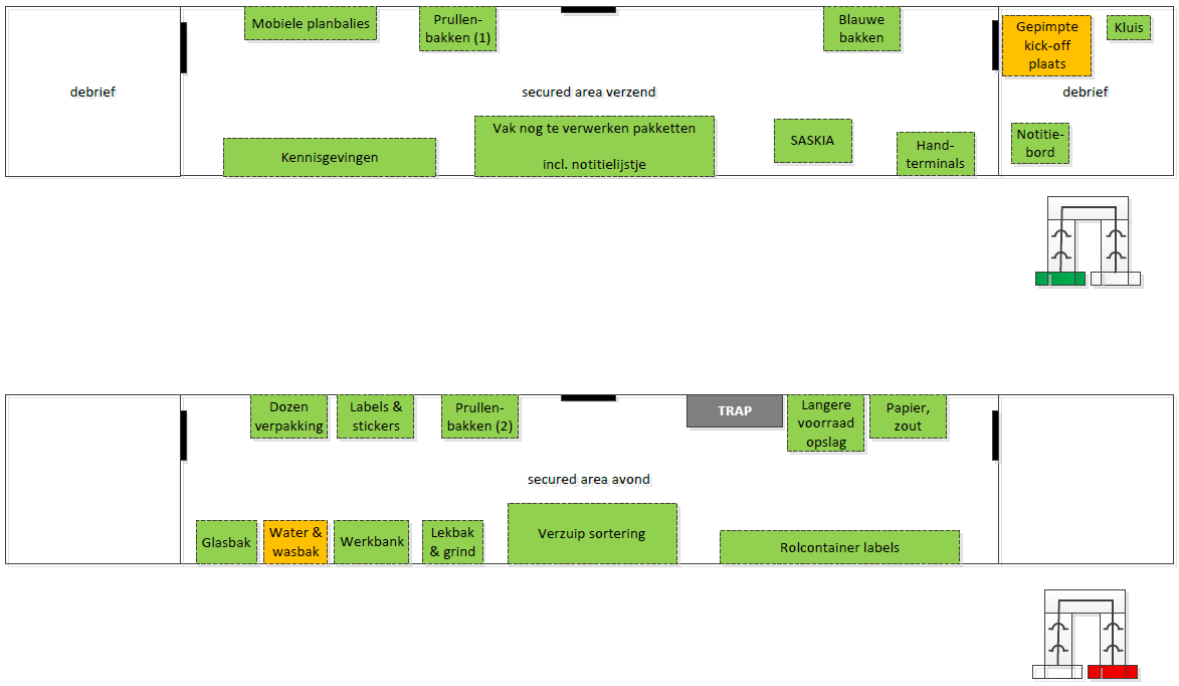


Figure 29. Proposed interior design group 2

- The secured area *keeper/administrator* is a solution to address the issue of attitude and behavior. However, the priority is to first create a well-organized configuration of the secured area. Thereafter a secured area keeper can be assigned.
- Responsibility and ownership should be present at all levels of a depot: depot manager, senior process manager, process managers and the planning desk employees.

5.3.6. Process-related results second workshop

Process related aspects are discussed during the evaluation section of the second workshop.

- This setting encourages to think on a company level instead of a local (depot) level.
- A well prepared meeting is conducive for commitment. The same holds for the group agreement
- Unclear about the final deliverable. What will be standardized and to what extent? The level of detail is unknown. This has to be clarified in advance. In other words, is the deliverable a fixed lay-out plan or will a list of secured area ingredient communicated in which depots have the freedom to accommodate these products according to their own view?
- Involving different organizational stakeholders and disciplines promote organizational learning through knowledge sharing.
- Through visualisation a sense of urgency was increased among the participants.
- Standardisation cannot be a goal on itself. So during implementation the argumentation of standardisation should be very clear. Thus, carefully explain the added value of new measures and think about the level of detail of standards. Also address different modules of standardisation.
- Depots have already designed their perceived optimal interior lay-out. Therefore, the change/implementation process is more difficult.
- There is a trade-off involved between presenting a clear problem statement at the beginning of the meeting versus not providing a problem statement. In the latter situation, participants are not restricted in their way of thinking. However, during implementation, a clear problem statement is paramount in order for other depots to create a sense of urgency as a number of facilities do not perceive a problem.
- This session was conducive for developing a learning organization since specific knowledge is shared. Often implementation processes face the argument of *not-invented-here* or *not accepted here*. This

approach of involving with a diverse set of organizational stakeholders more or less eliminates this issue.

- This collaborative approach also prevents ideas to be blocked in a later stage of a project. Think for example of the cost aspect. When an idea is expected to be too expensive, this can be communicated during a collaborative session and thus early in the project cycle.
- A main challenge is to implement the generated idea to depots which have not participated in these sessions. However, when people hear that a lot of viewpoints have been considered they are more likely to accept and conform to new standards. Additionally, depots have already designed their optimal lay-out and are not likely to change. Therefore a well elaborated explanation for change is required to convince other depots even though they perceive their situation as *desired*.
- The argumentation during the collaborative sessions should be used in the communication during the planning of the implementation.
- Involvement of different perspectives, hierarchical layers and employees helps management during implementation compared to a top down implementation.
- Quick follow-up is required to keep participants engaged. Otherwise established trust can be affected.
- The effects of a collaborative design workshop are:
    - Insights into different disciplines so that relevant knowledge is shared and used.
    - Involvement of different disciplines prevents that a develop plan is blocked on a later stage of the project cycle which also prevents disappointments later on: ''*after we've seen the involved costs, we have decided not to invest in this plan. Huh? But wasn't it important?* ''.
    - Also, all the different disciplines are required to resolve this issue. However, it is more time consuming, but collaboration is preferably the most effective approach to prevent disappointments later on.
    - ''*By participating in collaboration we collectively create acceptance beforehand*''.

5.3.7. Changes to the improved conceptual framework

The second workshop process gained insight into some relevant issues concerning possible modifications to the previously improved conceptual model. A number of notions are removed, reformulated or added to further improve the model.

Table 13. Framework modifications after second workshop

Level of design	Framework element	Changed aspect	Description
		Problem	The problem was not clear for everyone and thus there was no consensus. Some participants did not even perceive a problem as the involved depot was well organized. Visualisations helped to set a sense of urgency for the problem. There is a trade-off involved between presenting a clear problem statement at the beginning of the meeting versus not providing a problem statement. In the latter situation, participants are not restricted in their way of thinking. However, during implementation, a clear problem statement is paramount in order for other depots to create a sense of urgency as a number of facilities do not perceive a problem.
		Objectives	-

OBJECT OF DESIGN	Shared understanding	Scope	The scope was defined collectively.
		Expectations	One participants had different expectation regarding the level of detail of the discussion.
		Deliverables	Unclear what the final deliverables were, i.e. what is to be standardized and to what extent. Standardisation cannot be a goal on itself. So during implementation the argumentation of standardisation should be very clear. Thus, carefully explain the added value of new measures and think about the level of detail of standards. Also address different modules of standardisation.
	Shared mental model	Construction of meaning	Since the process was politicized, creating a shared understanding did not take place according to the steps of constructive conflict.
		Co-construction	
		Constructive conflict	
	Target area antecedents	Physical scope	The physical scope was defined together.
		Processes (hard factors)	The new scope impacted involved processes.
		Soft factors	Depots have already designed their perceived optimal interior lay-out. Therefore, the change/implementation process is more difficult.
		Employees	
CONTEXT OF DESIGN	Organizational antecedents	Management support: - Management involvement - Organizational goals - Resources - deliverables	Role of management. The argumentation during the collaborative sessions should be used in the communication during the planning of the implementation. Consider the project phase when initiating collaboration to prevent project being blocked in a later stage. And account for the type of problem to be resolved. Account for a) multi-site challenge and b) new design versus redesign. Has implications for implementation.
		Organizational characteristics: culture, structure and collaborative experience	
	Collaborative architecture	Governance	
		Openness	
	Individual antecedents: frame of reference	Position-role	The participants argued that the diverging functional roles was helpful to view a problem from multiple perspectives and thus enhancing problem solving capabilities.
		Goals and interests	The participants were rather involved in a politicized process as they wanted to incorporate their requirements into the final design. This caused the process to politicize. However, the group agreement maintained mutual respect among each other.
		Diversity	A lot of horizontal diversity. Limited vertical diversity. This led to a very politicized discussion.

ACTORS WHO DESIGN	Team antecedents	Size and equality	The number of participants was 9. Account for group size (trade-off between perspectives and input). Equality was promoted by a group agreement
		Trust	Mutual and process trust were established through collaborative design and group agreement. The group agreement led to honest and open communication
		Ownership	Ownership was enhanced through collaborative design and group agreement. During implementation ownership should be transferred to operational employees. This collaborative approach also prevents ideas to be blocked in a later stage of a project. Think for example of the cost aspect. A main challenge is to implement the final design to depots which have not participated in these sessions. However, when people hear that a lot of viewpoints have been considered they are more likely to accept and conform to new standards.
PROCESS AND METHOD-OLOGY	Workshop structure and agenda	Preparation	Expectations should be clear beforehand.
		Kick off	
		Design exercise	Involvement of multiple sites starts with explicitly addressing local deviations
		Synthesis	Formulate clear follow-up steps to avoid paradox of participation. Quick follow-up is required to keep participants engaged. Otherwise established trust can be affected.
	Techniques and methodology	Selection of methods	Promote team learning through interaction (facilitate feedback through presentations). This session was conducive for developing a learning organization since specific knowledge is shared. Often implementation processes face the argument of *not-invented-here* or *not accepted here*. This approach of involving with a diverse set of organizational stakeholders more or less eliminates this issue. Create an engaging environment for commitment to the process.

The final framework based on the insights from the second workshop can be found in chapter 7: final theoretical framework.

5.3.8. Conclusions after second workshop

In this paragraph preliminary conclusions are drawn concerning collaborative design for spatial redesign.

Object of design

As the involved depot was well organized there was not a perceived problem. Visualisations helped to emphasize the seriousness of the problem. At the beginning of the collaborative design process collectively a shared understanding on the problem should be created. A fixed problem statement is not desired as there are multiple views and the group should feel owner of the problem. A shared understanding om the physical scope smoothens the design process. Also shared understanding on the final deliverables is key to manage expectations. During implementation a clear problem statement is required for a sense of urgency.

Additionally, arguments used in the design process is crucial to communicate to organizational stakeholders who did not have participated. When involving multi sites local deviations should be clear beforehand to create a shared understanding regarding physical characteristics of the target area.

Context of design

The project phase when initiation of collaboration is should be determined to prevent project being blocked in a later stage. And account for the type of problem to be resolved.

During implementation it is important to consider the fact that a redesign involves a different strategy as regular design since layout configurations have already been designed. Here a clear problem statement and used arguments should be communicated openly.

Also, during implementation a multi-site problem is an extra challenge as these facilities have their own particular views and local deviations. Therefore, stakeholders who have not participated in collaborative design should be informed on the problem and design arguments.

Actors who design

Representatives from mainly diverging functional roles, i.e. horizontal diversity caused the process to politicize. However, these multi perspectives also led to team learning and organizational learning. More stakeholders from the operational core are to be involved and especially stakeholders who are familiar with less well organized layout configurations.

Process and methodology

The paradox of participation can be partly resolved to creating a shared understanding on the final deliverables, openly communicate the intended governance of the collaborative design process and to head everybody´s expectation. Also clear follow up steps should be evident.

5.3.9. Conclusions after both collaborative design workshops

Conclusions of the collaborative design workshop intervention are decomposed of four levels of collaborative design as elaborated in the conceptual framework. See below for the interim conclusions.

Object of design

Creating a shared understanding is key for facilitating collaborative design for spatial redesign. It does not only cover the involved problem, objectives of the design effort or expectations, but also social norms, vocabulary, the physical scope, including local deviations, and deliverables or the type of standardization and the degree of standardization. A shared understanding regarding these issues is achieved by constructive conflict, transparent communication by management and process facilitator, the use of visualisations and the signing of a group agreement. This also promotes trust and ownership. A fixed problem statement by management is not desired as participants should perceive ownership of the scope and involved problem. However, during implementation a clear problem statement is required to establish a sense of urgency to resolve the problem.

Context of design

The design process is an integral part of a broader context. This means that there is a particular project phase in which collaborative design is applied for problem solving purposes. Therefore adequate project planning is recommended to structure the project phases. Collaborative design for spatial redesign is useful to gather requirements and potential constraints and therefore to explore design options and to generate ideas.

Furthermore transparent communication by management is key regarding the collaborative governance and the way how a layout redesign positively contributes to achieve organizational goals. This also includes information on the design of the process, expectations, how participants are selected, follow up steps, deliverables etc. It is also important that stakeholders can think without any restrictions in order to facilitate effective brainstorming. Therefore participants have to collectively define the problem statement as this also promote mutual understanding.

Also, during implementation a multi-site problem is an extra challenge as these facilities have their own particular views and local deviations. Therefore, stakeholders who have not participated in collaborative design should be informed on the problem and design arguments.

Actors who design

It is crucial to both consider horizontal and vertical diversity of involved organizational stakeholders. During the workshop there was no perfect balance found between horizontal and vertical diversity. On the one hand, limited horizontal diversity implies a risk of not covering an integral set of design requirements and thus different functional roles are required to cover multiple perspectives. Also, mainly horizontal diversity increases the risk of politicization. On the other hand, limited vertical diversity restricts successful transferring ownership and to gather requirements from al operational levels, especially employees who are perform the actual work in the relevant work area and effected by the final design.

Ownership is enhance through the collaborative design process itself and by signing a group agreement. Furthermore, ownership is to be transferred to all hierarchical levels at the operational core in order to organize a successful collaborative design process.

Process and methodology

Interaction can be promoted by organizing sub groups and facilitate feedback sessions. These discussions are conducive for team and organizational learning. The paradox of participation can be partly resolved to creating a shared understanding on the final deliverables, openly communicate the intended governance of the collaborative design process and to head everybody´s expectation. Also clear follow up steps should be evident.

6. Developing a collaborative design approach for PNP

In this chapter an approach is developed for PNP to organized collaborative design. In the next paragraphs the outcome from the case study is validated by workshop participants and management . First participants during the workshops reflect on the concept design based on the design sessions. Also, management members elaborate on this new collaborative design approach at PNP and the effects of problem-solving in this manner. Thereafter, in paragraph 6.3 this collaborative approach is applied to gather requirements for a new design problem at PNP. In the last paragraph the roadmap is provided on how PNP should organize future collaboration.

6.1. Validation of designs by workshop participants

In this paragraph the concept designs based on the workshop outcomes are presented to workshop participants. In the last paragraph conclusions are drawn based on the stakeholder inputs.

6.1.1. Presentation of the concept designs

The concept designs based on the stakeholder input from the collaborative design workshops are depicted below. These are the result from the design process in which requirements are elicitated. However, different ideas are proposed by the workshop participants and not all preliminary design may be appropriate for implementation. The input and designs from the workshop participants are translated into concept designs for future implementation.

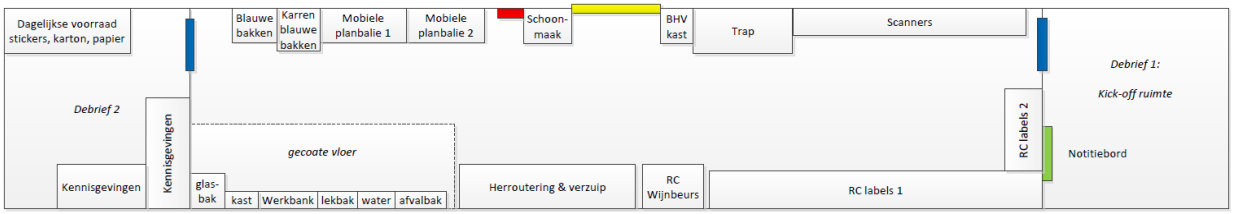


Figure 30. Concept layout redesign depots+ based on workshop outcome

Note that there are two designs: the first for cross dock depots (depot+) and the second layout design for regular or hinterland depots (standard depots). These designs are presented to a selection of the workshop participants for validation of the workshop outcome. This feedback is required to validate to what degree the final designs meet the stakeholder requirements according to their own view.

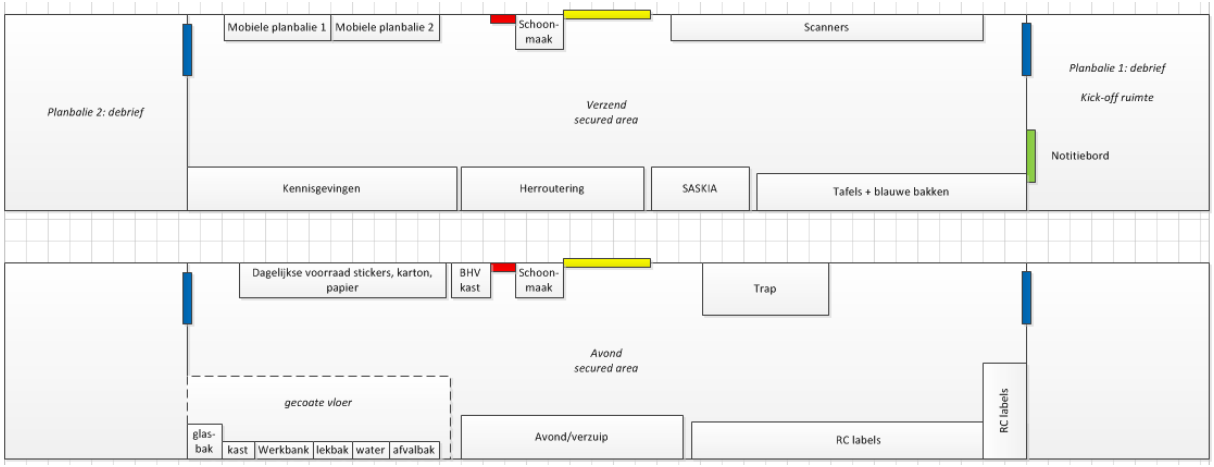


Figure 31. Concept layout redesign standard depots based on workshop outcome

6.1.2. Conclusions based on input from workshop participants

An overview of the workshop participant's feedback is provided in appendix F.1. as part of appendix F: outcome validation.

Generally, the designs are in accordance with stakeholders requirements as formulated during the collaborative design workshops. This means that the process of collaborative design has been successful as participants identify themselves with the concept designs and that the different preliminary designs by the workshop participants are well integrated within the new concept designs. However, there are some suggestions made by the workshop participants.

One is the integration of soft aspects as part of a lean system. As the concepts designs are solely physical layout designs, limited attention is paid to soft factors whereas the importance of a lean system also requires soft factors to be considered.

Thereafter, after the workshop results new constructions decisions have been made concerning the layout of the planning desks for new depot buildings. This influences the designs for future depot layouts and this has to be modified in a later stage.

Participants raise specific question concerning the detailed consequences of this layout. Unfortunately, this level of detail has not been researched so far and should be communicated as soon as possible. Moreover, participants requested to also present the arguments used during the design workshops and provide them together with the concept designs. In general, the concept designs should be work out more extensively in order to prepare for implementation. Also, it is important to concisely present the used arguments for introducing this final design.

6.2. Outcome validity by management: does this design work better?

In this paragraph input is gathered from management stakeholders and is reflected upon the design process as problem-solving method.

6.2.1. Interviewees from PNP

Process input is collected from interviews with PNP managers Eelke Stegehuis (Manager Staf Operations, 2016), Dirk Veldt (Manager Depotbeheer & Ontwerp, 2016) and Minke van der Kleij (Logistiek ontwerper, 2016). Several questions are asked and answered by the interviewees. The interviews can be found in appendix F.2. as part of appendix F: outcome validation.

6.2.2. Conclusions based on management input

The conclusions are decomposed into four different aspects: added value for management and the organization to hear employees voices, the collaborative design approach, appropriateness/circumstances and the effects of such an approach.

<u>Gathering employee input for management decisions</u>

The input from people who carry out the actual work is indispensable. They are the true knowledge providers, especially in the operational core and it is important to hear their voices. This approach is more beneficial since people perceive more ownership as they participate in the actual design process. Moreover, in such a collaborative way acceptance is enhanced. By involving employees in an early stage these organizational stakeholders are more willing to comply to future standards and measures at PNP. Furthermore, designs become qualitatively better since more issues are tackled in these designs, which can be tackled beforehand. Thus, feasibility issues can be addressed. Last, this approach facilitates organizational learning as participants from different depots are brought together. It is recommended to formulate clear guidelines on how and at what moment you involve organizational stakeholders. The level of participation can vary per subject/topic/problem: this should be determined beforehand in consultation with management.

<u>The added value of a collaborative design approach for spatial redesign</u>

This collaborative approach combines all relevant aspects which have to be considered and you offer depots an opportunity to make improvements for a specific situation. This resolves the issue of resistance in a later

stage since people can participate, have influence and can gather information. Trying to change something afterwards often causes resistance.

It is not certain if this collaborative approach will suffice for any design. Especially in the case of local deviations, it is difficult to come to sustainable designs which are also accepted by other depots. For this reason specific guidelines are to be formulated for what type of spatial layout problems this collaborative design approach is appropriate.

Appropriateness of the approach and preconditions

The level of involvement by participants from the operational core should be determined adequately beforehand as a precondition. Furthermore, this approach may be helpful in case of qualitative and/or complex problems in which many factors play a role with multiple possible solutions and various ways to arrive at a specific solution. This collaborative approach is especially useful during the preliminary research phase and perhaps the design phase as well (as part of a new workshop session) in which exploratory research can be performed. This collaborative design approach is less suitable when costs play a dominant role and when measures have to be taken quickly due to time pressure or in case of imposed legislation.

Effects of this collaborative way of designing for spatial redesign

There are some potential positive and negative effected involved with this collaborative design approach at PNP.

Main benefit is enhanced feeling of involvement and unity, both by the operational core as the organization itself. Furthermore, initiating such a collaborative approach in an early stage, when carried out well, leads to a quicker and more easy implementation process as voices are heard beforehand as employees have influence in the process. Last, acceptance and participation/involvement is enhanced. In this way, fact-based input is gathers in an early stage of a project and promotes mutual learning when different disciplines collaborate together.

Potential negative effects involve that this collaborative approach is time-consuming. Furthermore, there is a risk involved that non-participating depots will not accepted the developed solution. Also, insufficient formulation of follow-up steps can affect commitment to the process and outcomes, concerning goals, steps and deliverables. Last, it is important that a right balance is found for the intensity/frequency of facilitating such workshops as depots will be 'swamped with work' when too many workshops are initiated.

6.3. Testing the collaborative design approach at PNP

An internal validation at PNP is carried out to test the approach of involving operational core members from different roles and multiple depots. In this setting the collaborative design approach is used for resolving a specific issue of redesigning the evening distribution process and was initiated by Minke van der Kleij (Logistiek ontwerper, 2016) to gather requirements for this new process. However, this challenge was not directly related to lean management or a lay-out problem. Observations made:

- Participants were representatives from depot Son, Halfweg, Goes & Den Hoorn
- There was no personal introduction round as participants already knew each other
- Goals and objectives have been formulated and communicated clearly, including well-formulated follow-up steps after the workshop.
- Shared understanding was enhanced through collectively determine a scope. However, no shared understanding was reached on the used SADT as method for process improvement, especially the modeling language used in terms of input, output, mechanisms/resources and control aspects.
- This exercise caused stakeholders from a specific depot to think on a company level instead of a depot level. Participants considered local deviations which affect a new design.

- The goal of this workshop was to gather requirements for a new design. However, some participants delivered solutions rather than design requirements.
- Another observation was the role of the facilitator. In this workshop the facilitator was a relative speaker whereas during the case study intervention the facilitator was rather a listener. Additionally, during this workshop the facilitator was in charge of the final decision whereas the facilitator in the case study intervention was neutral. It is not possible to accurately describe how these factors influence the process and outcome of the workshops.
- The facilitator already had extensive past work relations with all of the participants. For this reason, it was relatively easy to involve participants as trust between the facilitator and participants was already established beforehand.

6.4. A roadmap for collaborative design at PNP for spatial redesign

The theoretical framework is tested in the case study intervention at PNP. Based upon the insights from literature, the theoretical framework and insights from the case study intervention and input from PNP management stakeholders a practical model can be constructed for PNP to facilitate collaboration. Three main project phases can be distinguished:

A. Management consultation
B. Collaborative design workshop facilitation
C. Planning for implementation

6.4.1. Management consultation

A first step is to get management involved in the project. The department of Staff Operations, Depotbeheer & Ontwerp and the manager depots should be engaged with for management support and assigning. In consultation with management a target area is identified. Additionally, criteria/metrics have to be established, collaboration should be designed in alignment with organizational goals, an appropriate project phase in the LE@D structure is to be determined, a business case is to be made, relevant resources need to be allocated (time and money) and an appropriate level of participation needs to be determined including the forming of the interdisciplinary project team in which participants are selected. These are either organizational stakeholders with decision-making power, knowledge holders or stakeholders possibly affected by a future measure. Both horizontal as vertical diversity (functional roles & hierarchical levels) need to be represented. Selecting participants from particular depots starts with commitment from depot managers and senior process managers. They are able to involve other stakeholders from a depot, e.g. process managers and planning desk employees. Thereafter an appropriate collaborative architecture needs to be established including a workshop design to facilitate a collaborative design meeting.

As already mentioned before, projects at PNP are structured according to the LE@D programme structure as depicted in table 9. Facilitating collaborative workshops for lean purposed is especially useful for application in mainly the preliminary research phase in which feasibility issues can be address through gathering requirements from relevant stakeholders. Feasibility issues can relate to technical, financial and social requirements. Furthermore, collaborative design can be applied in the design phase in which actual measures are designed and developed.

