

# Mobile applications on the work floor

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*The use of mobile applications in fast moving consumer goods warehouses*

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## **Abstract**

### **Purpose**

In the fast moving consumer goods warehousing sector companies are constantly in search to improve their processes. This improvement is both in efficiency as well as in the labor conditions for their staff. In the recent years companies got access to much more data about their processes. Now companies are looking for ways to transform this data in to information on which the can base decisions about their process. To help the staff in the warehouses it is important to have access to this data quickly and conveniently. This study focuses on the use of mobile devices in the fast moving consumer goods warehouses to support employees with data to obtain a more efficient process with improved working conditions.

### **Method**

This study will combine the current literature on the use of information technology, focusing on mobile devices in warehouses with interviews and a case study. With combination of these three sources an overview will be presented with recommendations for a company to successfully implement mobile devices in their warehouses.

### **Findings**

For the fast moving consumer good warehouses we found that the use of mobile devices has benefits for both the company and the employee. To achieve these benefits the company has to take the limitations of the environment into account. The benefits identified are; the motivation of staff, efficiency gains, effectiveness gains, speed of communication, electronic integration of business units, integration with supply chain partners, knowledge sharing, accommodating growth, improved decision making and contributing to a superior process. To obtain these benefits from the use of mobile applications the company should align the IT resources with the business needs. Furthermore the company should invest in the adoption of the technology they want to implement, since this differs for each company as well as each environment. In study there are several models which can be used to identify the aspects which influence this adoption. When the adoption succeeds the company can obtain the benefits identified in this study. Although this study is conducted in a single company, due to the support of the case study and the benchmarking company the results can be useful for the sector and future research.

### **Contribution**

This study contributes to the knowledge of the usage of mobile devices in a warehousing environment. The findings in literature are supported by the case study the interviews and the benchmarking company. These findings are not only focusing on the benefits and limitations of the use of mobile devices but also cover the adoption of technology and the use of gamification in mobile applications. From these findings a recommendation is provided which helps to introduce mobile devices in a fast moving consumer goods warehouse. This recommendation is not only applicable to Albert Heijn but also to other companies in the fast moving consumer goods warehouses.

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# 1. Introduction

## 1.1 Background

Albert Heijn is a retail company that started in 1887. The mother company Ahold was formed in 1973, which also holds other companies like Etos, Gall&Gall and Bol.com. At the moment Albert Heijn has more than 850 stores in the Netherlands of which 260 are operated by franchisers. In 2015, 236.000 people were employed by Ahold; Albert Heijn had a market share of 34% in the Netherlands. To supply the stores Albert Heijn has 5 distribution centers of which 4 are regional and 1 is national. Besides these the company has external service providers which operate specialized warehouses. This research will focus on the distribution centers but may eventually also be advantageous for the stores (Geschiedenis Albert Heijn in Detail | AH.nl 2016a). Mid 2016 Ahold merged with Delhaize. Together they have 6500 stores. Through the merger the companies wants to profit from sharing distribution and a higher purchasing power (Ahold, Delhaize Shareholders Approve Benelux Supermarket Merger 2016). Delhaize has 3 distribution centers in Belgium (Zellik, Ninove and Molenbeek).

Albert Heijn still uses the values defined in 1887, reliability, quality and service. Besides these values the mission of the company is to be a supermarket for the rich and the poor. They express this mission in the slogan; “the daily goods payable, the special goods accessible”(Over Albert Heijn | AH.nl 2016).

Since the amount of work is rising, the company is constantly looking to improve their efficiency, but also wants to take care of the wellbeing of their employees. For the improvement of the efficiency with respect to the wellbeing of the employees in the distribution centers the company is evaluating the use of applications on mobile devices in the workspace. This research will focus on the benefits and limitations of using such applications and proposing a way to successfully implement these in the current organization. As a first move in discovering the possibilities of mobile applications in the warehouse logistics support started with the pilot of an application called Prepchat, which main goal was to improve the communication between the employees in the distribution centers and the support department. The findings of this research will be compared with the case of Prepchat to compare the outcomes with the experiences of Prepchat.

## 1.2 Prepchat