Table 14. LE@D project structure at PNP

Tollgate phase	Question/decision	Supporting documents
Idea	Is the idea worthwhile to investigate in the future?	Project charter
Preliminary research	Is the rate potential-investment sufficient to allocate resources?	Project plan, business case, product planning, resource planning & checklist tollgate

Design	Is the business case sufficiently attractive for realization?	Project plan, business case, product planning, resource planning & checklist tollgate
Realization	Are the products available for implementation?	Resource planning, checklist tollgate & implementation checklist
Implementation	Can the project team already prepare the project decharge?	Resource planning, checklist tollgate & hand-over criteria list
Aftercare	Is the project well implemented and accepted by acceptor(s)?	Resource planning & decharge-evaluation document

6.4.2. Workshop facilitation

The second phase concerns the facilitation of a collaborative design session. A workshop consists of three sub-parts: a kick-off, the requirements elicitation phase including the actual design assignment and a brief workshop evaluation. Crucial is clarification of local deviations (client/process and construction-related) between the involved depots. In this manner a discussion can start right away taking into account local differences and viewpoints.

6.4.3. Implementation planning

The third phase is the planning for implementation. Management has to make a decision concerning the input from the workshop participants in which relevant knowledge is shared and possible design solutions are generated. These solutions have to be ranked and categorized according to the organizational goals (KPI's) and their impact-investment score. Future decisions should address both soft and hard factors within an integrated workplace. In figure 36 the roadmap is depicted for PNP to facilitate future collaboration.

6.4.4. Practical roadmap for collaboration at PNP

In the below figure the framework for PNP is depicted which is derived from the theoretical framework and insights from the case study intervention and interviews with PNP management. The required time for each step are provided on the left side. Planning requires approximately 3 months and dependent upon the level of participation one or two collaborative workshops (1 day per workshop) are held. Planning for implementation can also take up to three months. The actual implementation phase is not considered here since the resource scope only covers the implementation planning.

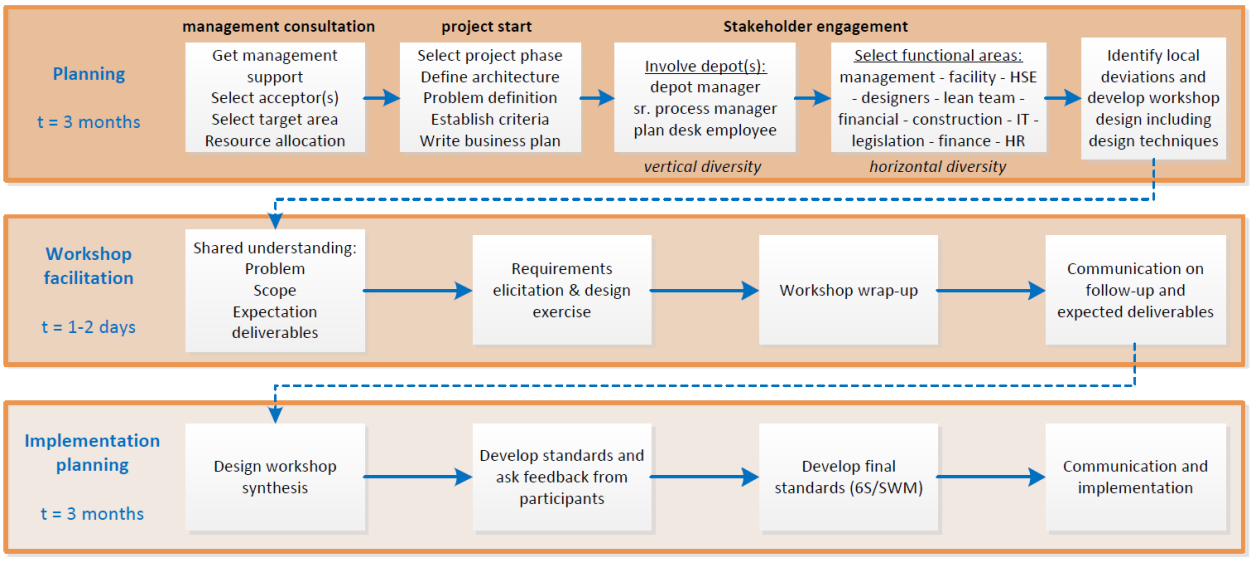


Figure 32. PNP roadmap for spatial layout redesign through collaborative design

6.4.5. Advice towards PNP in general

Collaborative design is an alternative design approach for PNP to account for multiple perspectives and promoting organizational learning. This design approach is to be applied in conditions with qualitative, wicked and complex problems, i.e. situation in which multiple solution are appropriate and problem-solving requires multiple perspective to solve an organizational spatial redesign problem. This approach is suitable for application in projects for exploratory research in which feasibility issues are addressed. For example, within the LE@D structure the preliminary research phase and actual design phase are two relevant project stages to perform collaborative design for spatial redesign. The preliminary research phase has a more exploratory character whereas the design phase develops concrete solutions. Thus a project team is in charge of the appropriate stage at which this approach is applied, including the collaborative architecture, level of participation and other relevant aspects as will be elaborated upon below.

Less appropriate is a situation in which time pressure or imposed legislation plays a significant role. In these conditions a more bottom-up approach is less suitable and a more top-down decision-making process is preferred. Moreover, trust building and creating acceptance and ownership requires time to develop. Therefore, collaborative processes are not to be considered as activities to quickly *tick-off*.

Generally, the above framework helps to structure the collaborative design process and should be used in combination with the generic conceptual framework which addresses the building blocks of collaborative design for spatial redesign.

6.4.6. Specific guidelines for PNP

The guidelines for PNP are decomposed into four different aspect according to the conceptual framework in chapter 3. These are the levels of collaborative design: object of design, context of design, actors who design and process & methodology. These collaborative design aspects are addressed during the design phases in the above roadmap.

<u>Object of design</u>

Creating a shared understanding among the team members is key. First of all, what type of problem is faced? Qualitative and complex with several possible solutions are suitable to resolve through collaborative design. Note that problems with a focus on cost are less suitable. Furthermore, situations with time pressure or regulations which have to be complied to also limits the potential of collaborative design for spatial redesign. Note that a fixed problem statement is not desired as this limits unrestricted thinking by participants. However, during implementation a clear problem statement is required for clear communication to non-participants.

Special attention is to be paid to the prioritization of stakeholder needs or requirements. As collaborative design requires equal participation, specific requirements may be more important than other stakeholder needs. Therefore, this should be made clear in advance and communicated openly with the design team. Conflicts can be resolved through constructive conflict in which conflicts between stakeholder requirements can be addressed right away.

Concerning the target area characteristics, a very important aspect of shared understanding for PNP is the identification of local depot deviations when multiple depots participate in the collaborative design process. Also, the physical scope should be carefully agreed on by the workshop participants.

Furthermore, both hard and soft factors should be addressed. An important factors involves ownership as participants not only gather requirements, but also perceive ownership over the final design to avoid resistance beforehand.

Context of design

The collaborative governance/architecture is to be determined by management. This should be communicated openly to workshop participants as this determines the level of involvement and the way how participants are selected. Note that the deliverables should be clear for the participants. This encompasses what is actually standardized and to what degree. See also 'actors who design'.

Furthermore, an appropriate time for stakeholder engagement is to be determined. This also depends on the goal of the collaborative design process. Thus, a project timeline is to be drawn with the appropriate moment for collaborative design for spatial redesign.

Actors who design

Decide upon the degree of involvement during the project phase and how participants are engaged with. This relates to the project phase in which collaborative design is applied. Different types of stakeholders can be involved in the design process. Distinction is made between horizontal and vertical diversity. Horizontal diversity relates to different disciplines, functional roles or geographical facility locations. Thus the department of sales, facility, ARBO, designers and the different distribution centres. Note that specific stakeholders will lead to specific requirements. On the other hand vertical diversity relates to power relations, thus managers, local managers, supervisors and lower operational employees can be engaged with. Finding the right balance is key.

Process and methodology

Clear follow-up steps is paramount as unclear information may diminish commitment and perceived ownership by workshop participants. Furthermore, during implementation communication of used arguments by workshop participants is important to inform non-participants with the required design information.

7. Generic framework for intra-organizational collaborative design

This sixth chapter aims at providing a generic framework for collaborative design interventions to facilitate lean implementation is similar environments, e.g. with multiple (internal) stakeholders. First, the initial approach is evaluated. This activity is concerned with making improvements on the developed conceptual framework. Thereafter, the improved generic framework for such collaborative design interventions is provided the subsequent paragraph. Finally, generalizability issues are addressed in the last paragraph.

7.1. Framework modifications after management consultation

Since the applied conceptual is a learning model several modifications are performed in order to improve the framework. The initial framework was based on literature insights and in-field observations. This framework is tested during the workshop intervention at PNP. Based on this process the initial model is adapted and consequently used as basis for the second case study intervention at PNP. The modifications after each workshop can be found in chapter 5: case study intervention.

Thereafter, the preliminary conceptual model has been constructed as described in chapter 3: the conceptual framework. Based on interviews with management members a practical model for PNP is develop to organize collaboration workshop as input for management decision-making for spatial redesign. The insights from these interviews are depicted in the figure below.

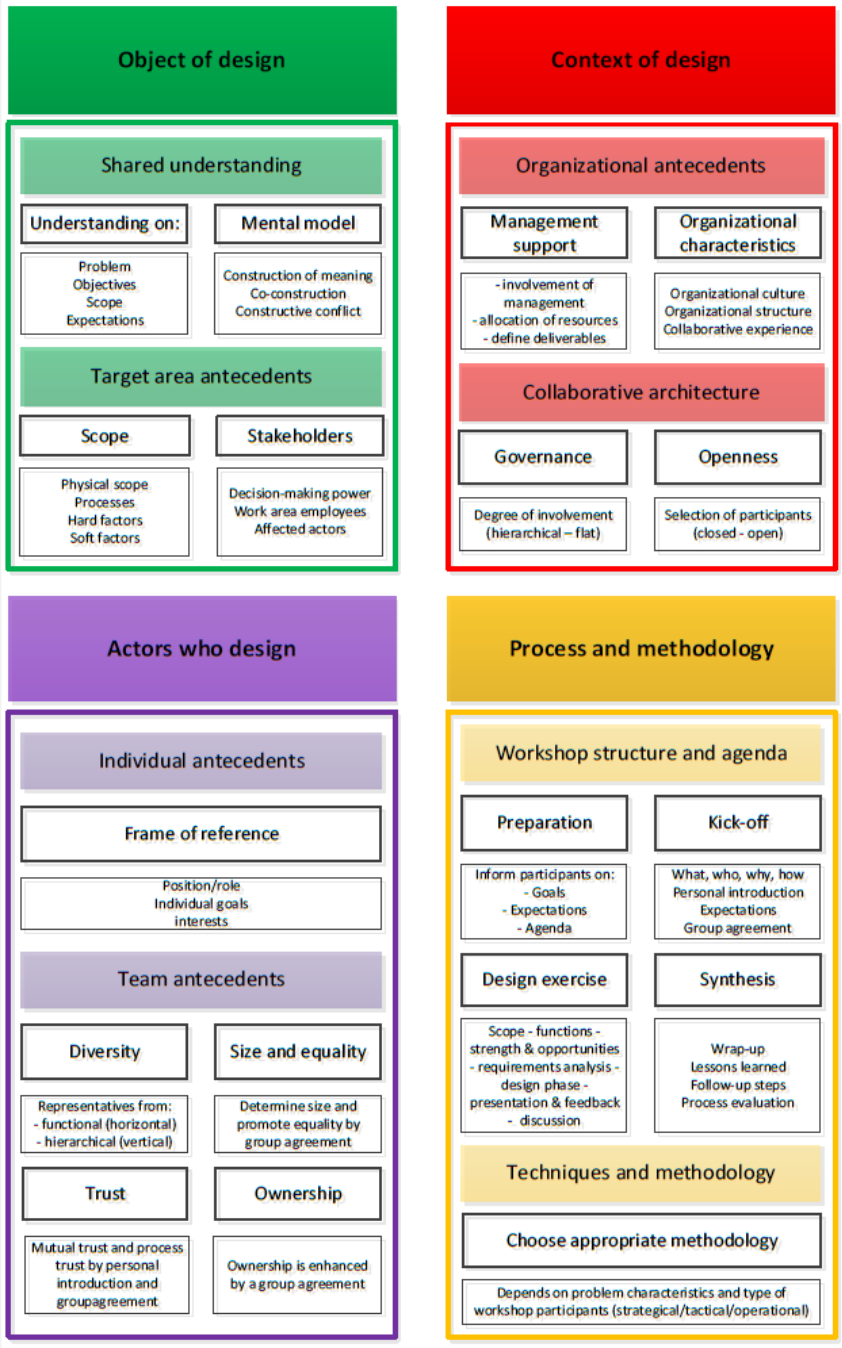


Figure 33. Improved generic framework based on management consultation

7.2. Expert validation of the conceptual framework

In this paragraph an expert validation is carried out at Tata Steel with Matthijs Jansen (Programme-manager Operational Excellence Tata Steel, 2016). First a brief company description is provided, Thereafter insights from the interviews are listed and last potential modifications to the conceptual framework are suggested.

7.2.1. Company description

Tata Steel is an steel making company with various sites across the world. The firm has a strong operational and logistical character with approximately 9.000 employees in which continuous improvement (lean six sigma as operational excellence strategy) projects are key to realize cost-efficient production processes. The size of the operating core is extensive. Formalized procedures intend to promote safety and clarity for the operating core to perform cost-efficient daily operational activities.

7.2.2. Insights from the interview

Matthijs Jansen is interviewed from the perspective of lean management/operational excellence expert at Tata Steel. Below the insights from this expert meeting are provided. One should distinguish between *transforming an organization versus a project initiative*. Collaborative design for spatial redesign is rather a project initiative. For this reason a more project management approach is desired. This is contrary to the Toyota way in which there is a short distance between management and the operational core. In this situation this distance with the shop floor is larger and for this reason a rather German engineering approach is required characterized as a top down strategy with slight bottom-up elements (collaborative design).

Figure 34. Project stages for collaborative design

It is crucial to think in terms of *project phases*. When applying collaborative design the appropriate phase needs to be determined as depicted above, ideally during the *solution development* stage and during analysis cause. Also, the right moment of employee involvement and shaping of the multidisciplinary team needs to be agreed on.

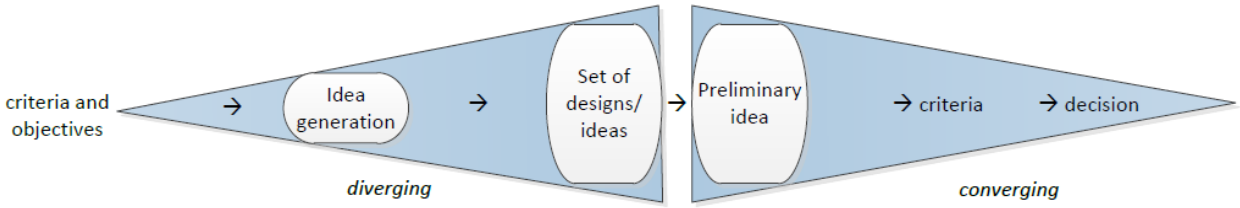


Figure 35. Diverging and converging phase during the project

An important aspect is that management sets *design metrics* in order to assess several proposed designs. These metrics are aligned with strategic and organizational objectives to ensure that the collaborative effort contributes to meeting organizational goals. Once metrics have been established, the multi-disciplinary team needs to be selected. Collaborative design can be used in the stage of divergent thinking, to gather requirements and develop potential designs. In the convergent phase proposed ideas can be evaluated based on the set metrics to assess appropriateness of solutions.

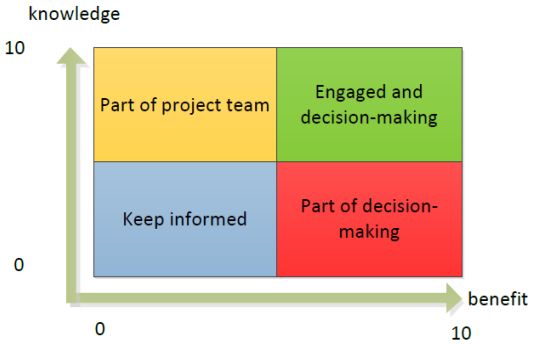


Figure 36. Stakeholder engagement matrix

Stakeholder management can be performed more extensively. See the figure above. At Tata Steel stakeholders are categorize stakeholders according to two dimensions. Their degree of knowledge and the degree to which a stakeholder is accountable for a specific project result. When management decides upon the final decision, stakeholder management is especially required.

Management should be aware that a *business case* is required for management to invest in the idea of collaborative design. Otherwise management does not have incentives to support collaboration. what is the

added value of a particular measure? Does it generate money directly or indirectly? Are the benefits increased safety, flexibility or uniformity? What about increased cost-efficiency by introduction of standards? Really important is clarifying why a specific standard is to be implemented.

Furthermore, it is recommended that there is an distinction between *long and short term thinking* by organizational stakeholders. Organizational stakeholders involved from the operational core mainly focus on the short term whereas managers or local managers especially pay attention to long term issues. It is important to be aware of this distinction.

When involving participants and specific locations you should explicitly address the question ''*what's in for me?*'' This is especially the case when the educational level of the participating employees is lower. This issued can be tackled beforehand by a) clarifying incentives beforehand and b) emphasizing what the benefits are for the company, such as continuity and more convenient ways of work processes.

The process should also address *conflicting goals* and how this should be resolved. Organizational stakeholders from the operational core will mainly focus on their own specific local situation and not merely on organizational goals and strategy.

7.2.3. Modifications to the framework after the expert validation

Several modifications are suggested to incorporate in the final conceptual model. These are listed below and the final conceptual framework is elaborated upon in the next paragraph 7.3: framework for collaborative design as decision-making input.

- A business case is to be develop indicating project deliverables, governance structure, benefits, risks and stakeholders.
- Design criteria or metrics have to be established by management for evaluation of proposed designs.
- The appropriate project stage for collaborative design needs to be determined. Collaborative design for spatial redesign is especially suitable for idea generation purposes and to test feasibility issues.
- Extensive stakeholder management is required when involving employees, especially when management decides upon the final design. Stakeholders are categorized based on two dimensions: degree of knowledge (expertise) and the degree of benefit (accountability).
- Note that involving employees from the operational core brings extra challenges: short versus long term thinking, limited thinking instead of organizational level, the question *what's in for me?* and providing particular incentives for participation in collaborative design for spatial redesign.

7.3. Framework for collaborative design as decision-making input

Below the final conceptual framework is provided. This is based on literature insights, field observations, the case study workshops and two expert validation meetings. A detailed clarification of the building blocks is provided in chapter 3: the conceptual framework.

This framework addresses the building blocks to support the organization of a collaborative design process for spatial redesign challenges within organizations. The levels of design are elaborated for this specific context to structure the collaborative design practices. Note that the framework elements are not an exhaustive set of principles. The conceptual framework forms an initial approach for such a design practices and future research should aim at developing a more comprehensive model, e.g. accounting for psychological factors.

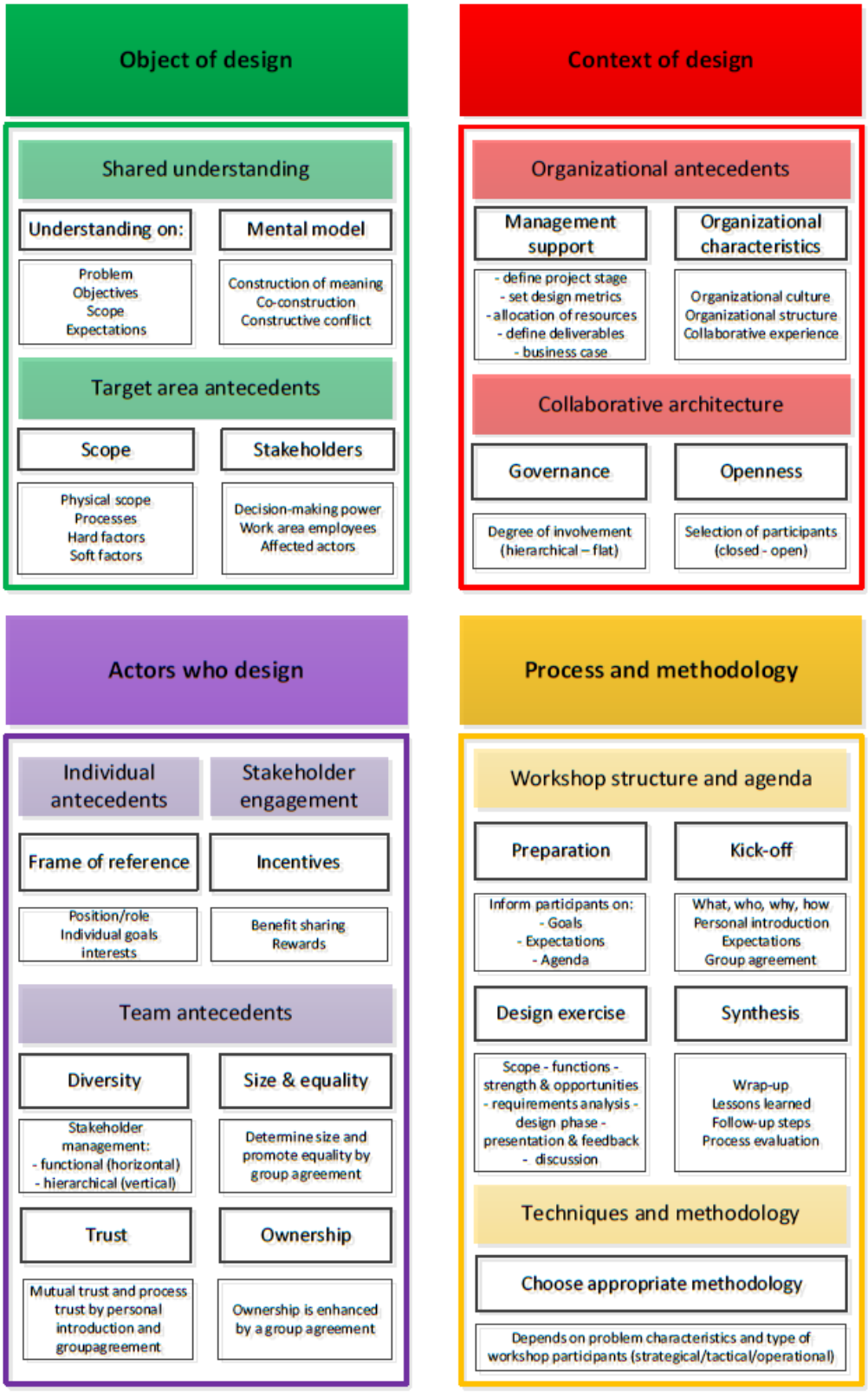


Figure 37. Final generic framework

7.4. Generalizability, effects and limitations

This paragraph addresses generalizability issues in the first paragraph. Thereafter, positive and negative aspects of the conceptual framework are discussed and is ended with limitations of the model.

7.4.1. Generalizability

This conceptual framework especially focuses on the application of intra-organizational collaborative design for lay-out or spatial redesign problems. It is important to address the circumstances under which this research is conducted and these aspect are mentioned hereafter. First of all, a strong operational and bureaucratic (hierarchical) context was identified with mainly participants from the operating core.

Furthermore, the case study is performed at PNP which has adopted lean as systematic method to realize cost-efficient business processes. In other words, a lean environment was identified within the case study. Note that a lean environment and operational context are closely related and can often be found in organizations with rather top-down strategies.

Another important issue is the practice of the design versus redesign of an artefact. The latter has implications for the implementation phase since in the initial situation requires change in which resistance to change is more likely to play a role. This means that the framework is also applicable to generic design problems as the implementation phase is more convenient.

Thereafter, the research focuses on intra-organizational collaborative design and has not been tested in an inter-organizational context, thus between multiple organizations. Involving stakeholders from multiple organizations involve a more complex situation which requires additional measures. Thus research transferability is limited to an intra-organizational context.

In this intra-organizational context, engagement with different hierarchical layers in the operational core (vertical diversity) is required for successfully transfer ownership of a chosen solution. On the other hand a balance is to be found regarding the horizontal diversity. This entails representation of various disciplines to cover all required design requirements, i.e. finance, facility/construction, HSE, supporting staff members, lean/kaizen experts, IT experts, management members and human resources stakeholders, however this depends on the nature of the design challenge.

This framework can be applied to complex, qualitative layout-related problems in which an appropriate solution cannot be known in advance and when there are several ways to arrive at a specific solution. This is also known as ill-defined/structured problems. However, in case of restricted time or imposed legislation this framework is less suitable as collaborative design is relatively time consuming and needs an extensive planning in order to be employed.

7.4.2. Potential positive and negative effects

Positive effects are the following: a) increased acceptance and perceived ownership as a number of organizational stakeholders have influence in the process of idea generation and can have their voices heard during collaboration which, in the long term, allows for a more convenient implementation process. Furthermore, main advantage is that for lay-out redesign their b) specific requirements can be shared which are to be integrated in the final design which leads to better problem-solving. Better problem solving also enhances c) organizational learning as different perspectives and positions are brought together. Another advantage may be that d) the tension between standardization (control) and innovation (freedom/autonomy) can be resolved by allowing organizational stakeholders to participate in the design process. In this way participants can contribute to problem solving processes, innovation and the establishment of specific lean-related standardization for spatial redesign. Furthermore, e) feasibility issues can be addressed at an very early

stage. By facilitating different perspectives to contribute to the potential designs, financial, technical and social requirements can be checked beforehand which prevents ideas from being blocked in a later stage.

Negative aspects of collaborative design for spatial redesign may be that an insufficiently designed processes of collaboration may a) increase the risk of the paradox of participation. If this is the case then collaboration will work counterproductive. Furthermore, b) collaborative design assumes that participants are treated equally, however, different organizational priorities may exists which makes one's argument more urgent than someone's other input. It is unclear how these conflicts can be resolved properly without negatively affecting trust and acceptance. Finally, a collaborative design process requires accurate planning and thus this is very time-consuming.

7.4.3. Limitations of the conceptual framework

Several limitations are involved when applying the conceptual framework to facilitate collaborative design for spatial redesign problems. First of all, the main focus within this research is on the problem definition (planning) and the actual design phase. The testing/validation during actual implementation phase is not addressed extensively and is relatively underexposed. No actual implementation has been carried out and therefore the potential effects of the framework cannot be made more explicit.

Moreover, the conceptual framework does not address an exhaustive list of factors, and for this reason, conclusions should be interpreted carefully. Thirdly, psychological factors are not considered within this research. However, they are important determinants for collaboration processes and provide insights into how the conceptual framework is to be further improved.

Last, observations are based on a limited number of two workshop and involved participants. This has implications for the generalizability of the conducted research. Due to time restriction a larger number of collaborative design workshops was not feasible. Future workshop sessions should be organized to obtained knowledge from a larger number of workshop and input from participants. Moreover, other involved aspects are to be researched in this manner, i.e. the link between psychological factors and the collaborative design process.

8. Conclusions and recommendations

Conclusions of this study are drawn in the last chapter. Based on these conclusions relevant recommendations are suggested for both future academic research and PNP to conduct additional internal research activities. The next paragraph is concerned with discussing this research and providing recommendations for future research. In paragraph 8.3 the research is discussed.

8.1. Conclusions

Within literature collaboration is extensively elaborated upon and brings many advantages for organizations as increased acceptance, increase problem-solving capabilities and organizational learning. Application of collaboration for spatial redesign challenges is not described in detail in literature. For this reason a framework is developed based on literature insights and a case study intervention at PNP. This paragraph provides answers to the research questions as described in chapter 2. In the first sub paragraph the academic research questions are addressed. Thereafter the case study research questions are discussed. Subsequently, the case study insights are used to provide answers to the main research question: ''*how can collaborative design be applied for spatial redesign problems?*''

8.1.1. Literature study research

Within literature there are different views on collaboration. However, this also highlights the essence of collaboration: incorporating different views for problem-solving purposes in which actors interact with each other to work towards common goals. Within literature, collaboration has many advantages, such as increased acceptance, enhanced problem-solving capabilities, organizational learning and better decision-making as multiple viewpoints are accounted for. Additionally, job satisfaction, organizational commitment and performance can be promoted through collaboration. However, just putting together participants does not make it a collaborative process. Various factors play a role as collaboration is process-oriented and impacted by input factors (on an individual, team and organizational level), process factors (thus interaction between team members) and output factors. Structuring a collaborative process according to these categories will promote successful collaboration.

A specific application of collaboration is collaborative design. Design approaches have changed to more participative ways in which multiple viewpoints are incorporated in designs. This concept shares common principles as collaboration. However, during the collaborative process, participants design a specific artefact. Within this research the following definition of collaborative design is established: ''*design approach in which a variety of stakeholders participates in the design process using shared rules aimed at incorporating diverging views, promote mutual learning and working towards a common goal to collectively achieve better organizational outcomes.*'' Within the concept of collaborative design four levels of design are identified which should be considered:

- Object of design: creating a shared understanding concerning the problem and the designed artefact.
- Context of design: the environment in which the artefact is implemented is to be considered.
- Actors who design: stakeholders who participate in designing needs to be involved adequately.
- Process and methodology: the design process itself and used methods influence the design process.

Spatial redesign is performed by establishing standards with organizational stakeholders. Spatial redesign is a design challenge based on the overarching theme of lean management in which continuous improvement (standardization practices) is key to remove waste or slack by organizing the workplace in a most efficient manner. However, there is currently no structured approach which deals with the question how collaborative design is ideally applied within spatial redesign challenges.

Collaborative design is both a solution as a problem as multiple viewpoint are accounted for during the design process, however, collaborative design implies that multiple perspectives have to be considered and incorporated in a design. This means that collaborative processes have to be designed adequately to deal with

diverging perspectives, backgrounds, individual (conflicting) goals and their attitudes towards a new layout design. Conflicts can arise between participants in terms of definitions, scoping, interests, goals, expectations and desired outcomes. Moreover, participation of diverging organizational stakeholders also implies power relations, whereas collaboration requires equality among participants. Another issue concerns the level of participation by the operational core. It is not evident to what degree workplace employees are to be involved in in such decision-making processes. This should be addressed in the design of the collaborative architecture. A specific challenge is the fact that redesign assumes that the current layout is already 'designed' which implies that the implementation process is more complex as change of the current situation is required which makes resistance more plausible.

Furthermore, a set of two paradoxes have been identified. The first concerns the tension between on the one hand standardization from a lean perspective to realize continuous improvement through standards and on the other hand collaboration as method to promote innovation. Second, the *participation paradox* plays a role within this research. An organization can involve the operational core in decision-making processes or idea generation initiatives, however, when management is in charge of a final decision, participated employees can experience distrust when their input is not heard sufficiently. In other words, there is a risk that participants of a collaborative design workshop can have different expectations and can be disappointed when their expectations are not met when management decides to implement alternative ideas.

Specific preconditions apply when design processes are organized in this context of collaborative design for spatial reconfigurations. The *role of management* is essential when collaboration is applied to spatial redesign. The role of management is not only restricted to provide support, they also have to establish a sense of urgency, allocate resources, decide on the project phase for collaborative design, assign a project team for making a business plan, setting design metrics, involve design participants and select appropriate design techniques. Thereafter, the *design of the collaborative architecture* is important as this can be shaped in various ways. The governance of collaboration should be determined a forehand, i.e. how horizontal and vertical diversity is managed (i.e. level of participation and the way how participants are selected) and the way collaboration contributes to the realization of organizational goals. Next to the collaborative architecture, also the principles of *collaborative design* play a main role which applies to the design process itself. Concepts such as *shared understanding* (on scope deviations, expectations, vocabulary and deliverables), multi-perspective, *constructive conflict* and team learning are key in order to promote successful collaborative design processes. Also soft factors influence the design process in terms of trust and ownership. Finally, the deliverables should be clear as this concerns *what is actually standardized and to what extent*.

8.1.2. Case study research

This paragraph addresses the case study research questions. Conclusions can be drawn based upon the case study intervention at PNP. The below conclusions are categorized according to levels of design: object of design, context of design, actors who design and the process & methodology. Thereafter potential effects are listed.

Object of design: creating a shared understanding is key for facilitating collaborative design for spatial redesign. It does not only relate to the problem definition, also objectives of the design effort, expectations, social norms, vocabulary, the physical scope of the target area (including local deviations), and final deliverables (in terms of the type of standardization and the degree of standardization). A shared understanding regarding these issues is achieved by constructive conflict, transparent communication by management, the use of visualisations and the signing of a group agreement. The latter also promotes trust and ownership. A fixed problem statement by the project team is not desired as participants should perceive ownership of the scope and involved problem. However, during implementation a clear problem definition is required to establish a sense of urgency to resolve the problem.

Context of design: the design process is an integral part of a broader context. This means that there is a particular project phase in which collaborative design is applied for problem solving purposes. Therefore adequate project planning is recommended to structure the project phases. Collaborative design for spatial redesign is useful to gather requirements and potential constraints and therefore to explore design options and to generate ideas. Furthermore, transparent communication by management is key regarding the collaborative governance and the way how a layout redesign positively contributes to achieve organizational goals. This also includes information on the design of the process, expectations, the way how participants are selected, follow up steps, deliverables, etc. It is also important that stakeholders can think without any restrictions in order to facilitate effective brainstorming. Therefore participants have to collectively define the problem as this also promotes mutual understanding. Also, during implementation a multi-site problem is an extra challenge as these facilities have their own particular views and local deviations. Therefore, stakeholders who have not participated in collaborative design should be informed on the problem and design arguments.

Framing is important during the idea generation process to avoid resistance. This can relate to specific choices of words, but also to the fact that lean does not need to be mentioned explicitly, as long as lean principles are applied. Next to that, collaborative design for spatial redesign is suitable for qualitative complex problems to test feasibility issues and gather relevant requirements. Less suitable are projects which a strong focus on costs or in case of time pressure or restricting regulations.

An important insight is the environment in which the artefact is to be implemented. A spatial redesign is part of a broader context: it is an integrated lean system with both hard and soft elements. Addressing both factors is conducive for successful implementation of a new spatial design.

Actors who design: it is crucial to consider both horizontal and vertical diversity of involved organizational stakeholders. During the workshop there was no perfect balance found between horizontal and vertical diversity. On the one hand, limited horizontal diversity implies a risk of not covering an diverse set of design requirements and thus different functional roles are required to cover multiple perspectives. On the other hand, mainly horizontal diversity increases the risk of politicization. Also, limited vertical diversity restricts a successful process of gathering requirements from all operational levels, and also transferring ownership to all hierarchical levels, especially employees who are perform the actual work in the relevant work area and effected by the final design. Ownership is enhanced through the collaborative design process itself and by signing a group agreement which also promotes trust and shared understanding on social norms and expectations.

Process and methodology: interaction can be promoted by organizing sub groups and facilitate feedback sessions and constructive conflict in general (identifying potential conflicting goals and interests beforehand). These discussions are conducive for team and organizational learning. The paradox of participation can be partly resolved to creating a shared understanding on the final deliverables, open communication of the collaborative architecture of the collaborative design process, establishment of trust and perceived ownership of the final deliverables and to hear everybody´s expectation. Also clear follow-up steps should be clear.

The effects of collaborative design for spatial redesign is that insight is gained into different disciplines and perspective to share all relevant knowledge regarding the redesign and thus to develop better solutions. When facilitated well, ownership is enhanced as people's voice are heard in the idea generation phase. Collaborative design for spatial redesign reduces the gap between standardization and innovation. By allowing organizational stakeholders participate in the design process, innovation and problem solving capability are enhanced. Collaborative design for spatial redesign is especially appropriate in an early stage of a project. At this stage also feasibility (technically, financially and socially) issues can be addressed when diverging functional roles are represented.

At first sight this approach is more time consuming that designing unilaterally. However, gathering design requirements at an early project stage smoothens the implementation phase as potential issues are

already addressed in the idea generation phase. A risk is an increased perceived paradox of participation which is counterproductive in the long term as participants do not feel that their voices are sufficiently heard. It remains a challenge to deal with conflicts in organizational priorities and the fact that collaborative design assumes that participants are equally treated and that there input is assessed based on equality. Here transparent communication by the project team is recommended with clear communication on (organizational) goals and how the final designs contributes to more efficient workplace layout configurations.

Specifically for the case of PNP, the collaborative model starts with consultation of management to seek for support and select relevant acceptors. Thereafter a target area is to be selected by management for which the organization faces a spatial redesign challenge. An appropriate project phase is to be considered to apply collaboration, management conditions and design metrics have to be established and communicated, an appropriate level of participation needs to be determined including the allocation of required resources. Subsequently, relevant organizational stakeholders have to be engaged with in consultation with depot managers and senior process managers. First vertical diversity is addresses by involving depots and engaged employees. Additionally, stakeholders from the supportive staff can be involved to also tackle other perspectives, i.e. finance, management, HSE, IT, facility, construction, security, HR, designers and lean experts. It is important to carefully consider the cooperating depots and what local deviations can be identified. Thereafter an appropriate workshop design needs to be developed. The second phase concerns the actual design workshop in which the process of requirements engineering takes place. This follows a logical structure and the outcome concerns potential designs and the underlying arguments that led to these designs. This may provide valuable insights for management to take future decisions. The third phase relates to the planning of implementation by management. Workshop outcomes have to be evaluated and required soft and hard elements needs to be documented. Thereafter a final decision is to be made including a plan for the actual implementation.

8.1.3. Scientific conclusions after the case study intervention

In this paragraph the results from the case study intervention are used to provide answers to the other scientific research questions. Based on the literature study and case study intervention a conceptual framework is developed addressing specific issues regarding collaborative design for spatial redesign. It comprises of four levels of design: object of design, context of design, actors who design and the process & methodology.

This framework can be applied to organizations with a relative strong operational and bureaucratic (hierarchical) context was identified in which mainly participants from the operating core contribute significantly to develop better solutions for existing spatial problems. Note that operational context is closely related to lean management organizations and can often be found in organizations with rather top-down strategies. The framework is both useful for spatial- design and redesign challenges. Application of the framework is limited to an intra-organizational level. This means that only participants from one organization can participate during the design process as involving designers from other organizations requires additional strategies.

The project stage in which collaborative design is applied needs to be determined by management. In the context of spatial redesign problems, collaborative design is an appropriate concept for idea generation purposes and to test feasibility issues in which specific organizational stakeholders are only engaged with in the design stage based on stakeholder engagement strategies. Based on the design metrics the best suitable designs are selected for future implementation.

Furthermore, application of this framework is restricted to complex, qualitative layout-related problems in which an appropriate solution cannot be known in advance and when there are several ways to arrive at a specific solution. This is also known as ill-defined/structured problems. However, in case of restricted time or imposed legislation this framework is less suitable as collaborative design is relatively time consuming and needs an extensive planning in order to be employed.

Application of this conceptual framework brings various advantages and potential risks that have to be taken into account. Positive effects are the following: a) increased acceptance and perceived ownership as a number of organizational stakeholders have influence in the process of idea generation and can have their voices heard during collaboration which, in the long term, allows for a more convenient implementation process. Main advantage is that for lay-out redesign their b) specific requirements can be shared which are to be integrated in the final design which leads to better problem-solving. Better problem solving also enhances c) organizational learning as different perspectives and positions are brought together. Another advantage may be that d) the tension between standardization (control) and innovation (freedom/autonomy) can be resolved by allowing organizational stakeholders to participate in the design process. In this way participants can contribute to problem solving processes, innovation and the establishment of specific lean-related standardization. Furthermore, e) feasibility issues can be addressed at an very early stage. By facilitating different perspectives to contribute to the potential designs, financial, technical and social requirements can be checked beforehand which prevents ideas from being blocked in a later stage.

Negative aspects of collaborative design for spatial redesign involves that an insufficiently designed processes of collaboration a) increases the risk of the paradox of participation. If this is the case then collaboration will work counterproductive. Furthermore, b) collaborative design assumes that participants are treated equally, however, different organizational priorities may exists which makes one's argument more urgent than someone's other input. It is unclear how these conflicts can be resolved properly without negatively affecting trust and acceptance. Last, a collaborative design process requires accurate planning and thus this is very time-consuming.

8.2. Recommendations

This chapter elaborates on recommendations for future research on this topic and recommendation for PNP.

8.2.1. Future academic research

First, the role and impact of the workshop facilitator has not been investigated within this research. Future research should address the criteria for a good workshop facilitator and the impact of personal leadership styles on the outcome of the collaborative design process.

Secondly, psychological aspect have not been considered. Personality traits, religion, assertiveness etc. could not be assessed here due to time restrictions. It is recommended to also incorporated these influences within the conceptual framework as it is expected that psychological factors that underlie specific collaborative behaviors by the workshop participants.

Thirdly, the conceptual framework for application of collaborative design to spatial redesign problems is a first point of departure for research. The framework is not exhaustive and research is to be performed what other factors have influence on the collaborative process. Especially dealing with conflicting interests and goals is to be researched further, this also holds for resolving the paradox of participation when management is responsible for final decision-making. Furthermore, generalizability issues should be elaborated more extensively. Research should be carried out to what particular problems the conceptual framework can be applied to and the conditions under which collaborative design should be initiated.

Finally, within this research the main focus was on the problem definition and construction phase. Further research should be performed concerning the testing/validation and actual implementation phase to further research appropriate steps for these project phases. Thus future research should address how workshop participants reflect on the collaborative design process after management decision-making and the final implementation stage. This gains insights into how the collaborative planning process and design process can be further refined and improved.

8.2.2. Recommendations for PNP

Several practical recommendations for PNP are identified. First of all, in order to develop final standards for the secured area a 6S and SWM should be presented to depot managers for further feedback and refinements. The configurations of the final deliverables and standards should be included in the lean scan to secure compliance.

Secondly, successful realization and implementation of layout redesigns require ownership at all levels of the organization. In other words, top management should feel responsible for successful lean adoption, as well as depot managers, (senior) process managers and especially plan desk employees as they have to carry out the actual work. This starts with depot managers to communicate the necessity of ownership. Thereafter, transferring ownership to subordinate levels of the operational core is recommended.

Thirdly, lean at PNP is built around three focus areas: processes, management infrastructure and attitude & behaviour. More attention should be paid to the aspect of attitude and behaviour as this element contains the most room for improvement. This can be realized to actively involving employees to develop and improve standards and to gain insight into their reasons for showing their specific behaviours. Furthermore, a secured area keeper should be assigned who monitors inventory and behavioural aspects. It also starts with organizating collective kick-off and kick-down sessions.

Fourthly, PNP could facilitate knowledge sharing through a platform. Currently local best practices at depots are not formalized, known or implemented. Through knowledge sharing depots can learn from each other and this gained knowledge can be incorporated in designs by the department Depotbeheer & Ontwerp.

When involving the operational core to design sessions, the governance of collaboration (collaborative architecture) and level of participation should be carefully addressed as this determines the degree of participation and the way how organizational stakeholders are engaged with.

8.2. Discussion

Several discussions point are elaborated below. In this research management is accountable of the final decision as PNP has a rather hierarchical organizational structure. This is concerned with the paradox of participation. As Stohl and Cheney describe: ''participate but only in the way we have commanded'' (Stohl & Cheney, 1997). It remains difficult to provide guidelines on how to resolve the paradox of participation as the actual implementation is out-of scope within this research. Furthermore, it remains unclear how a hierarchical setting has affected and influenced the generation of data.

Secondly, the main focus within this research is on the problem definition and construction phase. Less attention is paid to the testing/validation and actual implementation phase. No actual implementation has been carried out, for this reason, it remains unclear what the final impact is on trust, ownership and acceptance issues. Moreover, the conceptual framework does not address an exhaustive list of factors, both for the planning as do collaboration phase. Therefore, conclusions should be interpreted carefully.

Thirdly, psychological factors are not considered within this research. However, they are important determinants for collaboration processes and provide insights into how the conceptual framework is to be further improved.

Lastly, observations are based on a limited number of two workshop and involved participants. This has implications for the generalizability of the conducted research. Due to time restriction a larger number of collaborative design workshops was not feasible. Organizing more collaborative design sessions enhance the degree of generalizability of this research.

9. Reflection

An important step within the research processes deals with reflecting on how the research is conducted from the perspective of the researcher. The research process is described in the first paragraph and my personal development during this research process is elaborated in the subsequent paragraph.

9.1. Research process

In this section the research process is considered. It comprises of doing research in a group versus individually, planning, shifting between academic-practical perspectives and with hindsight specific issues I would have done differently.

9.1.1. Doing research on your own

Obviously, in the past I have tackled very challenging assignments during my master programme: the expansion of London Heathrow, the planning and employment of an offshore wind farm in the Netherlands, a design of a sustainable supply chain for beer products in Germany and a planning for a high speed rail connection in the UK. However, the main difference between the above assignments and graduation is the fact that you have to conduct the research individually.

9.1.2. Shifting between the academic and practical perspective

Most challenging of my graduation was shifting between the academic perspective and practical world. Initially, the practical problem at PNP was well formulated and based on this info I have looked into literature to find related theories and concepts to define the academic research. However, this was extremely difficult as there were so many possibilities in the research area of lean management, acceptance and decision-making processes. Admittedly, I was frequently drowning in research options. For this reason, I was contented that prof. Brazier suggested to 'just put the organizational stakeholders together' as part of participation and collaboration. Eventually, this helped me a lot in defining the scope and to structure the research and visualizing the direction I was heading to.

Another aspect was the fact that the practical activities were extremely specific and tangible (''where do we store our scanners?'') whereas literature concepts only consider aspect on a higher level of aggregation (''enhance ownership through collaboration''). This became clear during the definition phase but also during the design workshops in which a conceptual model is to be tested. During the sessions, very practical issues are discussed and afterwards you have to reflect on the workshop from the perspective of the conceptual model in order to integrate these 'worlds'. During the research process is was often either in the *academic* or the *practical* world and it was difficult to find the right balance.

9.1.3. Planning

Planning was also challenging because of three main reasons. First of all, personally, I am not an extensive planner. I rather visualize the things to do in my head and act intuitively. Second, since the research scope was unclear for me, and for this reason it was difficult to plan work ahead for this. A last argument is that your project also relies on other and specific occurrences, e.g. interviews, the organisation of the design workshops, my broken ankle in January and the availability of relevant people.

9.1.4. Lessons learned and what I would have done differently

Define the research scope and finding relevant literature was challenging as this is an iterative process. Furthermore, I have learned to structure your research according to three elements: *how*, *what* and *why*? If research is structured according to providing answer to the how, what and why questions in this particular order, then the research is automatically structured. Also, performing research in an operational environment was a new enjoyable experience and is totally different from working behind your desk and computer.

9.2. Personal development

In this paragraph my personal development is discussed. Aspect which are addressed are working individual versus together and personal growth.

9.2.1. Individual versus group effort

During the master programme most assignments are carried out in groups. For this reason doing research on your own is more challenging, especially since I prefer to work in groups, get inspiration and motivation from others and work towards collective goals. However, graduation is an individual project and requires more intrinsic motivation as a researcher/student.

At PostNL I faced unlimited freedom. I had some struggle in the beginning to find my own way but I am grateful that this opportunity is offered me. Personally, trial-and-error is the best counsellor for me and this freedom and responsibility allowed me the learn a lot. Hesitation is not an option in this specific situation. Just go out there and discover everything, sense, feel, observe, taste and learn.

On the other hand when the first design workshop was successfully finished, the fact that this was your own full responsibility concerning both the preparation and facilitation absolutely filled me with joy and courage. Stepping out of your comfort zone and being more assertive was extremely helpful to discover your strengths and weaknesses, something I definitely will apply in my future career.

9.2.2. Personal growth

The experience I have gained during the research project is invaluable as I had to find my own way in an large company, my own thesis project and especially in the operational environment. How do you get things done in the operations, where it all happens in which the organizational has such a great impact on society? Developing a collaboration plan behind your desk is not sufficient when acceptance of the operational core is not there yet. I have spoken to employees with more than 30 years of experience at PostNL, authoritive personalities, from different backgrounds and religions, nationalities, attitudes, social norms, etc. I have learned that, because of this diversity, that gaining trust is really important when you want something to get done, to get commitment and cooperation. Also, talking in terms of each other's interest is conducive for good relationships and open attitudes. Obviously, graduate student will be 'tested' when entering a distribution center, but when a right open attitude is adopted and respect is shown than you are offered room to show your capabilities.

Bibliography

Ackoff, R. L. (1978). *The art of problem solving: Accompanied by Ackoff's fables*. University of Texas Press.

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of Planners*, *35*(4), 216–224.

Baxter, G., & Sommerville, I. (2011). Socio-technical systems: From design methods to systems engineering. *Interacting with Computers*, *23*(1), 4–17. doi:10.1016/j.intcom.2010.07.003

Bedwell, W. L., Wildman, J. L., DiazGranados, D., Salazar, M., Kramer, W. S., & Salas, E. (2012). Collaboration at work: An integrative multilevel conceptualization. *Human Resource Management Review*, *22*, 128–145. doi:10.1016/j.hrmr.2011.11.007

Bittner, E. A. C., & Leimeister, J. M. (2013). Why shared understanding matters - Engineering a collaboration process for shared understanding to improve collaboration effectiveness in heterogeneous teams. *Proceedings of the Annual Hawaii International Conference on System Sciences*, (2013), 106–114. doi:10.1109/HICSS.2013.608

Black, J. S., & Gregersen, H. B. (1997). Participative Decision-Making: An Integration of Multiple Dimensions. *Human Relations*, *50*(7), 859–878. doi:10.1177/001872679705000705

Boonstra, J. J., & Gravenhorst, K. M. B. (1998). Power dynamics and organizational change: A comparison of perspectives. *European Journal of Work and Organizational Psychology*, *7*, 97–120. doi:10.1080/135943298398826

Bortolotti, T., Boscari, S., & Danese, P. (2015). Successful lean implementation: Organizational culture and soft lean practices. *International Journal of Production Economics*, *160*, 182–201. doi:10.1016/j.ijpe.2014.10.013

Bossche, P. Van Den, Gijselaers, W., Segers, M., Woltjer, G., & Kirschner, P. (2010). Team learning: building shared mental models. *Instructional Sciences*, *39*, 283–301. doi:10.1007/s11251-010-9128-3

Burns, T., & Stalker, G. M. (1961). Burns and Stalker, The Management of Innovation. In *The Management of Innovation* (pp. 103–108). London: Travistock. doi:citeulike-article-id:1423577

Clegg, C. W. (2000). Sociotechnical principles for system design. *Applied Ergonomics*, *31*(February), 463–77. doi:10.1016/S0003-6870(00)00009-0

Corsaro, D., Cantù, C., & Tunisini, A. (2012). Actors' Heterogeneity in Innovation Networks. *Industrial Marketing Management*, *41*(5), 780–789. doi:10.1016/j.indmarman.2012.06.005

Cotton, J. L., Vollrath, D. A., Froggatt, K. L., Lengnick-Hall, M. L., & Jennings, K. R. (1988). Employee participation: Diverse forms and different outcomes. *Academy of Management Review*, *13*(1), 8–22.

de Bruijn, H., ten Heuvelhof, E., & in 't Veld, R. (2010). *Process management. Why Project management fails in complex decision making processes.* (Second edi). Berlin: Springer. doi:10.1007/978-3-642-13941-3

Détienne, F. (2006). Collaborative Design - Managing Task Interdependencies and Multiple Perspectives. *Interacting with Computers*, *18*, 1–20. doi:10.1016/j.intcom.2005.05.001

Dorst, K. (2008). Design research: a revolution-waiting-to-happen. *Design Studies*, *29*(1), 4–11. doi:10.1016/j.destud.2007.12.001

Dransfield, R. (2000). *Human Resource Management*. Pearson Education. Retrieved from

https://books.google.nl/books?id=Eq3Tcd9gYn8C

Dym, C. L., & Little, P. (2009). *Engineering Design. A Project-Based Introduction* (Third edit). John Wiley & Sons, Inc.

Farris, J. a., Van Aken, E. M., Doolen, T. L., & Worley, J. (2009). Critical success factors for human resource outcomes in Kaizen events: An empirical study. *International Journal of Production Economics*, *117*, 42–65. doi:10.1016/j.ijpe.2008.08.051

Fischer, G. (2004). Social creativity: Turning barriers into opportunities for collaborative design. *PDC 2004 - Proceedings of the Eight Participatory Design Conference 2004 - Artful Integration: Interweaving Media, Materials and Practices*, 152–161. doi:10.1145/1011870.1011889

Gottesdiener, E. (2007). You know when it's not there: How trust enables and enhances collaboration. *Cutter IT Journal*, *20*(8), 6–10.

Gray, B. (1989). Collaborating: Finding common ground for multiparty problems.

Guzzo, R. A., & Shea, G. P. (1992). Group performance and intergroup relations in organizations.pdf. In *Handbook of industrial and organizational psychology* (pp. 269–313).

Hansen, M. T., & Nohria, N. (2004). How to build collaborative advantage. *Mit Sloan Management Review*, *46*(January), 22–+. doi:Article

Healey, P. (1997). Collaborative Planning : Shaping Places in Fragmented Societies / P. Healey. Retrieved from http://www.researchgate.net/publication/31703522_Collaborative_Planning__Shaping_Places_in_Fragmented_Societies__P._Healey

Hermon, N. Van. (2012). PostNL: Logistieke oplossingen voor online retail. Retrieved September 24, 2015, from http://static.basenet.nl/cms/104468/pdf/presentatienikajvanhermon-postnl.pdf

Hevner, A. R. (2007). A Three Cycle View of Design Science Research, *19*(2), 87–92.

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in Organizations: From Input-Process-Output Models to IMOI Models. *Annual Review of Psychology*, *56*, 517–543. doi:10.1146/annurev.psych.56.091103.070250

Iqbal Raja, M. (2011). *Lean manufacturing - An integrated socio-technical systems approach to work design*. *Journal of Chemical Information and Modeling*. Clemson University.

Iversen, O., & Leong, T. (2012). Values-led participatory design: mediating the emergence of values. … *Interaction: Making Sense Through Design*, 468–477. doi:10.1145/2399016.2399087

Kang, M., Choo, P., & Watters, C. E. (2015). Design for Experiencing: Participatory Design Approach with Multidisciplinary Perspectives. *Procedia - Social and Behavioral Sciences*, *174*, 830–833. doi:10.1016/j.sbspro.2015.01.676

Kensing, F., & Blomberg, J. (1998). Participatory Design: Issues and Concerns. *Computer Supported Cooperative Work (CSCW)*, *7*(1993), 167–185. doi:10.1023/A:1008689307411

Kerzner, H. R. (2013). *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons.

Keyton, J., Stallworth, V., & Frey, L. R. (2003). On the verge of collaboration: Interaction processes versus group

outcomes. *Group Communication in Context: Studies of Bona Fide Groups*, *2*, 235–260.

Kolfschoten, G. L., & de Vreede, G.-J. (2009). A Design Approach for Collaboration Processes: A Multimethod Design Science Study in Collaboration Engineering. *Journal of Management Information Systems*, *26*(1), 225–256. doi:10.2753/MIS0742-1222260109

Koppenjan, J., & Groenewegen, J. (2005). Institutional design for complex technological systems. *International Journal Technology, Policy and Managment*, *5*(August), 240–257. doi:10.1504/IJTPM.2005.008406

Kvan, T. (2000). Collaborative design : what is it ?, 409–415.

Lantz, A., Hansen, N., & Antoni, C. (2015). Participative work design in lean production: A strategy for dissolving the paradox between standardized work and team proactivity by stimulating team learning? *Journal of Workplace Learning*, *27*(1), 19–33.

Liker, J. K. (2004). The Toyota Way: 14 Management Principles from the World's Greatest Automaker. New York: McGraw-Hill.

Lu, S. C., & Cai, J. (2001). A collaborative design process model in the sociotechnical engineering design framework. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, (May 2001), 3–20.

Marks, M. a., Mathieu, J. E., & Zaccaro, S. J. (2001). A Temporally Based Framework and Taxonomy of Team Processes. *Academy of Management Review*, *26*(3), 356–376. doi:10.5465/AMR.2001.4845785

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*(13), 370–396.

Mcbride, T. (2005). Key Steps in Implementing a Kaizen Event. In *Northeast Supply Chain Conference*.

McGrath, J. E. (1964). *Social psychology: a brief introduction*. Holt, Rinehart and Winston. Retrieved from https://books.google.nl/books?id=g_i3AAAAIAAJ

McGregor, D. (2004). The Human Side of Enterprise in Peril. *Academy of Management Review*, *29*(1), 293–296. doi:10.5465/AMR.2004.12736104

Mintzberg, H. (1980). Structures in five: designing effective organizations. *Management Science*, *26*(3), 322–341. Retrieved from http://links.jstor.org/sici?sici=0025-1909(198003)26:3<322:SI5ASO>2.0.CO;2-#

Monden, Y. (2011). *Toyota production system: an integrated approach to just-in-time*. CRC Press.

Niepce, W., & Molleman, E. (1996). Characteristics of work organization in lean production and sociotechnical systems: a case study. *International Journal of Operations & Production Management*, *16*(2), 77–90.

Niepcel, W. (1998). Work Design Issues in Lean Production from a Sociotechnical Systems Perspective: Neo-Taylorism or the Next Step in Sociotechnical Design? *Human Relations*, *51*(3), 259–287. doi:10.1177/001872679805100304

Patel, H., Pettitt, M., & Wilson, J. R. (2012). Factors of collaborative working: A framework for a collaboration model. *Applied Ergonomics*, *43*(1), 1–26. doi:10.1016/j.apergo.2011.04.009

Piirainen, K. A., Kolfschoten, G. L., & Lukosch, S. (2012). The Joint Struggle of Complex Engineering: a Study of the Challenges of Collaborative Design. *International Journal of Information Technology & Decision Making*, *11*(06), 1087–1125. doi:10.1142/S0219622012400160

PostNL. (2015a). PostNL Corporate Presentation March 2015. Retrieved February 11, 2016, from http://www.slideshare.net/PostNLCommunication/20111110-

postnlcorporatepresentationnovember2011?related=1

PostNL. (2015b). PostNL: Kerstrecord van ruim 1.4 miljoen pakketten op één dag | PostNL. Retrieved February 11, 2016, from http://www.postnl.nl/over-postnl/pers-nieuws/persberichten/2015/december/postnl-kerstrecord-van-ruim-1-4-miljoen-pakketten-op-een-dag.html

PostNL. (2016). Downloads - Pakketten | PostNL. Retrieved February 12, 2016, from http://www.postnl.nl/over-postnl/pers-nieuws/downloads/pakketten/

Probst, T. M. (2005). Countering the negative effects of job insecurity through participative decision making: lessons from the demand-control model. *Journal of Occupational Health Psychology*, *10*(4), 320.

Rahmawati, Y., Utomo, C., Anwar, N., Nurcahyo, C. B., & Negoro, N. P. (2014). Jurnal Teknologi Theoretical Framework of Collaborative Design Issues, *7*, 47–53.

Reina, D., & Reina, M. (2005). Trust and Betrayal in the Workplace. Building effective Relationships in Your Organisation, 2–13.

Rittel, H., & Webber, M. M. (1984). Planning problems are wicked problems. In *In N. Cross (Ed.). Developments in Design Methodology* (pp. pp. 135–144). New York: John Wiley & Sons.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(October), 5–18. doi:10.1080/15710880701875068

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management*, *25*, 785–805. doi:10.1016/j.jom.2007.01.019

Simonsen, J., & Hertzum, M. (2008). Participative Design and the Challenges of Large-Scale Systems: Extending the Iterative PD Approach. *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*, 1–10.

Somech, A. (2002). Explicating the Complexity of Participative Management: An Investigation of Multiple Dimensions. *Educational Administration Quarterly* , *38* (3), 341–371. doi:10.1177/0013161X02383003

Stohl, C., & Cheney, G. (1997). Participatory processes. Paradoxical practices. Communication and the Dilemmas of Organizational Democracy, *14*(3), 349–407.

Sudweeks, F., & Allbritton, M. (1996). Working together apart: communication and collaboration in a networked group. *Proceedings of the 7th ACIS96: Australasian Conference of Information Systems, Vol.2*, *2*(ii), 701–712.

Thomson, A. M., & Perry, J. L. (2006). Collaboration Processes: Inside the Black Box. *Public Administration Review*, *66*(December), 20–32. doi:10.1111/j.1540-6210.2006.00663.x

Timming, A. R. (2014). The “reach” of employee participation in decision-making: exploring the Aristotelian roots of workplace democracy. *Human Resource Management Journal*, *25*(3), n/a–n/a. doi:10.1111/1748-8583.12050

Van der Helm, R. (2007). Ten insolvable dilemmas of participation and why foresight has to deal with them. *Foresight*, *9*(3), 3–17.

West, M. a, Hirst, G., Richter, A., & Shipton, H. (2004). Twelve steps to heaven: Successfully managing change through developing innovative teams. *European Journal of Work and Organizational Psychology*, *13*(2), 269–299. doi:10.1080/13594320444000092

Wilkinson, A., Gollan, P., Marchington, M., & Lewin, D. (2010). Conceptualizing Employee Participation in Organizations. *The Oxford Handbook of Participation*, (December), 3–25. doi:10.1093/oxfordhb/9780199207268.003.0001

Womack, J. P., Jones, D. T., & Roos, D. (1990). *Machine that changed the world*. Simon and Schuster.

Woodhill, J. (2004). Facilitating Complex Multi-Stakeholder Processes: A Social Learning Perspective, (August).

Woodland, R. H., & Hutton, M. S. (2012). Evaluating Organizational Collaborations: Suggested Entry Points and Strategies. *American Journal of Evaluation*, *33*, 366–383. doi:10.1177/1098214012440028

Xie, A., Carayon, P., Cartmill, R., Li, Y., Cox, E. D., & Kelly, M. M. (2014). Facilitators and barriers to multi-stakeholder collaboration in the redesign of the family-centered rounds process. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *58*, 175–179. doi:10.1177/1541931214581037

Interviews

Kleij, M. van der (2016). Personal interview. Logistiek Ontwerper. PostNL Parcels Benelux

Jansen, M. (2016). Personal interview. Programme manager Operational Excellence. Tata Steel

Laat, L. de (2016). Personal interview. Logistiek ontwerper. PostNL Parcels Benelux

Stegehuis, E. (2016). Personal interview. Manager Staff Operations PostNL Parcels Benelux

Veldt, D. (2016). Personal interview. Manager Depotbeheer & Ontwerp. PostNL Parcels Benelux

Appendices

A. Project description PNP

Optimale procesvoering & inrichting Secured Areas en Planbalies NLI depots

Algemeen

Projectnaam:	Optimale procesvoering & inrichting SA's en PB's NLI depots
Opdrachtgever (acceptant)	Directeur Depots (Manager Depot Beheer & Ontwerp)
Projectleider:	[Rob Simmers Afdeling Depot Beheer & Ontwerp]
Deel projectleider/uitvoering:	Cursist Green Belt

Projectinhoud

Aanleiding/probleemstelling: vastgesteld is dat de inrichting (gebruik) en procesvoering in- en rondom de Secured Areas niet uniform is vorm gegeven. De NLI depots hanteren allen een lokale indeling, gebruiken de SA voor opslag van materialen etc. Hierdoor zijn er afwijkingen in de procesvoering en dus geen SWM. Uniformiteit en toepassen van SWM is noodzakelijk, deels om een efficiënt proces en gebruik van de SA te realiseren, deels om de impact van wijzigingen (nieuwe processen, aanpassingen, herinrichting) te kunnen beoordelen.

Doelstelling: vaststellen optimale indeling en procesvoering in de Secured Areas + planbalies NLI depots. Hierbij wordt een "basis" indeling opgesteld van de inrichting van de SA's en PB's, afgestemd op een efficiënt proces en ruimte gebruik. De basis indeling en procesvoering geldt voor alle NLI depots. Lokale bijzonderheden zijn in beeld gebracht. Dit geldt m.n. voor de processen en ruimte indeling van de depots+. Tevens zijn inzichtelijk, welke lokale varianten op de basis indeling gedoogd worden c.q. noodzakelijk zijn, zoals OBSB in Den Hoorn.

Eindproducten: beschrijving procesvoering (SWM) in planbalie en Secured Areas Indeling (plattegrond) basis Secured Area en Planbalies Indeling depots+; bijzonder procesvoering Aangetekenden Overzicht beschikbare m2, verdeeld in procesvoering, opslag en overige Overzicht beschikbare m2 t.b.v. lokaal specifieke processen

Afbakening project: advies betreft de (standaard) procesvoering en inrichting van de Planbalies en Secured Areas. Opslag van niet direct proces gebonden hulpmiddelen e.d, bijvoorbeeld kennisgevingen, kerstversiering, pennen, papier, etc. valt buiten de opdracht I.r.t. de inname en uitgifte van scanners valt het beheer hiervan buiten scope.

Stappenplan

Inventarisatie

- Inventariseren (alle) processen die worden uitgevoerd in de planbalies en secured area.
- Processchema's en, beschrijving opstellen aangetroffen processen
- Indeling (plattegrond) per NU locatie, incl. m2

Analyse

- Vaststellen welke processen tot primaire taak behoren (landelijke basis)
- Vaststellen welke processen lokaal specifiek zijn (wél primair proces)
- Vaststellen welke processen en inrichting (m2) niet tot primaire taak behoren van SA & PB

Ontwerp

- Definitief ontwerp vaststellen van procesvoering en inrichting (m2) voor landelijke indeling en SWM
- Idem voor locaties met lokaal specifieke processen, depots+ en Den Hoorn

Advies: SWM en "basis" inrichting/Kosten-Baten analyse & Impact analyse Security (ARBO?)

B. Brainstorm on facilitating the design workshop process

A brainstorm is carried out with Lise de laat, logistiek ontwerper (2016) and former trainee at Essent) who has frequently participated in brainstorm initiatives and in the facilitation and process design of such meetings. The following issues have been addressed. These aspects should be dealt with effectively in the design of the design workshops.

Verwachtingsmanagement

- Belangrijk is het verwachtingsmanagement aan de voorkant.
- Wat wordt er van de stakeholders verwacht qua rol en verantwoordelijkheid?
- Hoe zorg je dat ze na het proces niet teleurgesteld zijn? Want dat kan weer juist ten koste gaan van de acceptatie van de nieuwe inrichting.
- Flipover ophangen met de agenda en tijdsplanning. Steeds refereren aan de agenda (flipover).

Diversiteit perspectieven

- Verschillende disciplines en die gebruiken ieder ander jargon. Zorg dus voor eenzelfde taal.
- verschillende probleem definities → framing: niet over problemen praten maar verbeter kansen. En waarom wil je het verbeteren? Dat goed communiceren

Commitment is ook een issue: hoe krijg je ze mee?

- Incentives (*what's in for me?)*
- Hoe gecommitteerd zijn deelnemers aan het proces en de inhoud?
    - Aangedragen issue: deelnemers vragen naar issues en podium geven. Zelf laten benoemen
    - Bij evaluatie – na de wrap-up (in de meeting zelf): flipover maken met twee kanten: proces en inhoud verbetering voorstellen. Verdelen in tip en tops.

Eigen belang versus collectief belang. Ophangen aan kapstok: lean methodiek. Sommige stakeholders alleen vanuit hun eigen straatje redeneren. Bepaalde werknemers zijn niet op de hoogte van elkaars situatie en lokale verschillen. Wat voor de één een probleem is, is dat voor de ander wellicht niet.

Conflicten

Zorg dat je juist omgaat met conflicten. Behandel ze meteen. Opnieuw uitleggen en meteen bespreken. En voorleggen aan de groep: wat zullen we hier nu meedoen? Als je er dan niet meteen uitkomt kan je ervoor kiezen om ze op de 'parkeerplaats' te zetten. Dan worden deze issues in tijdens de sluiting nog besproken.

Besluitvorming

Zorg voor duidelijke structuren & regels. Meer op vertrouwen gericht; luisteren naar elkaar. Info blijft binnenskamers. Laat de deelnemers een groepsovereenkomst tekenen waarbij iedereen een bepaalde waarde/norm/omgangsvorm op tafel legt. Zo zorg je voor commitment aan elkaar en het proces.

Diversiteit van relaties zorgt voor mogelijke uitdagingen:

- Hiërarchisch. depot manager vs. Planbaliemedewerker (met de klok mee mensen voor input vragen). Altijd met de klok mee hoeft niet per se qua tijd. Soms vragen: wie is het hiermee niet eens?
- Introvert vs. extravert: aan de voorkant duidelijk maken en expliciet benoemen/voorkomen dat mensen ondergesneeuwd worden.
- andere depots: deelnemers kennen elkaar niet. → voorstelrondje (wellicht elkaar voor te laten stellen + apart issue *(ice breaker)

Mate van participatie

Workshop gaat vooraf aan procesontwerp (achteraf) en vaststellen van inhoudelijke discussiepunten (voor- en achteraf). Zorg dat duidelijk is wat van de deelnemers wordt verwacht en wat hun rol precies is. Verder follow-up/vervolgstappen duidelijk maken voor en na meeting.

Aspect houding en gedrag moet je ook meenemen in je analyse. → flipover en post-its: gezamenlijk overleggen over hoe we ervoor kunnen zorgen dat we ons houden aan de standaard. Ook zoeken naar oorzaken.

Overig

- bereid vragen voor om het gesprek op gang te brengen.
- Wat betreft indeling zaal: weet je al wie en wat zich waar moet bevinden?
- Zorg voor een strakke tijdsplanning en houd constant de tijd in de gaten
- Laat deelnemers zelf dingen op flipover noteren die worden besproken. Op die manier kan jij je aandacht bij de discussie houden.

C. Case study research

In this appendix the initial framework is depicted and the improvements made.

C.1. Initial framework

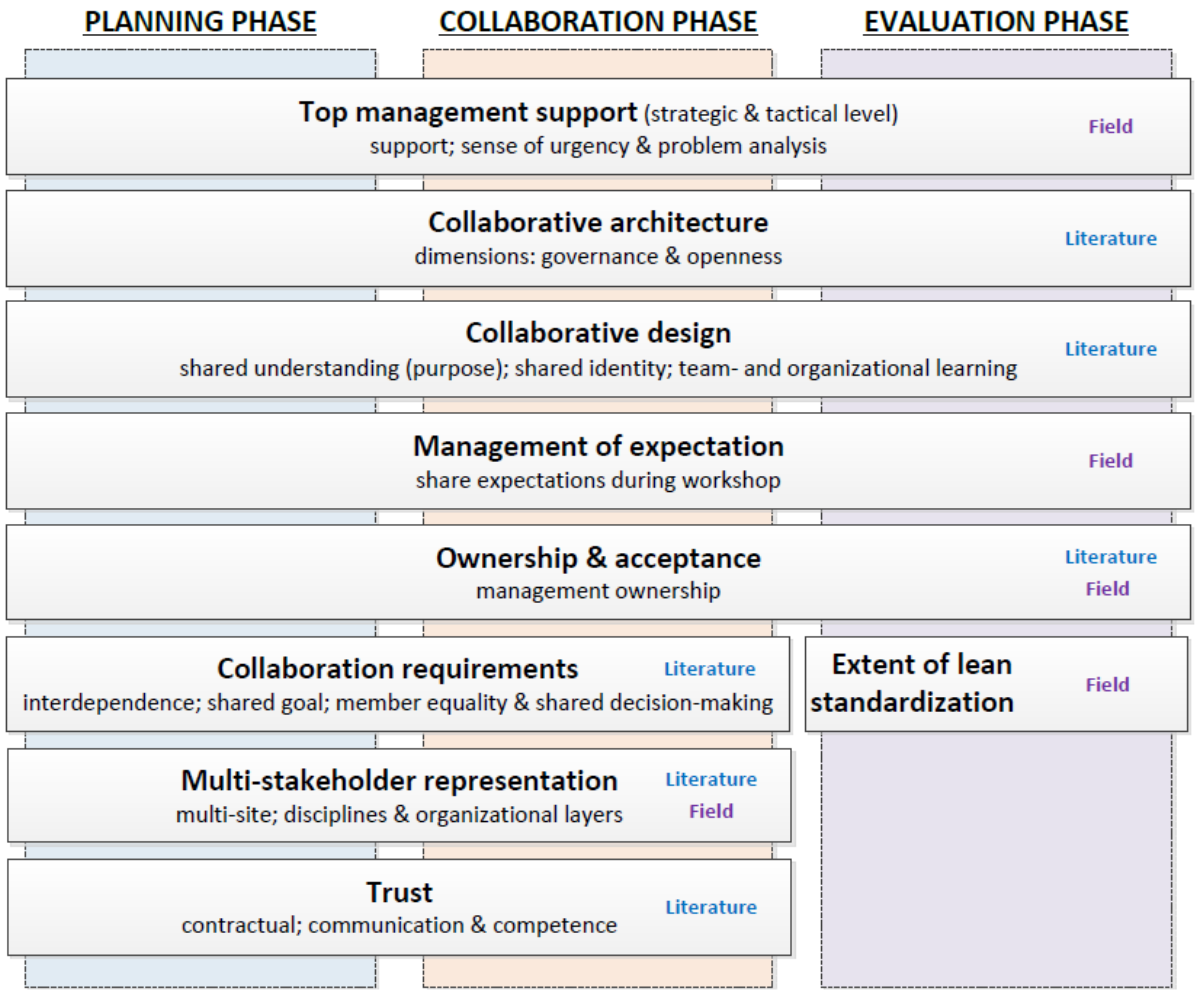


Figure 38. Initial conceptual framework

The first distinction is made between the phase of the collaboration effort. First a planning phase is conducted to design the actual collaboration and engage with organizational stakeholders. Thereafter, the actual design workshops take place in which stakeholder requirements are elicitated. Finally, the evaluation phase takes place until the point where management used the input from the workshop sessions to make a future decision.

Top management commitment is key for organizing collaborative initiatives. They are needed to for direct support (is collaboration required here?), to create a sense of urgency and to perform an initial problem analysis (in case management identifies a business opportunity).

When a collaborative initiative is appropriate for a specific business problem, the collaborative architecture needs to be established. This structure deals with how the collaboration is design along two dimensions: governance (hierarchical versus flat) and openness (closed versus open). Choices depend on the current organizational structure, organizational readiness, culture and past experiences within the organization. These choices also determine the collaborative process outcome.

When organizing a collaborative initiative the principles of collaborative design are applied to design a specific artefact in a collaborative manner. These include shared understanding (regarding the purpose of the collaborative effort), shared identity (group cohesion) and team- & organizational learning: the collaborative event aims at enriching knowledge by bringing together different perspectives. In this manner, participants learn from each other and thus develop better solutions for organizational problems.

Management of expectations is key in collaborative initiatives. This works two-directional: on the one hand management expects commitment and knowledge sharing by participants throughout the entire process. On the other hand, participants want their voices to be heard and want decision-making influence.

The collaborative initiative is ideally owned by a process owner to enhance ownership and acceptance. This is for example top management who is ultimately responsible for the collaborative effort. Additionally, this also holds for the participants in the collaborative process who should feel responsible for a successful collective outcome. Furthermore, line management should perceive a sense of ownership as implementation of future measures should be carried out by line management themselves, including operational employees.

When initiating collaboration certain collaboration requirements play a role. These include interdependence (participants rely upon each other to achieve organizational goals); a shared goal to be addressed within the collaborative initiative; member equality stressing that participants should be treated equally to promote information sharing and mutual learning; and shared decision-making addressing that decisions are made collectively.

Multi-stakeholder representation deals with increasing diversity in order to have all perspectives represented. This includes participants form multiple sites, disciplines (functional roles) and diverging organizational layers: strategic, tactical and operational.

Organizing successful collaboration is optimally achieved by establishing trust. However, trust is a very broad term. Here trust refers to contractual (trust in the collaborative process), communication (trust in open and honest information sharing) and competence (trust in each other). Additionally, trust can refer to trust in the organization, direct supervisors or top management.

Form of lean standardization: what form of standardization is required/appropriate and to what extent is standardization of lean practices desired/appropriate?

D. First design workshop

D.1. Design of first workshop

In this paragraph a design is developed for the collaborative design workshop. It addresses the planning, collaboration and evaluation phase. The first paragraph describes the planning phase, second the workshop itself is addressed and thereafter the final design.

D.1.1. Planning phase

The planning phase is crucial to set expectations and to get all relevant stakeholders engaged. This entails interviews with management, supportive staff and employees from distribution centres. This is twofold: there is a process and substance component involved (de Bruijn et al., 2010). Substance refers to what is actually discussed. Members should feel that an interior redesign is desirable and also that collaboration is a way to achieve this. Moreover, a first problem analysis should be performed to design the first workshop. The second component concerns the process of collaboration and this addresses how collaboration is organized. Trust should be created during visits and also expectations and objectives should be shared. From these interviews and conversation a workshop design is created.

D.1.2. Design workshop

The workshop design/documentation is included in appendix D. This design is based on input from organizational members to elicit stakeholder requirements for a potential secured area lay-out design. Furthermore, general brainstorm practices have been researched (appendix B) on how to guide a workshop meeting and aspect to pay attention to, such as interactivity etc. Additionally, the current PNP approach of lean project is to be considered as collaboration as a problem-solving method is not familiar for the current lean approach.

Proposed design 1st intervention

The table below highlights how literature insights and field observation related to the practical application of these theories and concepts. The presentation/documentation of the first workshop is included in appendix D.

Table 15. Case study design first intervention

Literature		Application	Approach
Top management consultation		Involve top management stakeholders and depots managers (creating sense of urgency and initial problem analysis)	Interviews
Collaborative architecture	governance	Management decides upon final decision (fixed process & agenda), but participants are not restricted during the workshop.	Consultation with top management
	openness	Closed collaboration: pre-selected participants, but discussion is transparent	
Collaborative design	shared understanding	Clarification regarding objectives and goals	Reach group consensus on objectives & goals
	shared identity	Individual contributions behavioral rules	Group agreement
	learning	Interdisciplinary and designing by subgroups	Feedback opportunities
Expectations	planning	Clarification of expectations beforehand	Frequent communication

management	workshop	Individual clarification of expectations	of expectations
Ownership & acceptance		Both management and group ownership should be assigned	Framing
Collaboration requirements	interdependence	Selected participants who rely on each other	Stakeholder analysis
	shared goal	Clarification of purpose and objectives	Presentation
	member equality	Set up behavioral rules	Group agreement
	shared decisions	Allow participants to share their knowledge	Design exercise and feedback possibilities
Multi-stakeholder represen-tation	multi-site	Participants from different depots	Stakeholder interviews & analysis
	disciplines	Participants with diverging expertises	
	hierarchical layers	Participants from strategic, tactical & operational levels	
Trust	contractual	Participants underline the importance of a collaborative process	Communication of objectives and goals
	communication	Participants share knowledge honestly and frequently	Group agreement/ informal setting
	competence	Participants need each other to succeed	Expectations sharing
Form of lean standardization		Balancing the need of standardization (control) and freedom (autonomy)	Input from participants

D.2. Workshop design and documentation slides PNP case

PostNL Pakketten

Ontwerp workshop Secured Area

Documentatie

Datum: 9 maart 2016
Tijd: 09:00 –11:30
Locatie: Depot Amersfoort

Aanwezigen

Naam	Functie/rol
Guido Veltman	Facilitator proces
Minke van der Kleij	Logistiek ontwerper DB&O
Johan ten Brinke	Depotmanager AMF
Rob Sypkens	Planbaliemedewerker depot AMF*
Wim Nijenhuis	Senior procesmanager depot AMF
Gert Jan <last name>	Planbaliemedewerker depot AMF
Marcel Ravenschot	Senior procesmanager depot WVN
Ad de Beer	Planbaliemedewerker depot WVN

2 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Agenda

- Kick-off 09:00 – 09:25 30 min
- Ontwerpproces deel 1: ''*SA basisfuncties*''
  - Uitleg 09:25 – 09:30 5 min
  - Uitvoering 09:30 – 10:10 40 min
- Pauze 10:10 – 10:20 10 min
- Ontwerpproces deel 2: ''*slimme SA indeling*''
  - Uitleg 10:20 – 10:30 10 min
  - Uitvoering 10:30 – 11:00 30 min
- Sluiting en evaluatie 11:00 – 11:30 30 min

3 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Kick-off onderdelen

- Introductie workshop 09:05 – 09:10
  - Wat?
  - Wie?
  - Waarom?
  - Hoe?
- Voorstelronde
  - Over jezelf 09:10 – 09:15
  - Verwachting: wat wil je uit de workshop halen? post-it 09:15 – 09:20
- Groepsovereenkomst flipover 09:20 – 09:25

4 | Kick-off 9:00- 9:25 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wat, wie, waarom en hoe

Wat

- Nu veel inrichtingsvormen, best practices niet overal benoemd, bekend en ingevoerd
  - Basisfuncties onduidelijk en kansen voor meer efficiënte procesvoering
- Samen nadenken over een slimme inrichting van de secured area op landelijk niveau

Wie

- Deelnemers van verschillende disciplines and depots
- Workshop depot Ridderkerk, facility, ARBO, NLI expert & logistiek ontwerpers

Waarom

- Gebruiken van meerdere gezichtspunten waardoor we leren van elkaar
  - Identificeren en/of ontwikkelen van best practices

Hoe

- Eerst bepalen van de basisfuncties van secured area
  - Sterktes en kansen-analyse
- Daarna in groepen een lege secured area inrichten

5 | Kick-off 9:05- 9:10 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Groepsovereenkomst

Kernwaarden en omgangsnormen*
1. Respectvol met elkaar omgaan
2. Op basis van gelijkwaardigheid
3. Naar elkaar luisteren
4. Elkaar in waarde laten
5. Eerlijkheid
6. Toon inlevingsvermogen
7. Openheid
8. Houd de aandacht erbij
9. Samenwerken voor één PostNL

*op basis van individuele bijdragen en groepsconsensus over kernwaarden en normen

6 | Kick-off 9:20- 9:25 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Ontwerpproces deel 1 agenda

- Naam activiteit: ''*wat zijn de secured area ingrediënten?*''
- Uitleg: 09:25 – 09:30
  - Wat: basisfuncties & objecten bepalen
  - Waarom: inzicht krijgen in wat er wel en niet thuishoort
  - Hoe: brainstorm & sterkte-kansen analyse
- Structuur vervolg deel I:
  - Bepalen basisfuncties secured area 09:30 – 09:40
  - Intermezzo: sterkte-kansen-analyse 09:40 – 09:50
  - Functionele objecten identificeren 09:50 – 10:10

7 | Kick-off | Toel. deel 1 9:25-9:30 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Uitvoering activiteit ''SA basisfuncties''

1. Omschrijven basisfuncties secured area flipover 09:30-09:40
2. Sterkte- en kansen-analyse
3. Intermezzo ''verbeterkansen secured area'' flipover 09:40-09:50
4. Bedenk per categorie 2 (non-) functionele objecten → twee aparte post-its in afzonderlijke kwadranten. De categorieën: flipover 09:50 – 10:10

herstellen pakket | procesondersteuning | opslag
schoonmaak | veiligheid | overig
communicatie

	gewenst	niet-gewenst
aanwezig	1	3
niet-aanwezig	2	

8 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:30-09:40 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Basisfuncties secured area

Basisfuncties secured area	Basisfuncties planbalie
Herstellen van pakketten	Uitvoeren PB werkzaamheden
Opslaan AGT attributen (kar)	Uitvoeren van administratie (klachten, DIS-lijst)
Opslaan voorraad 2e bestelling (kennisgevingen)	Opslaan van bedrijfsmiddelen (sleutels)
Opslaan niet verwerkte pakketten	Onderbrengen koeriersdienst (Valid)
Opslaan handterminals en accu's	
Sorteren van AGT post	
Opslaan van mobiele planbalies (2x)	
Opslaan van rolcontainerkaarten (labels)	
Opslaan van materiaal (cartridges, zout, papier) dat eigenlijk niet in SA hoort	
Communiceren planbalie (kick-off/down)	

9 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:40-09:45 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Sterkte-kansen-analyse

Onderscheid maken tussen zaken die in de secured area die:
- nu goed gaan of staan (sterktes)
- verbeterd kunnen worden (verbeterkansen)

	AMF	WVN
Sterktes	Sorteren AGT	Sorteren AGT
	Kick-off bord secured area	
Kansen*	Herstellen pakketten (locatie & benodigdheden)	Herstellen pakketten (locatie & benodigdheden)
	Inrichting beperkte ruimte	Inrichting beperkte ruimte
	Bestemming Valid locatie depots+	
	Ruimte boven sorter benutten	Ruimte boven sorter benutten

10 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:40-09:45 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Intermezzo: verbeterkansen secured area (1/3)

- Rondje gemaakt langs 8-tal depots:
  - HBD – LW – KHM – HW – WVN – SSH – AMF – RDK
- Inzicht in huidige basisfuncties van de secured area

	gewenst	niet-gewenst
aanwezig		
niet-aanwezig		

- Opslaglocatie bepalen van:
  - Handterminals (debrief) en blauwe bakken
  - Rolcontainers (weekend), rc-kaarten & kennisgevingen
  - Toekomstige producten zoals foodbox
- Delen van management info (kick-off bord)



11 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:40-09:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Intermezzo: verbeterkansen secured area (2/3)

- ARBO en veiligheidsvoorzieningen
  - procesvoering beschadigd pakket (lekbak, werktafel)
  - watervoorziening (kraan)
  - vloercoating
  - ventilatie
- Klant- en pandverschillen
  - klant: producten van invloed op inrichting
  - pand: specifieke pandkarakteristieken →
    - depot+ met AGT proces
    - OBSB-proces HBD
    - vluchtroute WVN
    - locatie debrief (spiegeling)



12 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:40-09:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Intermezzo: verbeterkansen secured area (3/3)

- Aansprakelijkheid SA procesvoering
- Vernieuwing kar blauwe AGT bakken
  - Huidige kar wordt vaak beschadigd (aanpassingen nodig)
  - Aantal karren per depot niet eenduidig (2-4)
- Optimale voorraad SA materiaal
  - Momenteel worden grote batches besteld (labels, HT-stickers, dozen, etc.
  - Optimale voorraad door afstemming tussen depots (1 batch verdelen).
- Houding en gedrag
  - Ordenen van de werkomgeving start bij voorbeeldgedrag

13 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:40-09:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Uitvoering activiteit ''SA basisfuncties''

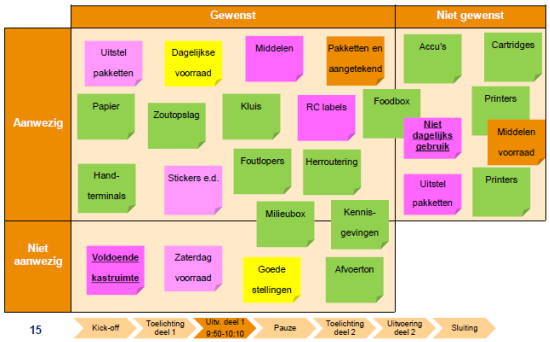
1. Omschrijven basisfuncties secured area
2. Intermezzo ''verbeterkansen'' (eigen analyse)
3. **Bedenk per categorie 2 (non-) functionele objecten**
   → twee aparte post-its. De categorieën:

herstellen pakket | procesondersteuning | opslag
schoonmaak | veiligheid | overig
communicatie

	gewenst	niet-gewenst
aanwezig	1	3
niet-aanwezig	2	

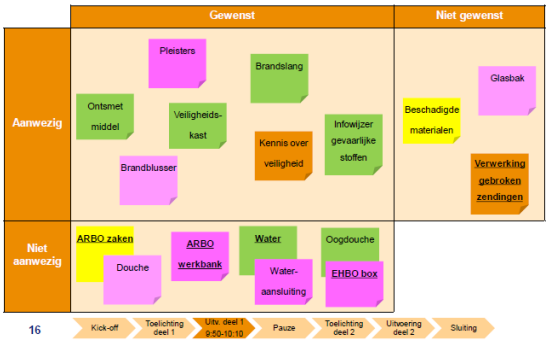
14 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:50-10:10 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Objecten categorie OPSLAG/VOORRAAD



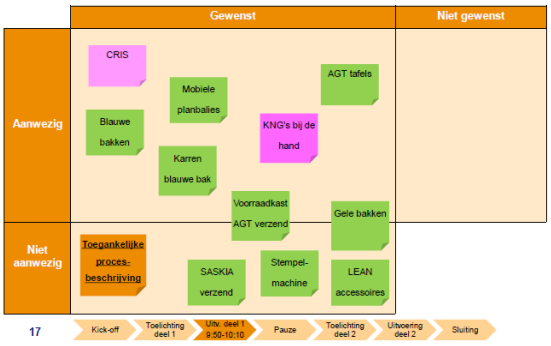
15 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:50-10:10 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Objecten categorie VEILIGHEID

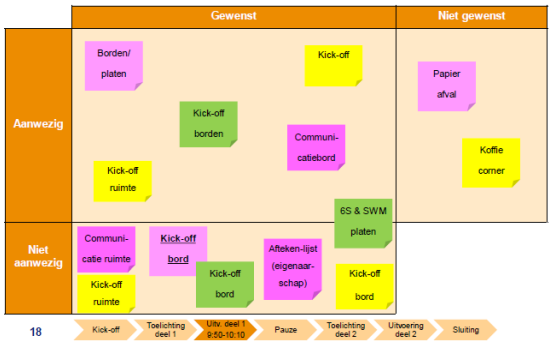


16 | Kick-off | Toelichting deel 1 | Uitv. deel 1 9:50-10:10 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

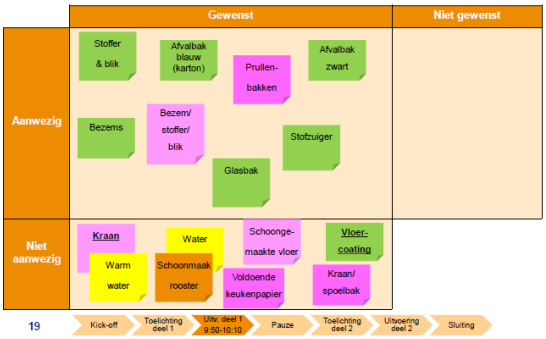
Objecten categorie PROCESONDERSTEUNING



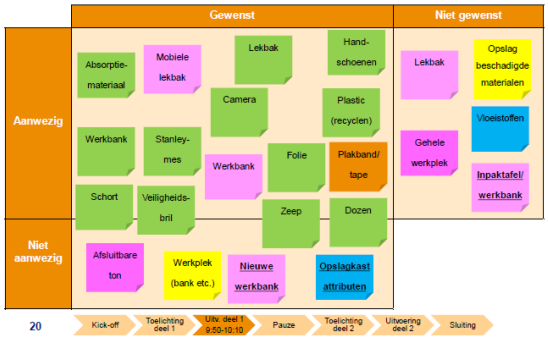
Objecten categorie COMMUNICATIE



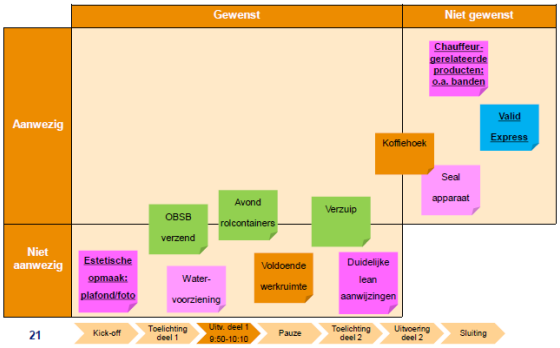
Objecten categorie SCHOONMAAK



Objecten categorie HERSTELLEN PAKKET



Objecten categorie OVERIG



Ontwerpproces deel 2 agenda

- Activiteit "*wat is een slimme SA indeling?*"
- Uitleg activiteit': 10:20 – 10:25
  - Wat: o.b.v. functionele objecten lege SA indelen
  - Waarom: ideeën genereren en evalueren
  - Hoe: 2 groepen en lege SA, daarna presenteren
- Structuur vervolg deel 2: 10:25 – 11:00
  - Beschrijving functionele objecten
  - Twee groepen maken en verdeling over lege SA's
  - Ontwerpen inrichting secured area
  - Presentatie groep 1
  - Presentatie groep 2

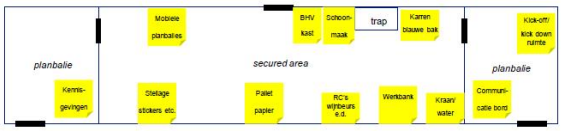
22 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toel. deel 2 10:20-10:25 | Uitvoering deel 2 | Sluiting

Activiteit "slimme SA inrichting" 10:20 – 11:00

1. Groep verdelen in 2 groepen 10:25 – 10:30
2. Beschrijving functionele objecten 10:30 – 10:35
3. Voorbeeld SA ontwerpen met functionele objecten 10:35 – 10:50
   (inrichten van niet-AGT secured area)
4. Presenteren van voorbeeld ontwerpen
   - Groep 1 10:50 – 10:55
   - Groep 2 10:55 – 11:00

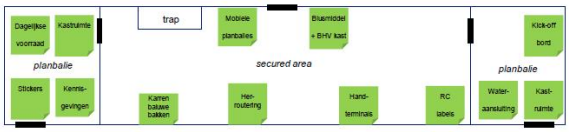
23 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 10:20-11:00 | Sluiting

Groep 1



24 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 10:20-11:00 | Sluiting

Groep 2



25 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 10:20-11:00 | Sluiting

Sluiting

- Parkeerplaats — flipover — 11:00 – 11:05
- Samenvatting van inzichten — 11:05 – 11:10
- Evaluatie
  - Verwachtingen — flipover — 11:10 – 11:15
  - Evaluatieformulier — formulier — 11:15 – 11:20
  - Verbetersuggesties — 11:20 – 11:25
- Vervolgstappen — 11:25 – 11:30

26 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:10-11:15

Wrap-up inhoudelijke discussie (1/4)

- Urgentie: de huidige situatie vraagt om verandering naar een geordende werkplek;
- Secured area kan qua indeling niet los van de planbalies worden gezien (dus samentrekken PB & SA);
- Uitdaging herindeling secured area heeft betrekking op lege SA bij depots+ (niet-AGT);
- Secured area basisfuncties zijn landelijk niet algemeen benoemd en bekend;
- Lokale best practises zijn niet benoemd, bekend en/of ingevoerd;
- Verandering omvat naast fysieke aanpassingen vooral het aspect houding en gedrag (d.w.z. voorbeeldgedrag, informeel eigenaarschap, aansprakelijkheid & aanspreekcultuur);

27 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:15-11:20

Wrap-up inhoudelijke discussie (2/4)

- Werknemers betrekken van verschillende depots biedt inzicht in problematiek en leidt tot de *lerende organisatie*. Lokale (pand-)afwijkingen voor aanvang sessie expliciet vermelden;
- Herstellen van pakketten vindt bij voorkeur niet in de secured area plaats met oog op stank, gevaarlijke stoffen risico en ontbreken van ventilatie (buiten);
- Ook is niet duidelijk welke hulpmiddelen voor herstellen van beschadigde pakketten (incl. ARBO zaken) en waar opslag plaatsvindt;
- Er is behoefte aan een wateraansluiting (stromend) in de secured area;
- De planbalie dient een ruimte te zijn voor communicatie (KPI's; *to do; issues*);

28 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:15-11:20

Wrap-up inhoudelijke discussie (3/4)

- Bevorderen van de esthetiek maakt de ruimte toegankelijker (foto's, plafond, versiering);
- Valid Express wordt bij voorkeur verwijderd uit planbalie van depots+ door schaarse ruimte;
- Ruimte boven de sorteermachine optimaler gebruiken (d.w.z. met niet-dagelijkse middelen);
- Er is behoefte aan gestandaardiseerde opbergstellingen, werkbank voor herstellen pakketten en karren voor blauwe AGT bakken (beschadiging);
- Lean informatie zou duidelijker aanwezig moeten zijn: *6S & SWM, beijning, vloerplaten* en *kanban* visualisatie (voorbeeld Ridderkerk & Kolham);
- Geluiden werkvloer essentieel voor inhoudelijke input en draagvlak;

29 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:15-11:20

Wrap-up inhoudelijke discussie (4/4)

- Ontwerp SA inrichting overlaten aan depots zelf a.h.v. vastgestelde best practices;
- Prioriteren van mogelijke maatregelen* (low-hanging fruit) met oog op vervolgstappen

30 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:15-11:20

Evaluatie proces

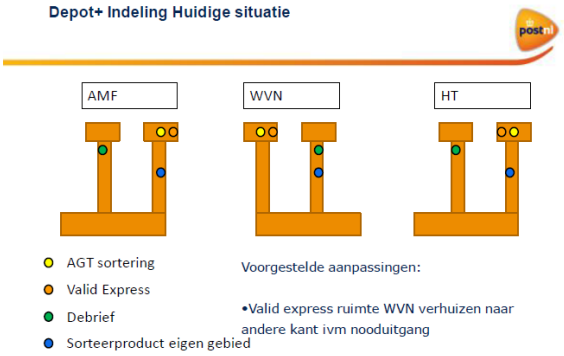
Goede punten	Verbeterpunten
Iedereen was betrokken bij de open discussie	Groepsgrootte ≤ 8 deelnemers (kleinschalig houden)
Goed dat kennisdragers aanwezig waren (2 depots inclusief planbaliemedewerkers)	Groep had gevoel dat discussie "nog niet klaar" was (extra detailslag van bijv. eigenaarschap/SA keeper)
Ontspannen sfeer voor samenwerking	Vervolgmeeting om inrichting te verbeteren
Goede voorbereiding vooraf (plezierig brainstormen)	Explicieter vermelden dat geluiden van de werkvloer gehoord zijn (planbalie interviews). Versterkt beeld van verricht vooronderzoek ("is mijn stem gehoord?")
Gedragsafspraken waren bevorderlijk voor groepsgevoel en commitment (eigen inbreng)	Bij aanwezigheid van meerdere depots verschillende uitgangsposities noemen qua pandafwijkingen
Goed functioneren van de facilitator	Duidelijker de vervolgstappen communiceren (hoe, wie, wanneer wordt beslissing genomen)
Visualiseren helpt om de discussie op gang te brengen	Feedback op presentaties qua tijd langer inplannen

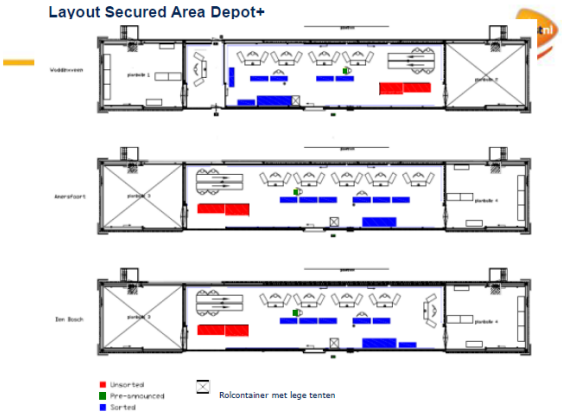
31 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:15-11:20

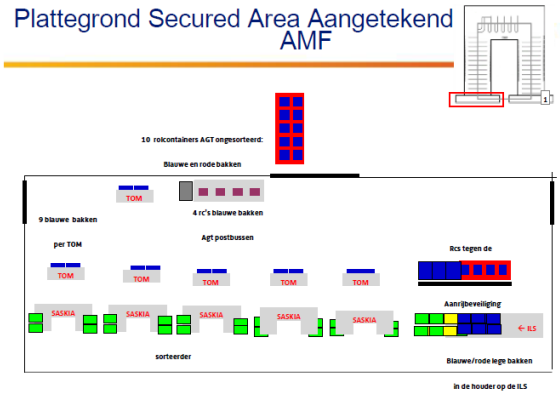
Vervolgstappen

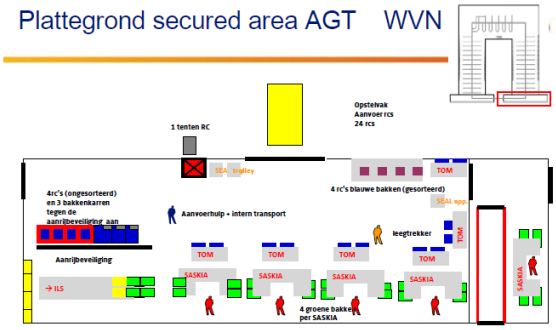
- Analyse van deze workshop
- Vervolgmeeting depot WVN op kleine schaal (eind maart)
- Workshop op depot Ridderderk op 31 maart met:
  - DM; srPM; PM en planbaliemedewerker;
  - ARBO; Facility; NLI expert;
  - Logistiek ontwerper
- Identificeren en/of ontwikkelen best practices
- Voorleggen best practices op depot-managers overleg
- Landelijke implementatie

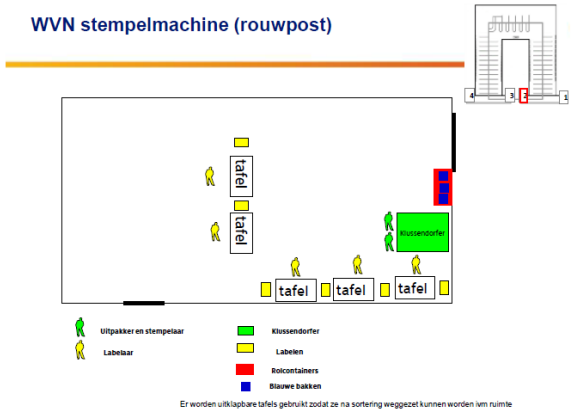
32 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 11:25-11:30

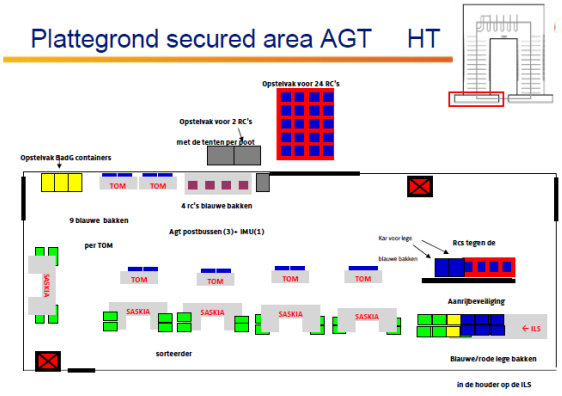

Depot+ Indeling Huidige situatie
AMF
WVN
HT
AGT sortering
Valid Express
Debrief
Sorteerproduct eigen gebied
Voorgestelde aanpassingen:
•Valid express ruimte WVN verhuizen naar andere kant ivm nooduitgang


Layout Secured Area Depot+
Unsorted
Pre-announced
Sorted
Rolcontainer met lege tenten

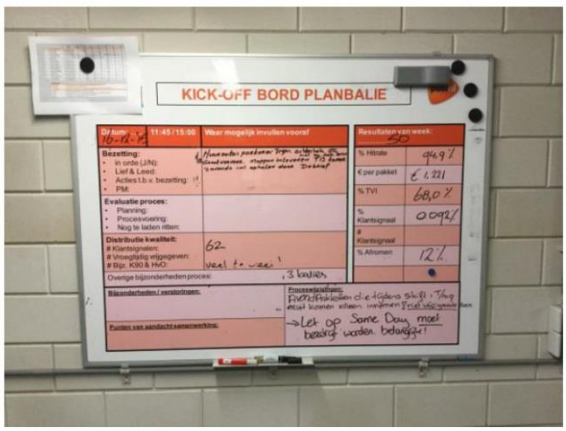

Plattegrond Secured Area Aangetekend AMF
10 rolcontainers AGT ongesorteerd:
Blauwe en rode bakken
9 blauwe bakken
4 rc's blauwe bakken
per TOM
Agt postbussen
Rcs tegen de
Aanrijbeveiliging
sorteerder
Blauwe/rode lege bakken
in de houder op de ILS

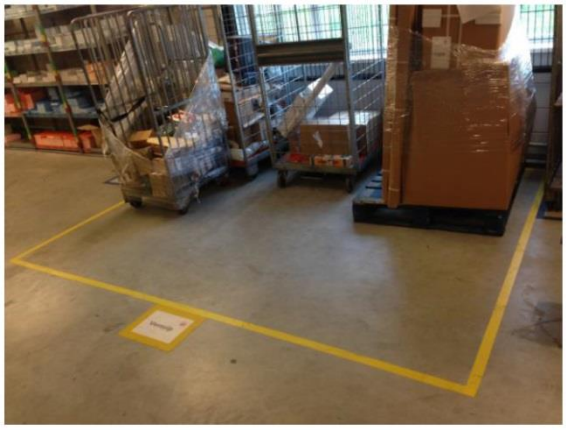

Plattegrond secured area AGT WVN
1 tenten RC
Opstelvak Aanvoer rcs 24 rcs
4rc's (ongesorteerd) en 3 bakkenkarren tegen de aanrijbeveiliging aan
Aanvoerhulp + intern transport
4 rc's blauwe bakken (gesorteerd)
leegtrekker
Aanrijbeveiliging
4 groene bakken per SASKIA

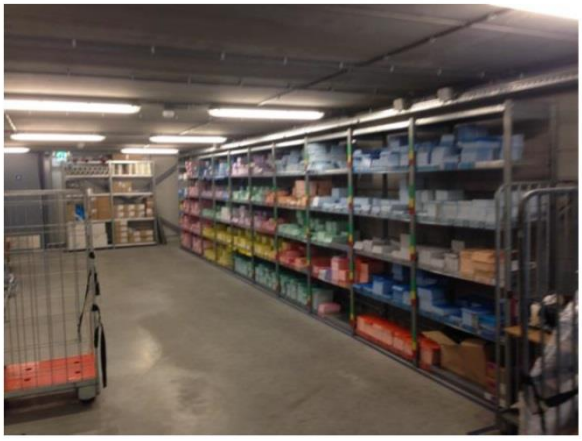

WVN stempelmachine (rouwpost)
tafel
Klussendorfer
Uitpakker en stempelaar
Labelaar
Klussendorfer
Labelen
Rolcontainers
Blauwe bakken
Er worden uitklapbare tafels gebruikt zodat ze na sortering weggezet kunnen worden ivm ruimte

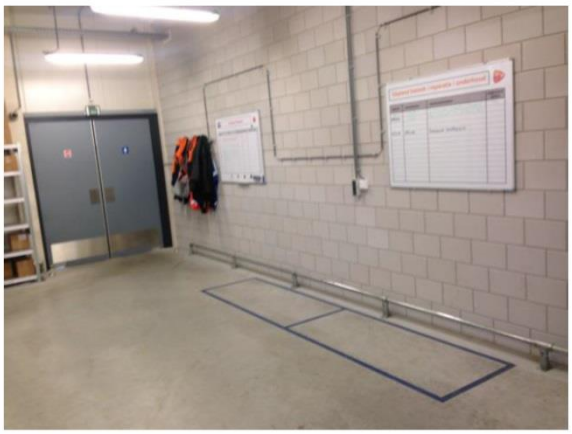

Plattegrond secured area AGT HT
Opstelvak voor 24 RC's
Opstelvak voor 2 RC's
met de tenten per boot
Opstelvak BadG containers
4 rc's blauwe bakken
9 blauwe bakken
Agt postbussen (3)+ IMU(1)
per TOM
Rcs tegen de
Aanrijbeveiliging
sorteerder
Blauwe/rode lege bakken
in de houder op de ILS

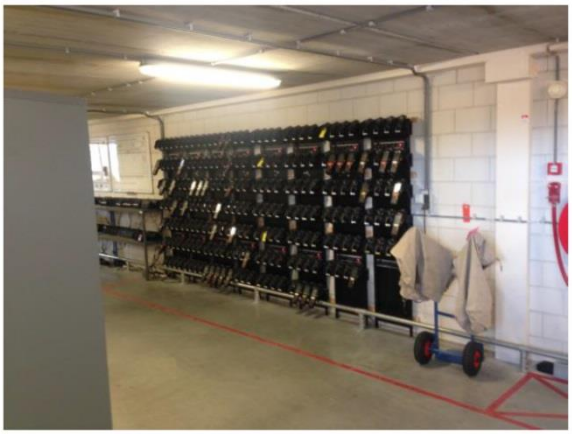

Voorbeelden best practices
39

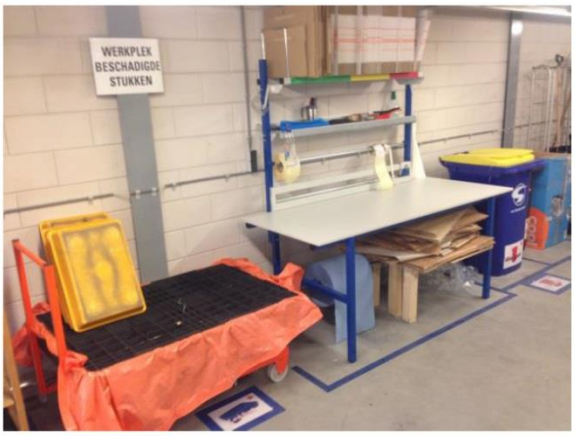

KICK-OFF BORD PLANBALIE











Belijning opstelplek Aangetekend Secured Area

- Blauwe lijnen
  - 1 Saskia
  - 2 bakkenkasten
  - 1 opstelvak Trolley
- Gele lijnen
  - 3 RC's aanvang shift
  - 1 RC interne foutlopers
  - Bakken op de grond (onder de Saskia)
- Rode lijnen
  - Brandblusser

Secured Area: aangetekenden (AGT)

Bij het aangetekenden proces worden de SWM opgehangen naast de AGT bakjes.

Belijning = geel.

51

Secured area

In de secured area worden de volgende vakken afgetapt:

-Herroutering (ma-vrij)

-Wijnbeurs

-Nespresso

-overige opstelplekken (papier, labels etc)

52

Secured area: kennisgevingen distributie

55

Secured area: labelkasten identificatie

- De label kasten zijn aan de zijkanten geplakt stickers die het voorraadniveau aangeven:
  - Voldoende voorraad
  - Direct bestellen
  - Noodsituatie
- De kasten zijn ingericht op alfabetische volgorde van AMF tot ZL.
- Voor iedere stapel is met dubbelzijdig tape een geplastificeerd label gehangen zodat duidelijk is welke labels op welke stapel liggen.

56

D.3. Results first workshop

Within this paragraph the results of the first intervention are presented including an analysis upon which an improved conceptual model is based. First the workshop outcome results are discussed and thereafter modifications for improving the model are listed.

D.3.1. Outcome results

During the first workshop the conceptual model is tested and observations from the design intervention provide valuable insights for further improving the conceptual model. Observations are done for specifically the building blocks of the conceptual model in which distinction is made between the planning, workshop and evaluation phase. Improvement suggestions are presented and in the next paragraph these recommendations are included in the improved design.

Table 16. First design workshop outcome results

		PROJECT PHASE		
CONCEPT		**Planning**	**Workshop**	**Evaluation**
Top management support		Align collaboration with organizational strategy/goals, pre-conditions & resources	Unclear next steps: who/when/how will management make a decision? Transparent decision-making	
Collaborative architecture	governance		Participants should not feel any restriction in their way of thinking	
	openness			
Collaborative design	shared understanding	Get shared understanding on physical scope & vocabulary norms & interests	There was a conflict identified regarding the physical scope of the project. Resolved directly.	Clarify starting assumptions for design (shared understanding)
	shared identity		Group agreement was helpful (and did not affect informality)	
	learning		Visualisation is key for learning Idea feedback fosters learning Multi-perspective foster learning	
Expectations management	planning	Clarify two-directional expectations beforehand		
	workshop		Participants did not have explicit expectations	Clear follow-up steps

Ownership & acceptance		Executive & line ownership is crucial for sense of urgency, role modeling	Explicitly communicate that all workplace voices are heard Problem analysis by participants	Ownership should also be assigned to operation employee
Collaboration requirements	interdependence		Participants relied upon each other	
	shared goal		Reach consensus on the goals	
	member equality		Agreement maintains equality	
	shared decisions		Clarify how future management decisions are made (transparency)	
Multi-stakeholder represen-tation	multi-site		Multi-site representation fosters learning	No more than 8 participants
	disciplines		Not addressed in 1st workshop	
	hierarchy layers	Have all layers repre-sented (knowledge and ownership)		
Trust	contractual		Committed participants by group agreement and room decoration Problems are opportunities	Paradox of participation can affect trust in the collaboration effort And thus make expectations and goals more clear
	communication		Informality & group agreement led to honest communication	
	competence	Offer room to share expertise and individual expectations		
Form of standardization			Lean was not addressed (framing)	Depends on lean-familiarity

E. Second design workshop

E.1. Workshop design

Observations from the first workshop are incorporated in the improved conceptual framework. Concepts and insights can related to added concepts (green); reformulated concepts (yellow); and removed concepts (red).

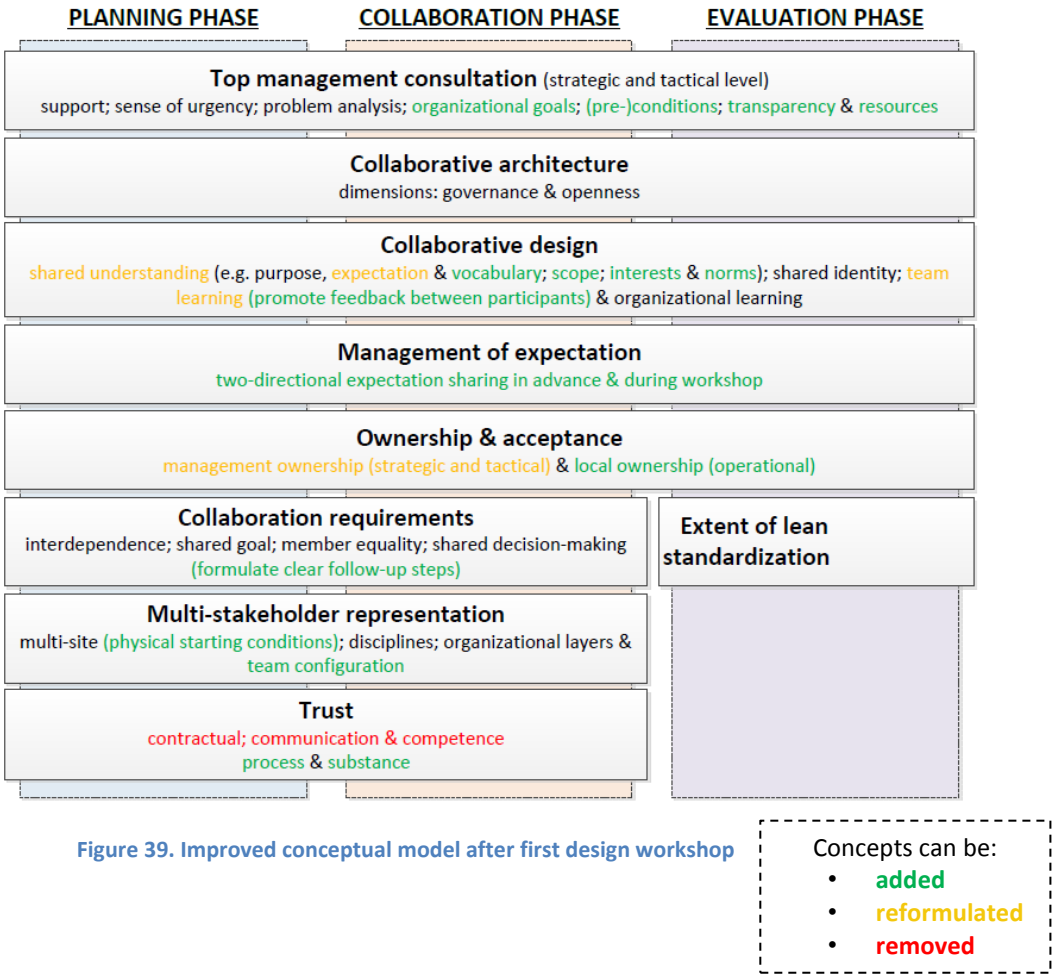


Figure 39. Improved conceptual model after first design workshop

In paragraph 5.4.1 the improved design for the second workshop is provided. Thereafter in the next paragraph aspects are listed for further improvement of the conceptual framework.

E.1.1. Second workshop intervention results

In the below table insights are given concerning the second design workshop intervention. These notions are based on observations during the first workshop and follow-up interviews with participants and management.

Table 17. Improved design for the second design workshop

Literature		Application	Approach
Top management consultation		Involve top- and line management (align org. goals, sense of urgency, problem analysis, (pre-)conditions, transparent decision-making & resource allocation)	Interviews
Collaborative architecture	governance	Hierarchical format (fixed process & agenda)	Consultation with top- and line management

	openness	Closed collaboration: pre-selected participants	
Collaborative design	shared understanding	Clarification regarding objectives and goals and on physical scope/technical terms	Reach group consensus on goals/scope aspects
	shared identity	Individual contributions to behavioral rules	Group agreement
	learning	Interdisciplinary and designing by subgroups	Feedback opportunities
Expectations management	planning	Clarification of expectations beforehand	Frequent communication of expectations
	workshop	Two-way clarification of expectations	
Ownership & acceptance		Process ownership by team Importance of local ownership (operational level)	Framing
Collaboration requirements	interdependence	Selected participants who rely on each other	Group agreement
	shared goal	Clarification of purpose and objectives	Presentation
	member equality	Set up behavioral rules	Group agreement
	shared decisions	Allow participants to share their knowledge	Design exercise
Multi-stakeholder represen-tation	multi-site	Participants from different depots	Stakeholder interviews & analysis
	disciplines	Participants with diverging expertises	
	hierarchical layers	Participants from strategic, tactical & operational levels are represented	
Trust	process	Participants underline the importance of the collaborative process	Communication of org. strategy and collaboration goals
	mutual	Participants trust each other for effective collaboration (*chicken-egg-problem*)	Group agreement
Extent of lean standardization		Balancing the need of standardization (control) and freedom (autonomy)	Input from participants

E.2. Workshop design and documentation PNP case

PostNL Pakketten

Ontwerpworkshop Secured Area

Documentatie

Datum: 31 maart 2016
Tijd: 13:00 –15:30
Locatie: Depot Ridderkerk

Aanwezigen

Naam	Functie/rol
Guido Veltman	Procesfacilitator
Minke van der Kleij	Logistiek ontwerper depotbeheer & ontwerp (StafOps)
Eelke Stegehuis	Depotmanager Ridderkerk*
Alex de Groot	Senior procesmanager Ridderkerk
Louis Stellenaar	Procesmanager Ridderkerk (aandachtsgebied lean)
Rob Simmers	Projectleider NLI
Wilbert de Vries	Adviseur huisvesting (facility)
Frank van Muiden	ARBO coördinator & veiligheidsadviseur

2 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Agenda vandaag

Kick-off	13:00 – 13:30	30 min
Ontwerpproces deel 1: "huidige situatie"		
Uitleg	13:30 – 13:35	5 min
Uitvoering	13:35 – 14:10	35 min
Pauze	14:10 – 14:20	10 min
Ontwerpproces deel 2: "gewenste situatie"		
Uitleg	14:20 – 14:30	10 min
Uitvoering	14:30 – 15:00	30 min
Evaluatie en sluiting	15:00 – 15:30	30 min

3 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Kick-off onderdelen

Introductie workshop	13:00 – 13:05
Voorstelrondje	13:05 – 13:15
Groepsovereenkomst	13:15 – 13:25
Verslag workshop 9 maart depot AMF	13:25 – 13:30

4 Kick-off 13:00-13:30 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wat, wie, waarom en hoe

Wat
- Basisfuncties onduidelijk en kansen voor slimmer gebruik van ruimte
- Veel inrichtingsvormen, best practices niet overal benoemd, bekend en ingevoerd

Wie
- Deelnemers van verschillende disciplines
- Rondje langs 8-tal depots voor eerste situatieschets

Waarom
- Gebruiken van meerdere gezichtspunten waardoor we leren van elkaar
- Identificeren van eisen, ideeën en best practices (klant- en pand-afwijkingen)
- Draagt bij aan veiligheid, kwaliteit, kosten-efficiënte procesvoering & klanttevredenheid
- Gegenereerde ideeën als input voor landelijk management besluit
- Stappenplan voor toekomstige vergelijkbare projecten

Hoe
- Huidige en toekomstige situatie in kaart brengen
- Implementatie gegenereerde ideeën

5 Kick-off 13:00-13:05 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Groepsovereenkomst

Kernwaarden en omgangsnormen*
1. Open en eerlijk
2. Respect voor elkaar
3. Niet door elkaar heen praten
4. Realistisch blijven
5. Hard op de inhoud, zacht op de relatie
6. Duidelijkheid
7. De mens centraal
8. Samen voor één PostNL

*op basis van individuele bijdragen en groepsconsensus over kernwaarden en normen

6 Kick-off 13:15-13:25 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Uitkomsten workshop AMF

- Basisfuncties landelijk niet algemeen benoemd en bekend;
- Lokale best practices niet benoemd, bekend en/of ingevoerd (vb. werkbank);
- Aspect houding en gedrag zeer belangrijk (eigenaarschap, voorbeeldgedrag);
- Klant- en pandverschillen belangrijk bij vaststellen inrichting (o.a. depot+);
- Kennis vanuit div. perspectieven leidt tot nieuwe inzichten (samen leren);
- Secured area is ook een ruimte voor communicatie planbalie (medewerkers);
- Ruimte kan esthetischer worden vormgegeven

7 Kick-off 13:25-13:30 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Input n.a.v. sessie AMF

- Fundamenteel verschil inrichting depot+ en standaard depot
- Best practices bepalen voor landelijke implementatie
- Benadrukken aspect houding & gedrag
- Meer gebruik van visualisatie
- Vervolgstappen duidelijker formuleren

8 Kick-off 13:25-13:30 | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Ontwerpproces deel 1 agenda

- Naam activiteit: "huidige situatie secured area"
- Uitleg:
  - Wat: afbakening, definitie & basisfuncties bepalen
  - Waarom: inzicht in huidige situatie en mogelijke kansen
  - Hoe: brainstorm & sterkte-kansen analyse
- Structuur vervolg deel I:
  - Bepalen afbakening 13:30 – 13:35
  - Bepalen basisfuncties 13:35 – 13:45
  - Sterkte-kansen-analyse 13:45 – 14:00
  - Vergelijking met huidige kansen 14:00 – 14:10

9 Kick-off | Toel. deel 1 13:30-14:10 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Afbakening

Binnen de scope	Buiten de scope
Secured area	Hal/vloer
Planbalies	Terrein
Ruimte boven sorteermachine	

- Naam secured area is wellicht verwarrend, hetgeen de ruimte aanduidt tussen de planbalies;
- Planbalie en secured area hebben veel onderling in- en uitgaande stromen;
- Ruimte boven de sorter meenemen gezien alternatief van opslaglocatie;
- De vloer en buiten terrein vallen buiten de scope

10 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:30-13:35 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Identificatie gewenste basisfuncties

Secured area	Planbalies	Ruimte boven sorter
• AGT sortering • veilige opslag niet bestelde pakketten • herverpakking beschadigd pakket • Netlink scanners • doorgang planbalie ↔ vloer • opslag & opladen mobiele planbalies	• afhandeling ritten • opslag handterminals • kick-off/kick-down	• opslag Beumer • opslag (niet-dagelijkse) middelen

- Basisfuncties op basis van bepaalde afbakening: SA, PB en zolder

11 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:35-13:45 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Sterktes-kansen-analyse

- Geïdentificeerde sterke eigenschappen

Sterktes
• Gebruik van 2 planbalies i.p.v. 4 (concentratie)
• Functionele indeling depot Ridderkerk
• Beheer door vastgestelde taken dagdienst
• Planbalie is een centrale plek (debrief)
• Opslag van 'dagelijkse' voorraad
• Lean toepassingen

12 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:45-14:00 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Sterktes-kansen-analyse

- Geïdentificeerde verbeterkansen

Niet-aanwezig & gewenst	Aanwezig & niet-gewenst
• watervoorziening & afvoer	• niet-dagelijkse voorraad (voorbeeld reservebanden) bepalen
• toilet voor bezorgers (urinoir)	• Optimale voorraad RC labels
• ventilatie voor dampen (boven werkbank)	• Afvoerton – ADR (functie & locatie)
• standaard werkplek/-bank beschadigde stukken	• Opslag schoonmaakmiddelen
• vak voor RC's met pakketten 'TO DO'	
• KGA*	
• Kick-off/kick-down plek planbalie	

13 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:45-14:00 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Huidige verbeterkansen secured area (1/3)

- Rondje gemaakt langs 8-tal depots:
  - HBD – LW – KHM – HW – WVN – SSH – AMF – RDK
  - Gesprekken met uiteenlopende disciplines
- Houding en gedrag
  - Ordenen van de werkomgeving start bij voorbeeldgedrag
  - Eigenaarschap (bijv. secured area 'keeper')
- Opslaglocatie bepalen van (linker/rechter SA):
  - Handterminals (debrief) en blauwe bakken
  - Rolcontainers en -labels
  - Kennisgevingen
  - Toekomstige producten (o.a. foodbox)
  - Mobiele planbalies en lekbakken
  - Linker versus rechter SA & zolder versus SA



14 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:40-13:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Huidige verbeterkansen secured area (2/3)

- Veiligheidsvoorzieningen
  - watervoorziening (kraan)
  - vloercoating
  - Ventilatie (herstel pakket)
- Standaardisatie van best practices:
  - Herstel pakketten (locatie; voorraadkast; middelen)
  - Communicatie (lean info; kick-off bord; proces beschrijving)
  - Standaard-stellingen voor opslag en werktafels
- Communicatie:
  - Kick-off meeting
  - Delen van management info (lean bord)
  - Lean



15 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:40-13:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Huidige verbeterkansen secured area (3/3)

- Vernieuwing kar blauwe AGT bakken
  - Huidige kar wordt vaak beschadigd (aanpassingen nodig)
  - Aantal karren per depot niet eenduidig (2-4)
- Optimale voorraden SA materialen
  - Grote batches (labels, stickers, dozen, etc.)
  - Afstemming tussen depots: batch verdelen* (geldt ook voor best practices)
- Estethiek
  - Secured area: decoreren plafond/wand**
  - Planbalie: bevorderen huiselijke sfeer
- Ruimte boven de sorter beter benutten
  - Scheiding opslag in secured area versus ruimte boven sorter

16 Kick-off | Toelichting deel 1 | Uitv. deel 1 13:40-13:50 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Ontwerpproces deel 2 — agenda

- Activiteit "toekomstige situatie"
- Uitleg activiteit': 14:25 – 14:30
  - Wat: o.b.v. basisfuncties en kansen lege SA inrichten
  - Waarom: ideeën genereren en evalueren
  - Hoe: 2 groepen en lege SA, daarna presenteren
- Structuur vervolg deel 2: 14:30 – 15:00
  - Groepen delen in twee
  - Ontwerpen inrichting secured area
  - Presentatie groep 1
  - Presentatie groep 2

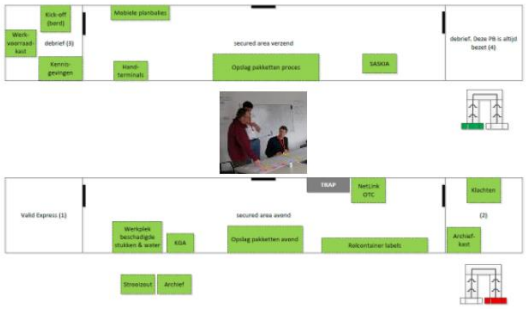
17 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toel. deel 2 14:20-14:25 | Uitvoering deel 2 | Sluiting

Activiteit "toekomstige situatie" — 14:20 – 15:00

1. **Inrichten lege SA per groep** 14:20 – 14:40
   - o.b.v. basisfuncties en verbeterkansen
   - uitgangspositie: depot RDK
   - diavoorstelling voor verdere inspiratie
   - fysieke lay-out en aspect houding en gedrag
2. Presentatie groep 1 14:40 – 14:45
   - Feedback groep 2 14:45 – 14:50
3. Presentatie groep 2 14:50 – 14:55
   - Feedback groep 1 14:55 – 15:00

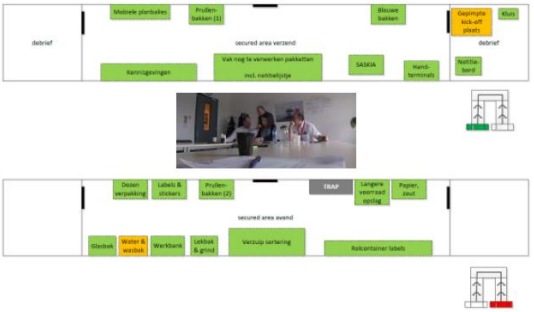
18 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 14:20-14:40 | Sluiting

Presentatie groep 1



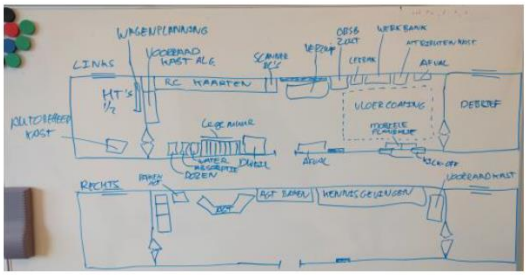
19 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 14:40-14:50 | Sluiting

Presentatie groep 2



20 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 14:50-15:00 | Sluiting

Plattegrond Ridderkerk (huidige situatie)



21 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitv. deel 1 15:00-15:05 | Sluiting

Agenda sluiting

- Parkeerplaats flipover 15:00 – 15:05
- Samenvatting van inzichten 15:05 – 15:10
- Vervolgstappen 15:10 – 15:15
- Evaluatie 15:15 – 15:30

22 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 15:00-15:05

Vervolgstappen

- Analyse van deze workshop
- Vervolgmeeting Waddinxveen (depots+)
- Formuleren best practices
- Voorleggen op depot-managers overleg
- Proefopstelling organiseren
- Input voor uiteindelijke besluitvorming management (tijd, ☺ en €)
- Landelijke implementatie

23 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 15:25-15:30

Verbetersuggesties proces

Sterke punten	Verbeterpunten
• Goede voorbereiding bevordert scherpte discussie	• Rolverdeling en perspectieven van deelnemers eerder verduidelijken
• Samenstelling (afvaardiging van diverse disciplines)	• Doel → probleemstelling in definitiefase meer helder krijgen (depot RDK is immers goed op orde qua secured area
• Structuur en opbouw van de sessie	• Betrekken ander depot (met minder verzorgde secured area)
• Aanpak zorgt aan voorkant voor meer werk, maar makkelijkere implementatie	• Bepalen van eindproduct: standaardvorm en mate van detail. Kiezen voor vaste plattegrond versus vastgestelde basis ingrediënten?
• Groepsovereenkomst	• Let op pand- en klantafwijkingen tijdens implementatie-/acceptatie-traject
• Nadenken op landelijk niveau	• Lastig implementatietraject aangezien depots ruimte al ingericht hebben
• Bijdrage aan lerend vermogen van PostNL op organisatie niveau	• In vervolg visualisatie-voorbeelden eerder tonen om probleem te benadrukken.

24 | Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 15:15-15:25

Evaluatie vragen

- Zorgt deze aanpak ervoor dat de secured area op landelijk niveau efficiënter/slimmer wordt ingericht?
- In hoeverre verwacht je dat de ideeën geïmplementeerd zullen worden?
- Op welke manier worden aan de achterkant het vertrouwen, betrokkenheid en/of eigenaarschap gewaarborgd?
- Wat levert deze aanpak jullie op?

25 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting 15:25-15:30

Wrap-up inhoudelijke discussie (1/8)

Voortraject

- Afbakening betreft secured area, planbalies en ruimte boven de sorter (wisselwerking);
- Afweging tussen een duidelijke probleembeschrijving voor aanvang of juist geen beschrijving om denken vanuit bepaalde denkbeelden/verwachtingen te voorkomen (open houding);
- Goed voor inhoudelijke discussie om naast een goed presterend depot ook een minder presterend depot te betrekken (leren van elkaar);

26 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (2/8)

Fysieke best practices

- Functionele indeling: bepalen welke middelen er in de secured area/planbalie (dagelijks) thuishoren en wat in de ruimte boven de sorter (niet-dagelijks);
- Debrief planbalie hoort een centrale plek te zijn voor planbaliemedewerkers (communicatie, huiselijke sfeer, kick-off/kick-down;
- Standaard werkplek voor herstellen beschadigde pakketten (benodigdheden*, werkbank, afvoerton, lekbak, attributenkast, instructies, noodprocedures, schoonmaakmiddelen, etc.);
- Prioriteit is goed organiseren van de indeling en daarna kijken of er nog steeds ruimtegebrek is;
- Lean toepassing op depots Ridderkerk en Kolham als voorbeeld (belijning, platen, kanban);

27 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (3/8)

- Bundelen blauwe AGT bakken, handterminals en SASKIA-proces. Rekening houden met debrief locatie;
- Opstelvak maken voor pakketten die nog verwerkt/gedistribueerd dienen te worden;
- Kennisgevingen in secured area of debrief-planbalie op basis van bevoorrading kennisgevingen (tijdens uitgifte versus debrief);
- Nieuwe handterminals bij voorkeur in de secured area plaatsen;
- Opstelvak maken voor mobiele planbalies (in secured area met AGT sortering)
- Zoutopslag naar buiten verhuizen (creëer een aparte bak);

28 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (4/8)

- Onderscheid in type secured area: *debrief*-secured area is bestemd voor avond proces. Andere is meer een *verzend*-secured area, met opslag pakketten avond en AGT sortering;
- Lange termijn archief bij voorkeur verhuizen naar ruimte boven de sorter;
- Gecoate vloer rondom werkplek beschadigde stukken om werkomgeving netjes te houden;
- In secured area met werkplek beschadigde stukken voorraad dichtbij houden (dozen, etc. dus rechts in secured area). Papier bijv. dus links plaatsen in die secured area;
- Kansen voor kennis delen tussen depots onderling (voorbeeld werkbank). Te denken valt ook aan een standaardbestellijst voor secured area (zaken helstellen pakketten). Tevens centrale inkoop voor optimale voorraden (RC labels, dozen en kennisgevingen);

29 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (5/8)

Eigenaarschap, houding & gedrag

- Nette werkomgeving d.m.v. eigenaarschap en taakverantwoordelijkheden, op alle niveaus. Met elkaar bepalen wat nodig is. Begint bij aandacht van depotmanager en senior procesmanager. Betrokkenen:
  - depotmanager
  - senior procesmanager
  - procesmanager
  - planbaliemedewerker
- Aanwijzen van secured area 'keeper' en met duidelijke taakomschrijving*. Eerst prioriteit bij indeling fysieke inrichting;

30 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (6/8)

Implementatietraject

- Bepalen wat het eindproduct dient te zijn: een vaste inrichting of een overzicht van basiselementen en aan de depots zelf overlaten waar ze dat thuisbrengen;
- Standaardiseren mag niet een doel op zich zijn;
- Op den duur nadenken over water, ventilatie en alternatief lekbakken: ideeën-matrix;
- Nu implementeren van quick wins. Daarna andere oplossingen overwegen;
- Organiseren van dergelijke interdisciplinaire meetings o.b.v. bepaalde randvoorwaarden;
- Organisatie secured area opnemen in de lean-scan;

31 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (7/8)

- Grotere investeringen als water, ventilatie en aanpassing lekbakken doen o.b.v. twee overwegingen: is het wenselijk vanuit de wet of wensen PostNL (gezondheid/veiligheid);
- Dit implementatie traject is anders omdat depots al een eigen 'standaard' ontwikkeld hebben;
- Kaders scheppen waarbinnen depots zelf mogen beslissen (wetgeving, veiligheid, etc);
- Horen van verschillende disciplines bevordert draagvlak tijdens implementatieproces (eisen identificeren aan voorkant om zo teleurstelling aan achterkant te voorkomen);
- Lerend vermogen van de organisatie zou kunnen toenemen door deze aanpak;
- In communicatie naar depots voor implementatie duidelijk beargumenteren waarom oplossingen werken (toegevoegde waarde) en klant- en pandafwijkingen in kaart brengen;

32 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Wrap-up inhoudelijke discussie (8/8)

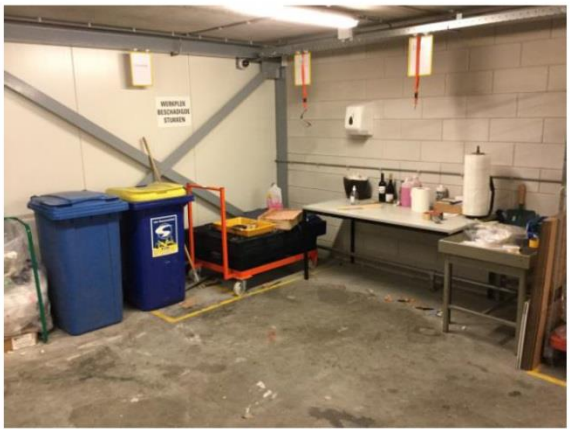
- Goed voor inhoudelijke discussie om naast een goed presterend depot ook een minder presterend depot te betrekken (leren van elkaar);
- In communicatie naar depots voor implementatie duidelijk beargumenteren waarom oplossingen werken etc. (toegevoegde waarde) en klant- en pandafwijkingen in kaart brengen;
- Kansen voor kennis delen tussen depots onderling (voorbeeld werkbank). Te denken valt ook aan een standaardbestellijst voor secured area (zaken helstellen pakketten)
- Betrekken van verschillende disciplines bevordert draagvlak bij implementatieproces (eisen identificeren aan voorkant om zo teleurstelling aan achterkant te voorkomen);
- Kaders scheppen waarbinnen depots zelf mogen beslissen (wetgeving, veiligheid, etc);

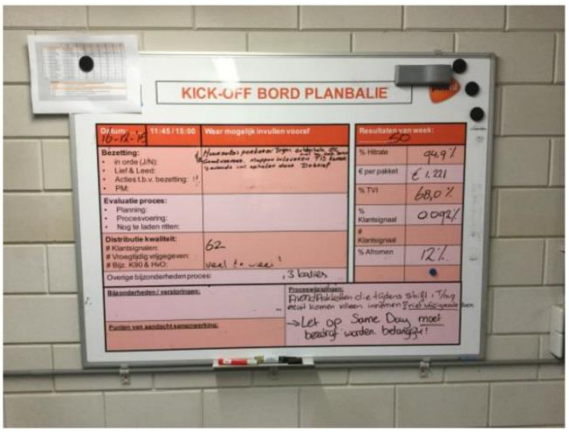
33 Kick-off | Toelichting deel 1 | Uitvoering deel 1 | Pauze | Toelichting deel 2 | Uitvoering deel 2 | Sluiting

Foto's van depots voor urgentie

- Met goede en slechte voorbeelden…
- … van verschillende depots

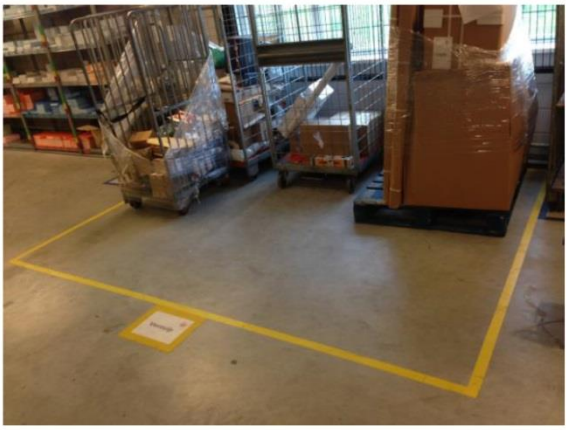
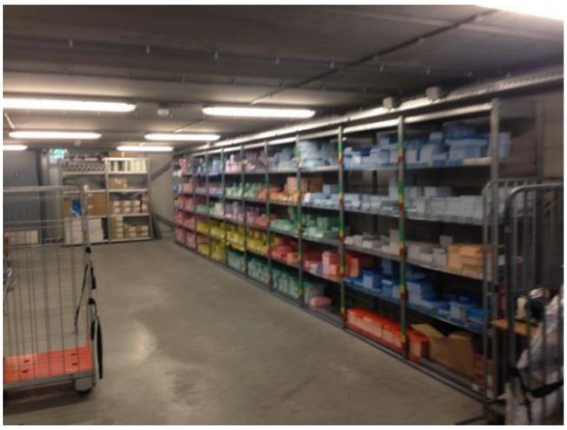
34

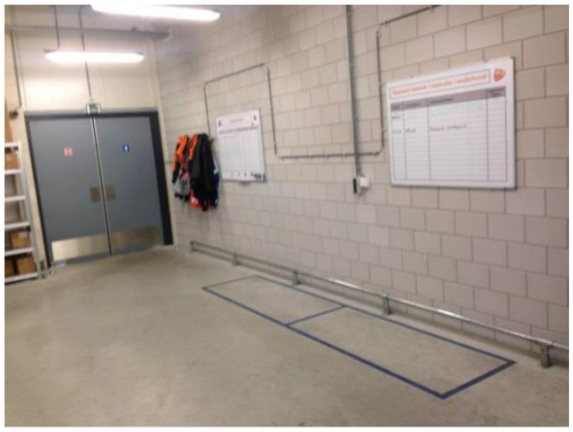


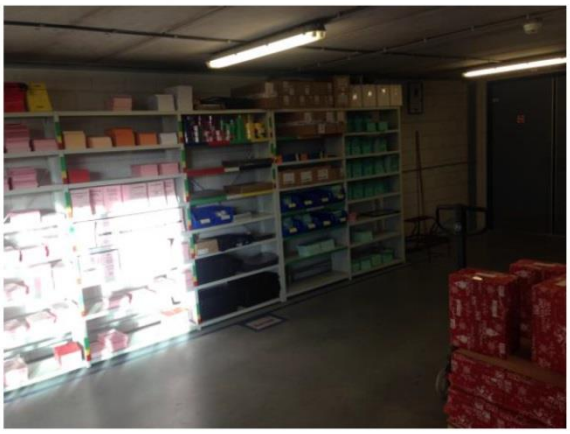


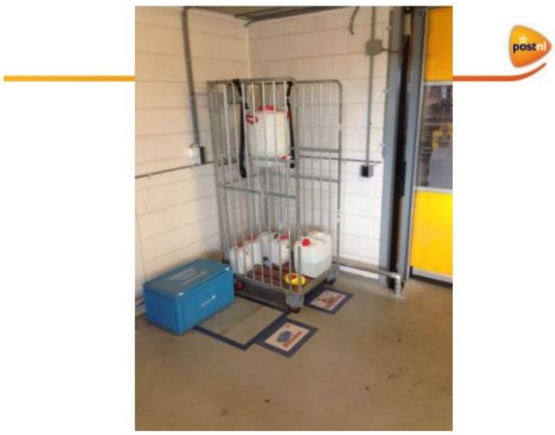


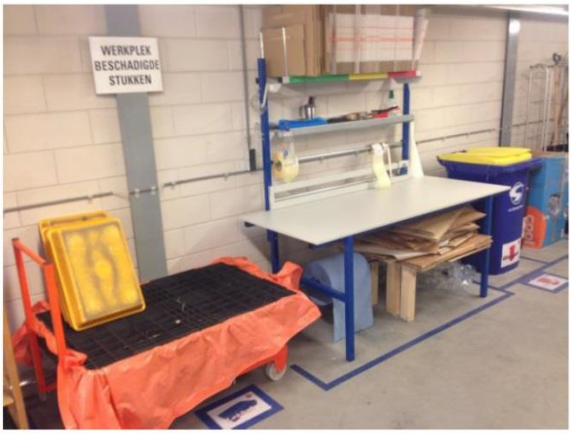









WERKPLEK
BESCHADIGDE
STUKKEN

E.3. Workshop results

E.3.2. Second workshop intervention results

In this paragraph observations from the second design workshop are provided which serves as basis for a second iteration of further improvement of the conceptual model.

Table 18. Results of the second design workshop

		PROJECT PHASE		
CONCEPT		**Planning**	**Workshop**	**Evaluation**
Top management support		Collaboration is time consuming, but the most ideal way of problem solving. In this way implementation is more easy as acceptance is partly realized.	The depot manager in now a member of management Important to consider costs as a criteria during the workshop	Emphasize on added value of measures taken (and *why)*. Standardization is not the goal
Collaborative architecture	governance			
	openness			
Collaborative design	shared understanding	Is a clear problem statement desired? No problem statements enhances creative thinking	Important to address local physical differences right from the start. Especially with participants from other sites	
	shared identity		Group agreement establishes trust and commitment	
	learning		Visualisations were helpful for understanding the problem Diverging disciplines helped to learn from other organizational members	Representation of multiple disciplines promote team- and organizational learning
Expectations management	planning		Clarify all perspectives beforehand to avoid conflict. Now one participants was disappointed as his expectation was not met (detail of discussion).	During implementation a clear problem statement is crucial as site managers are not aware of other situations
	workshop		One stakeholder	

			expected a more detailed discussion	
Ownership & acceptance				
Collaboration requirements	interdependence			
	shared goal			
	member equality			
	shared decisions			
Multi-stakeholder represen-tation	multi-site	Important to involve multiple depots	Trade-off between people from supportive staff vs. site employees	
	disciplines		Multiple disciplines encourages to think on a company level Introduce the perspectives more clearly	
	hierarchical layers			
Trust	process		Also trust in the organization plays a role	Trust can be damaged when there is no quick follow-up by management
	mutual			
Form of standardization			Explicitly address what type of standardization is desired (type and extent) Standardisation cannot be a goal on itself	Depots have already designed their SA lay-out. Change is therefore more difficult

F. Outcome validation at PNP

In this section the workshop designs and design process are validated. In appendix F.1 the workshop participants reflect on the final designs and in appendix F.2 management stakeholders provide feedback on the process of design for PNP.

F.1. Workshop participant's validation

The quotes below are provided by workshop participants after the design workshops. This is part of the participant's validation of the workshop outcome.

- ''Choices made. Hoe zijn ze uiteindelijk gekomen tot deze designs?
- Wat is nice to have en wat is must have binnen de designs?
- Input per deelnemer zou ik wel willen zien.
- Overige tips voor de secured area (soft factors): hoe verwerk je die precies? Denk aan eigenaarschap etc.
- Er loopt ook een project voor het plaatsen van toiletten. Deze worden geplaats bij de Debrief kant. Het is dus financieel (een stuk!) efficiënter om de werkplek beschadigde stukken in de SA te plaatsen waar ok de debrief is. Mocht je prijzen willen hebben, dan hebben we concrete info nodig om deze aan te vragen. Uiteraard kunnen mijn collega's ook prijzen aanvragen, maar dan moet de info helemaal concreet zijn omdat ze niet de zelfde info hebben op dit moment.
- Met betrekking tot gewone depots: volgens mij prima, hoek rechtsonder op de slide zijn geen RC's maar opslag andere spullen.
- Ik heb het even doorgekeken en het ziet er mijns inziens goed uit. Wel ben ik benieuwd wat de depotmanager ervan vindt dat we in deze opstelling de RC-labels vanuit ons hok op het cross dock naar de SA moeten verplaatsen, maar daar mag hij zelf verder een oordeel over vellen.
- Ik dat er een deel van de vloer gecoat gaat worden, op de plek waar de inpaktafel staat. Dat is erg prettig in verband met lekkende pakketten, waardoor de boel beter schoon te maken is. Uit kostenbesparend oogpunt snap ik waarom slechts een deel gecoat wordt, maar wat zouden de kosten zijn om de gehele SA te coaten? Stel dat er ooit in de toekomst nog een aanpassing gaat komen in de indeling, dan zou de inpaktafel eventueel ook ergens anders kunnen staan.
- Ik kan me nog een punt herinneren die een andere workshop deelnemer maakte, over de draagkracht van de ruimte boven de Secured Area. Ik zie in de toelichting dat de seizoensgebonden en bulkvoorraad hier kunnen staan, is dat ook geverifieerd via de bouwtekeningen?
- Vanuit het optiek van mij als planbaliemedewerker (verzend) lijkt me het ontwerp op deze wijze in elk geval goed werkbaar, vooral als we ook daadwerkelijk een afzuig- en watervoorziening krijgen. Als ik even boven mijn rol als planbaliemedewerker ga staan en kritisch kijk, zie ik dat er ten opzichte van de huidige situatie enkel de voorraad weg gaat naar de planbalie en dat we een kast RC-labels ervoor terugkrijgen. Één kast erin, één kast eruit dus.
- De grootste uitdaging voor elk depot zal zijn om te voorkomen dat er niet alsnog zooi neergezet wordt in de secured area. Ik denk aan een kapotte steekwagen die blijft staan (er staan er nu 3 bij ons bijvoorbeeld), een kapotte band die verwisseld is et cetera. Ik denk dat je terecht erbij opmerkt dat hiervoor een bewaker aangewezen moet worden.
- Ik zal een dezer dagen ook gelijk een start maken met de 3d-tekening.
- Voor de nieuw te bouwen depots worden aanpassingen uitgevoerd zie Wilbert aangeeft. We krijgen 2 inpandige planbalies, 1 voorzien van toiletruimtes. Tevens wordt een waterpunt aangebracht voor de Beschadigde stukken verwerking. E.e.a. zal ook leiden tot concentratie van de oplaadpunten van alle scanners in een SA. Ik heb hier tekeningen voor beschikbaar en een overzicht van afhankelijkheden (waar debrief, waar toilet, etc.). Lijkt me verstandig daar even voor rond de tafel te gaan zitten. Overigens doet dit geen afbreuk aan jou voorstellen, betreft immers de nieuw te bouwen depots.

Maar wel zo handig om qua indeling de bestaande depots hier op af te stemmen (dus ook je voorstellen)''

F.2. Management validation

In this paragraph input is gathered from management stakeholders Marjon de Koning (Directeur depots, 2016), Eelke Stegehuis (Manager Staf Operations, 2016), Dirk Veldt (Manager Depotbeheer & Ontwerp, 2016) and Minke van der Kleij (Logistiek ontwerper, 2016). Several questions are asked and answered by the interviewees:

Question 1

Why should management take the input from participants during the collaborative workshop sessions into account in their future decision-making regarding the secured area redesign?

[Eelke:]

In my opinion, the input from people who will actually work with a new design is indispensable. This approach is more time-consuming, however, it is more beneficial since people perceive more ownership as they have participated in the actual design process. Moreover, I think that designs become qualitatively better since more issues are tackled in these designs, which we surely would have faced in a later stage. Obviously, the level of participation can vary per subject/topic/problem: at least a phone call and at most involving operational people from the very start of a design process.

[Dirk:]

Employees with relevant knowledge for a future solution have participated. These persons have to carry out the actual process. It is recommended to formulate guidelines on how and at what moment you involve organizational stakeholders.

Moreover, in such a collaborative way acceptance is enhanced. By involving employees in an early stage these organizational stakeholders are more willing to comply to future standards and measures.

[Minke:]

They are the true knowledge providers, especially in the operational core. These people will carry out the process and therefore it is important to hear their voices. Our department can develop the best possible designs, however, in this manner at an early stage feasibility issues are addressed (e.g. immediately performing a pilot project). It is important to take into account that depots will mainly argue based on their own specific situation. So, representatives of different depots should be involved to promote learning on network level.

Question 2

Why would this collaborative design approach work better compared to the current approach (unilaterally) of design? Contrary, why would this collaborative approach work insufficiently?

[Eelke:]

The current lay-out and configuration of the secured area is unique. Normally, every single process and lay-out is standardized and formalized (which is also party established in consultation with the operational core), except for the secured area. I believe that when this collaborative approach is carried out adequately, then you combine all relevant aspects which have to be considered and you offer depots an opportunity to make improvements for a specific situation. Trying to change something afterwards often causes resistance: ''why should I change something? This already works fine for me.''

[Minke:]

In my view it is helpful to let stakeholders participate early in a project stage. This resolves the issue of resistance in a later stage since people can participate, have influence and can gather information. However, I am not certain if this collaborative approach will suffice for any design. It is especially interesting how we optimally should implement a plan at 18 different depots (since you only perform a collaborative design workshop at a specific depots with few participants from other depots). For this reason, the develop standard become very important if you have to consider local deviations due to specific client and/or processes and lay-out differences.

Question 3

Under what conditions or circumstances is a collaborative design approach desirable/suited? What are the pre-conditions? Contrary, under what conditions is a collaborative design approach undesirable?

[Eelke:]

This approach suits almost any design challenge. However, the level of participants is flexible (as already stated before) and should be determined adequately. In my opinion this approach is less desired when measures have to be taken quickly due to time pressure or in case of imposed legislation. Then it is not a possibility, but a necessity. However, in case of time pressure and legislation one could still create participation/involvement, but not in a very extensive way.

[Dirk:]

I think this approach is especially helpful in case of qualitative and/or complex problems in which many factors play a role. Often there are multiple possible solutions and various ways to arrive at a specific solution. This approach is less suitable when costs play a dominant role. So I would suggest to use it for qualitative problems.

[Minke:]

In my opinion this collaborative approach for new designs is recommended to perform with the operational core, however, such a workshop sessions can also be used for explorative purposes, so on multiple locations within the organization. Think for example of new customer cases with the operational core, the sales department and our department. And there are much more other possibilities and choices.

Other relevant definitions: workshop time, preparation, expectations (why would employees participate?) and follow-up steps. Furthermore, I think this collaborative approach is especially useful during the preliminary research phase and perhaps the design phase as well (as part of a new workshop session).

Note: this question is relatively broad: pre-conditions are dependent upon the target audience.

Question 4

What are the effects of this collaborative way of designing for the organization of PNP?

[Eelke:]

Main benefit is enhanced feeling of involvement and unity, both by the operational core as the organization itself. However, the most ideal situation is a design workshop with multiple participating depots (both depots+ and standard depots).

Negative effects:

- *this collaborative approach is time-consuming. It will take at least half a day to participate in a workshop session.*
- *when you always let operational employees participate in idea-generation, then our staff becomes superfluous?*

Positive effects:

- *initiating such a collaborative approach in an early stage, when carried out well, leads to a quicker and more easy implementation process as voices are heard beforehand and employees have had influence in the process.*

Other question: how do you make sure that implementation is carried out successfully? I mean, if you invite 2 depots, how do you make sure that the other 16 depots will also accept this solution? Because the not-invented-here argument is often used here.

[Minke:]
Positive effects: acceptance and participation/involvement. In this way, fact-based input is gathers in an early stage of a project and promotes mutual learning (however, this depends on the type of participating stakeholders and specific departments.

Potential negative effects: *this might be a time-consuming problem solving way and the formulation of follow-up steps are very important. So, show what you are doing, the goals, deliverables etc. Otherwise there is a risk that commitment will diminish. Also, it is important that a right balance is found for the intensity/frequency of facilitating such workshops as depots will be 'swamped with work' when too many workshops are initiated.*

Question 5
Eelke has participated in the second design workshop from his role as depot manager. Currently, he is manager Staff Operations and thus directly involved in the decision-making process concerning the secured area lay-out. How do you view this collaborative design approach from the perspective of your new position, compared to your previous role as depot manager? If yes, what has changed?

[Eelke:]
No, my view has not changed. I strongly believe in involvement of the operational core staff processes, in which everybody has his or her own responsibility.

G. Scientific article

Collaborative design for spatial redesign within an organization

A case study at PNP to develop a theoretical framework for facilitation of collaboration as input for top management decision-making

Guido P. Veltman

Section of Systems Engineering

Faculty of Technology, Policy & Management, Delft University of Technology, Jaffalaan 5, 2628BX, Delft, The Netherlands
E-mail address: G.P.Veltman@student.tudelft.nl
Student number: 1512420

June 1st, 2016

Abstract

Collaborative design processes can have many advantages for companies as a way of better problem solving by incorporating diverging views. The combination of collaborative design and spatial redesign has not extensively been applied so far. This research aims at exploring how collaborative design can be used for workplace lay-out redesign challenges on an intra-organizational level. However, involving different organizational stakeholders with multiple perspective is both a solution as well as a new problem concerning the incorporation of multiple viewpoints and how management should integrate collaboration outcomes in their decision-making processes. In this research a case study intervention is organized at PNP, as part of design science research, in which two design workshops are facilitated to allow organizational stakeholders to participate in the redesign of a specific workplace lay-out configuration. The results is a conceptual framework on how collaborative design should be used for lay-out redesign challenges. Future research should address individual factors, such as personality and acceptance/ownership outcomes after an implementation processes is finished.

Key words: collaboration, collaborative design, spatial redesign, requirements engineering, decision-making, case study

1. Introduction

Nowadays, the global market is becoming increasingly competitive. Globalization has significant impact on how organizations manage their daily operations: companies are faced with systematic problems that are complex, open-ended and ill defined. Such problems need contributions from multiple minds – e.g. stakeholders who are either affected by the new solution or have decision-making power – in order to include relevant perspectives to enhance problem solving capabilities. Collaboration is applied more often in organizations to incorporate diverging views.

A specific instinct of collaboration is collaborative design which is used to design artefacts with multiple actors working towards common goals. Within, literature, it has not been researched so far how collaborative design can be applied to resolve lay-out redesign problems. This explorative research aims at providing an answer to the following main research question: ''*how can collaborative design be applied to spatial redesign problems?*''

The next section encompasses a discussion on the research method and consequently insights from literature are provided and the case study description is provided. Thereafter, the intervention design, outcomes and conclusions are given. Subsequently, a generic conceptual framework is developed based on the insights from literature and field-observations from the case study. This article ends with an overview of conclusions and recommendations for future research.

2. Research method

In order to answer the main research question this research will be conducted according to the Design Science Research cycles (Hevner, 2007). This framework aims at guiding a design process by interweaving theory and practice. A first initial process model for collaborative design for spatial redesign is based on literature findings and field observations. Thereafter, this process design is improved based on the design workshops. The following steps are identified within this research: This improved conceptual model is further refined based on insights during the second intervention at PNP. The final model is validated through expert validation. This study includes the following research methods:

- Literature study (1) on relevant topics to construct a conceptual framework: collaborative design processes in a multi-stakeholder context for spatial redesign. This is done by selecting academic journals (e.g. Science Direct, Google Scholar and Scopus) in the field of *collaborative/participatory design, lean management, decision-making, requirements elicitation, process design.*
- Explorative interviews (2) to identify relevant stakeholders, their needs, objectives and perspectives. Output from these interviews are used to conduct a stakeholder analysis. These interviews are also used to derive field observations which can be included in the conceptual mode.
- Collaborative design workshops (3) with all stakeholders based on the TIP framework of Koppenjan and Groenenwegen (2005). This is an explorative method to validate the process design and practically, to elicit stakeholder requirements (requirements engineering) and develop ideas for a lean standard design. A number of two workshops is suggested. The first to validate the initial process design and set design requirements for the lean interior design; the second for validation of the improved process design and to reach consensus on the final technical design of the SA interior. The outcome of this intervention is input for management decision-making.
- Internal and expert validation (4) are carried out to test the final conceptual model. Internal validation is conducted through the organization a workshop at PNP based on the new collaborative design approach. This business problem subject differs from the actual case study topic. Expert validation is performed by expert consultation at Tata Steel.

The deliverables from scientific research include the following: a) literature study on collaboration, collaborative design, spatial redesign, participation and decision-making processes. Secondly, b) a conceptual framework on how to organize a generic collaborative design process for spatial redesign, based on the literature insights and field observations. The deliverables from case study at PNP are the following: c) practical roadmap for PNP to apply collaborative design to solve spatial redesign challenges. This roadmap is derived from the conceptual framework which is tested during the case study. Fourth deliverable is d) a case study inventions outcomes: workshop re-designs of the SA interior including a concept design and elicited stakeholder requirements and argumentation.

3. Insights from literature

Within literature there are different views on collaboration. However, this also highlights the essence of collaboration: incorporating different views for problem-solving purposes in which actors interact with each other to work towards common goals (Stohl & Cheney, 1997). Within literature, collaboration has many advantages, such as increased acceptance, enhanced problem-solving capabilities, organizational learning and better decision-making as multiple viewpoints are accounted for (Hansen & Nohria, 2004). Additionally, job

satisfaction, organizational commitment and performance can be promoted through collaboration (Black and Gregersen, 1997). However, just putting together participants does not make it a collaborative process. Various factors play a role as collaboration is process-oriented and impacted by input factors (on an individual, team and organizational level), process factors (thus interaction between team members) and output factors. Structuring a collaborative process according to these categories will promote successful collaboration.

A specific application of collaboration is collaborative design. Design approaches have changed to more participative ways in which multiple viewpoints are incorporated in designs (Sanders & Stappers, 2008). This concept shares common principles as collaboration. However, during the collaborative process, participants design a specific artefact. Within this research the following definition of collaborative design is established: ''*design approach in which a variety of stakeholders participates in the design process using shared rules aimed at incorporating diverging views, promote mutual learning and working towards a common goal to collectively achieve better organizational outcomes.*'' Within the concept of collaborative design four levels of design are identified which should be considered (Dorst, 2008):

- Object of design: creating a shared understanding concerning the problem and the designed artefact.
- Context of design: the environment in which the artefact is implemented is to be considered.
- Actors who design: stakeholders who participate in designing needs to be involved adequately.
- Process and methodology: the design process itself and used methods influence the design process.

Spatial redesign is performed by establishing standards with organizational stakeholders. Spatial redesign is a design challenge based on the overarching theme of lean management in which continuous improvement (standardization practices) is key to remove waste or slack by organizing the workplace in a most efficient manner. However, there is currently no structured approach which deals with the question how collaborative design is ideally applied within spatial redesign challenges.

Collaborative design is both a solution as a problem as multiple viewpoint are accounted for during the design process, however, collaborative design implies that multiple perspectives have to be considered and incorporated in a design. This means that collaborative processes have to be designed adequately to deal with diverging perspectives, backgrounds, individual (conflicting) goals and their attitudes towards a new layout design. Conflicts can arise between participants in terms of definitions, scoping, interests, goals, expectations and desired outcomes. Moreover, participation of diverging organizational stakeholders also implies power relations, whereas collaboration requires equality among participants. Another issue concerns the level of participation by the operational core. It is not evident to what degree workplace employees are to be involved in in such decision-making processes. This should be addressed in the design of the collaborative architecture. A specific challenge is the fact that redesign assumes that the current layout is already 'designed' which implies that the implementation process is more complex as change of the current situation is required which makes resistance more plausible.

Furthermore, a set of two paradoxes have been identified. The first concerns the tension between on the one hand standardization from a lean perspective to realize continuous improvement through standards and on the other hand collaboration as method to promote innovation. Second, the *participation paradox* plays a role within this research. An organization can involve the operational core in decision-making processes or idea generation initiatives, however, when management is in charge of a final decision, participated employees can experience distrust when their input is not heard sufficiently. In other words, there is a risk that participants of a collaborative design workshop can have different expectations and can be disappointed when their expectations are not met when management decides to implement alternative ideas.

Specific preconditions apply when design processes are organized in this context of collaborative design for spatial reconfigurations. The *role of management* is essential when collaboration is applied to spatial redesign. The role of management is not only restricted to provide support, they also have to establish a sense of urgency, allocate resources, decide on the project phase for collaborative design, assign a project team for making a business plan, setting design metrics, involve design participants and select appropriate design

techniques. Thereafter, the *design of the collaborative architecture* is important as this can be shaped in various ways. The governance of collaboration should be determined a forehand, i.e. how horizontal and vertical diversity is managed (i.e. level of participation and the way how participants are selected) and the way collaboration contributes to the realization of organizational goals. Next to the collaborative architecture, also the principles of *collaborative design* play a main role which applies to the design process itself. Concepts such as *shared understanding* (on scope deviations, expectations, vocabulary and deliverables), multi-perspective, *constructive conflict* and team learning are key in order to promote successful collaborative design processes. Also soft factors influence the design process in terms of trust and ownership. Finally, the deliverables should be clear as this concerns *what is actually standardized and to what extent*.

4. Case study introduction

This research is performed by design-cycle research in which first a conceptual model is develop based on literature insights. Thereafter, a case study at PNP is used to test a conceptual process model to apply collaborative design for spatial redesign problems. The case study is held at PNP which is a parcels delivery service provider in the Netherlands. Nowadays, e-commerce is becoming increasingly popular and this trend has a substantial impact on parcels services which annually increases significantly. In the context of meeting future growth in demand of online shopping and to reduce cost PNP is faced with a layout redesign problem in their distribution facilities. The PNP department Depotbeheer & Ontwerp is responsible to manage and design all procedural standards which serve as guidelines business processes within all 18 depots in the Netherlands mainly on a tactical and operational level. Command & control strategies are applied to ensure that NLI of activities and processes are standardized to ensure an uniform and cost-efficient business. PNP applies lean management to ensure that processes are standardized in order to promote uniformity across the depots, however, in the existing situation layout uniformity is lacking which requires a redesign standard. The selected target area concerns the secured area. Within SA's the following processes take place:

- Registered mail: e.g. passports or confidential letters. Since this service requires a customer signature it is distributed within the parcel service network.
- Chemicals and dangerous goods
- Storage of customer parcels and internal products
- In the planning desk areas (PB) vans are issued mobile administration device and registered mail for the route in the morning before distribution takes place. At the end of the day van drivers hand in non-ordered parcels at the docking stations and hand over the mobile devices at the PB (debrief).

5. Design of the intervention

The conceptual model, based on literature insights, has been translated according to the situation at PNP in which the collaborative model starts with consultation of management to seek for support and select relevant acceptors. Thereafter a target area is to be selected by management for which the organization faces a spatial redesign challenge. An appropriate project phase is to be considered to apply collaboration, management conditions and design metrics have to be established and communicated, an appropriate level of participation needs to be determined including the allocation of required resources. Subsequently, relevant organizational stakeholders have to be engaged with in consultation with depot managers and senior process managers. First vertical diversity is addresses by involving depots and engaged employees. Additionally, stakeholders from the supportive staff can be involved to also tackle other perspectives, i.e. finance, management, HSE, IT, facility, construction, security, HR, designers and lean experts. It is important to carefully consider the cooperating depots and what local deviations can be identified. Thereafter an appropriate workshop design needs to be developed. The second phase concerns the actual design workshop in which the process of requirements engineering takes place. This follows a logical structure and the outcome concerns potential designs and the underlying arguments that led to these designs. This may provide valuable insights for management to take future decisions. The third phase relates to the planning of implementation by management. Workshop

outcomes have to be evaluated and required soft and hard elements needs to be documented. Thereafter a final decision is to be made including a plan for the actual implementation.

6. Case study intervention findings

Below the research insights are elaborated on which the final conceptual framework is based. The insights are structured according to the four levels of collaborative design:

Object of design: creating a shared understanding is key for facilitating collaborative design for spatial redesign. It does not only relate to the problem definition, also objectives of the design effort, expectations, social norms, vocabulary, the physical scope of the target area (including local deviations), and final deliverables (in terms of the type of standardization and the degree of standardization). A shared understanding regarding these issues is achieved by constructive conflict, transparent communication by management, the use of visualisations and the signing of a group agreement. The latter also promotes trust and ownership. A fixed problem statement by the project team is not desired as participants should perceive ownership of the scope and involved problem. However, during implementation a clear problem definition is required to establish a sense of urgency to resolve the problem.

Context of design: the design process is an integral part of a broader context. This means that there is a particular project phase in which collaborative design is applied for problem solving purposes. Therefore adequate project planning is recommended to structure the project phases. Collaborative design for spatial redesign is useful to gather requirements and potential constraints and therefore to explore design options and to generate ideas. Furthermore, transparent communication by management is key regarding the collaborative governance and the way how a layout redesign positively contributes to achieve organizational goals. This also includes information on the design of the process, expectations, the way how participants are selected, follow up steps, deliverables, etc. It is also important that stakeholders can think without any restrictions in order to facilitate effective brainstorming. Therefore participants have to collectively define the problem as this also promotes mutual understanding. Also, during implementation a multi-site problem is an extra challenge as these facilities have their own particular views and local deviations. Therefore, stakeholders who have not participated in collaborative design should be informed on the problem and design arguments.

Framing is important during the idea generation process to avoid resistance. This can relate to specific choices of words, but also to the fact that lean does not need to be mentioned explicitly, as long as lean principles are applied. Next to that, collaborative design for spatial redesign is suitable for qualitative complex problems to test feasibility issues and gather relevant requirements. Less suitable are projects which a strong focus on costs or in case of time pressure or restricting regulations.

An important insight is the environment in which the artefact is to be implemented. A spatial redesign is part of a broader context: it is an integrated lean system with both hard and soft elements. Addressing both factors is conducive for successful implementation of a new spatial design.

Actors who design: it is crucial to consider both horizontal and vertical diversity of involved organizational stakeholders. During the workshop there was no perfect balance found between horizontal and vertical diversity. On the one hand, limited horizontal diversity implies a risk of not covering an diverse set of design requirements and thus different functional roles are required to cover multiple perspectives. On the other hand, mainly horizontal diversity increases the risk of politicization. Also, limited vertical diversity restricts a successful process of gathering requirements from all operational levels, and also transferring ownership to all hierarchical levels, especially employees who are perform the actual work in the relevant work area and effected by the final design. Ownership is enhanced through the collaborative design process itself and by signing a group agreement which also promotes trust and shared understanding on norms and expectations.

Process and methodology: interaction can be promoted by organizing sub groups and facilitate feedback sessions and constructive conflict in general (identifying potential conflicting goals and interests beforehand). These discussions are conducive for team and organizational learning. The paradox of participation can be partly resolved to creating a shared understanding on the final deliverables, open communication of the collaborative architecture of the collaborative design process, establishment of trust and perceived ownership of the final deliverables and to hear everybody´s expectation. Also clear follow-up steps should be clear.

7. Generic collaborative design framework

Based on literature and field observations a conceptual framework is established. The framework comprises four main levels of design in which collaboration takes place and is depicted in the figure below. Note that this framework is based on the case study findings.

Object of design

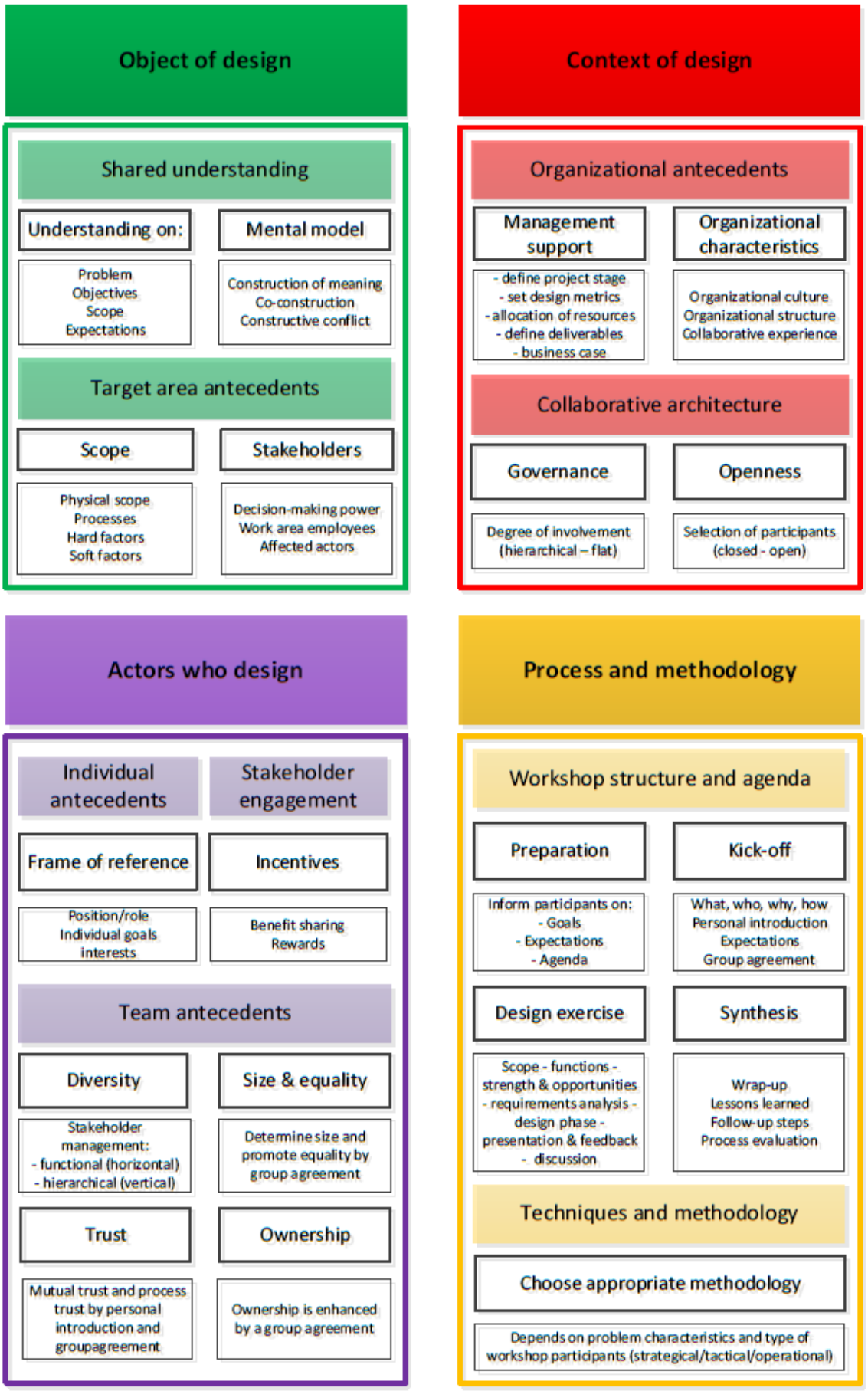
First, the object of design should be considered. Important factors is shared understanding on the problem, objectives, scope and expectations. Shared understanding can be enhanced through creating shared mental models which is realized by application of constructive conflict. In this way conflicts are resolved in a constructive manner and leads to a better shared understanding. Furthermore, the actual artefact to be designed, the target area, is considered. Target area antecedents comprises of scope and stakeholder factors. The scope concerns the physical scope, involved processes and relevant hard and soft variables. Additionally, stakeholders with decision-making power, involved and possible affected actors need to be engaged with.

Context of design

The context of design deals with the environment in which the design process takes place. It starts with organizational input antecedents. Important is the *role of management* to support collaboration, agree on deliverables, define an appropriate project stage for collaborative design and allocated resources. Furthermore, organizational characteristics have an impact on how collaboration should be designed. The organizational characteristics needs to be considered, e.g. organizational culture, structure and past collaborative experience of the organization. Based on this management consultation and the organizational aspects, the collaborative architecture needs to be assessed. There are two main dimensions: governance (hierarchical versus flat) which determines the degree of employee involvement; the second dimension is openness of collaboration (closed versus open) which determines how participants are selected. Important is the environment in which the redesign is integrated. This is a system with both relevant technical and soft factors.

Actors who design

A third aspect is the actors who actually design. Individual input antecedents structure how collaboration takes place between individual actors which need to be selected adequately. Designers have a particular frame of reference based on which they view the problem and thus express their requirements. The frame of reference consists of the individual position/role, their goals and interests. Additionally, team input antecedents concerns variables on the team level. Four elements of collaborative design on a team level are identified. Diversity is desired. This can be horizontal (specific disciplines and functional roles) and vertical diversity (hierarchical relations among participants) ranging from strategic, tactical and operational employees. Second element concerns the group size and member equality. The third and fourth element are soft factors: trust and ownership. Both trust in the process and in others participants is required for effective collaboration. Furthermore, designers should perceive the design process and outcome as their results (ownership) in order to create sustainable solutions which are accepted.


Object of design
Shared understanding
Understanding on:
Problem
Objectives
Scope
Expectations
Mental model
Construction of meaning
Co-construction
Constructive conflict
Target area antecedents
Scope
Physical scope
Processes
Hard factors
Soft factors
Stakeholders
Decision-making power
Work area employees
Affected actors
Context of design
Organizational antecedents
Management support
- define project stage
- set design metrics
- allocation of resources
- define deliverables
- business case
Organizational characteristics
Organizational culture
Organizational structure
Collaborative experience
Collaborative architecture
Governance
Degree of involvement (hierarchical – flat)
Openness
Selection of participants (closed - open)
Actors who design
Individual antecedents
Frame of reference
Position/role
Individual goals
interests
Stakeholder engagement
Incentives
Benefit sharing
Rewards
Team antecedents
Diversity
Stakeholder management:
- functional (horizontal)
- hierarchical (vertical)
Size & equality
Determine size and promote equality by group agreement
Trust
Mutual trust and process trust by personal introduction and groupagreement
Ownership
Ownership is enhanced by a group agreement
Process and methodology
Workshop structure and agenda
Preparation
Inform participants on:
- Goals
- Expectations
- Agenda
Kick-off
What, who, why, how
Personal introduction
Expectations
Group agreement
Design exercise
Scope - functions - strength & opportunities - requirements analysis - design phase - presentation & feedback - discussion
Synthesis
Wrap-up
Lessons learned
Follow-up steps
Process evaluation
Techniques and methodology
Choose appropriate methodology
Depends on problem characteristics and type of workshop participants (strategical/tactical/operational)

Process and methodology

The collaborative workshop should be well-prepared in order to engage with stakeholder participants, create commitment and create an attractive collaborative setting. Beforehand, participants should be informed on goals, expectations and the workshop agenda. The meeting starts with a kick-off in which the reasons, deliverables, involved stakeholders and approach is elaborated upon. Commitment and trust are established by sharing participants' expectations and by making a group agreement with a shared code of conduct. Thereafter the actual requirements elicitation takes place upon which the designs will be based. In the wrap-up the discussion issues are summarized and follow-up steps are communicated. A plausible structure of the design workshop is: a) kick-off; b) defining the physical scope; c) analysis of the target area's basic functions; d) a strength-opportunity analysis; e) the actual requirements analysis; f) addressed hard and soft system factors; g) comparison with preliminary analysis; h) actual design assignment; i) presentation and feedback; j) further discussion.

8. Conclusion and recommendations

This final conceptual framework can be applied to organizations with the following characteristics:

- a relative strong operational and bureaucratic context was identified in which mainly participants from the operating core contribute significantly to develop better solutions for existing spatial problems.
- The framework is both useful for spatial- design and redesign challenges. Application of the framework is limited to an intra-organizational level. This means that only participants from one organization can participate during the design process as involving designers from other organizations requires additional strategies.
- The appropriate project stage in which collaborative design is applied needs to be determined by management. In the context of spatial redesign problems, collaborative design is an appropriate concept for idea generation purposes and to test feasibility issues in which specific organizational stakeholders are only engaged with in the design stage based on stakeholder engagement strategies. Based on the design metrics the best suitable designs are selected for future implementation.
- Furthermore, application of this framework is restricted to complex, qualitative layout-related problems in which an appropriate solution cannot be known in advance and when there are several ways to arrive at a specific solution. This is also known as ill-defined/structured problems.
- However, in case of restricted time or imposed legislation this framework is less suitable as collaborative design is relatively time consuming and needs an extensive planning in order to be employed.

Application of this conceptual framework brings various advantages and potential risks that have to be taken into account. Positive effects are the following: a) increased acceptance and perceived ownership as a number of organizational stakeholders have influence in the process of idea generation and can have their voices heard during collaboration which, in the long term, allows for a more convenient implementation process. Main advantage is that for lay-out redesign their b) specific requirements can be shared which are to be integrated in the final design which leads to better problem-solving. Better problem solving also enhances c) organizational learning as different perspectives and positions are brought together. Another advantage may be that d) the tension between standardization (control) and innovation (freedom/autonomy) can be resolved by allowing organizational stakeholders to participate in the design process. In this way participants can contribute to problem solving processes, innovation and the establishment of specific lean-related standardization. Furthermore, e) feasibility issues can be addressed at an very early stage. By facilitating different perspectives to contribute to the potential designs, financial, technical and social requirements can be checked beforehand which prevents ideas from being blocked in a later stage.

Negative aspects of collaborative design for spatial redesign involves that an insufficiently designed processes of collaboration a) increases the risk of the paradox of participation. If this is the case then

collaboration will work counterproductive. Furthermore, b) collaborative design assumes that participants are treated equally, however, different organizational priorities may exists which makes one's argument more urgent than someone's other input. It is unclear how these conflicts can be resolved properly without negatively affecting trust and acceptance. Last, a collaborative design process requires accurate planning and thus this is very time-consuming.

Several recommendations for future research are suggested:

- The role and impact of the workshop facilitator has not been investigated within this research.
- Secondly, psychological aspect have not been considered. Personality traits, religion, assertiveness etc. could not be assessed here due to time restrictions.
- Thirdly, the conceptual framework for application of collaborative design to spatial redesign problems is a first point of departure for research. The framework is not exhaustive and research is to be performed what other factors have influence on the collaborative process.
- Finally, within this research the main focus was on the problem definition and construction phase. Further research should be performed concerning the testing/validation and actual implementation phase to further research appropriate steps for these project phases.

Several discussions point are elaborated below:

- It remains difficult to provide guidelines on how to resolve the paradox of participation as the actual implementation is out of scope within this research.
- Secondly, the main focus within this research is on the problem definition and construction phase. Less attention is paid to the testing/validation and actual implementation phase.
- Thirdly, psychological factors are not considered within this research. However, they are important determinants for collaboration processes and provide insights to further improve the framework.
- Lastly, observations are based on a limited number of two workshop and involved participants. This has implications for the generalizability of the conducted research.

References

Dorst, K. (2008). Design research: a revolution-waiting-to-happen. *Design Studies*, *29*(1), 4–11. doi:10.1016/j.destud.2007.12.001

Black, J. S., & Gregersen, H. B. (1997). Participative Decision-Making: An Integration of Multiple Dimensions. *Human Relations*, *50*(7), 859–878. doi:10.1177/001872679705000705

Hansen, M. T., & Nohria, N. (2004). How to build collaborative advantage. *Mit Sloan Management Review*, *46*(January), 22–+. doi:Article

Hevner, A. R. (2007). A Three Cycle View of Design Science Research, *19*(2), 87–92.

Koppenjan, J., & Groenewegen, J. (2005). Institutional design for complex technological systems. *International Journal Technology, Policy and Managment*, *5*(August), 240–257. doi:10.1504/IJTPM.2005.008406

Mintzberg, H. (1980). Structures in five: designing effective organizations. *Management Science*, *26*(3), 322–341. Retrieved from http://links.jstor.org/sici?sici=0025-1909(198003)26:3<322:SI5ASO>2.0.CO;2-#

Rittel, H., & Webber, M. M. (1984). Planning problems are wicked problems. In *In N. Cross (Ed.). Developments in Design Methodology* (pp. pp. 135–144). New York: John Wiley & Sons.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(October), 5–18. doi:10.1080/15710880701875068

Stohl, C., & Cheney, G. (1997). Participatory processes. Paradoxical practices. Communication and the Dilemmas of Organizational Democracy, *14*(3), 349–407.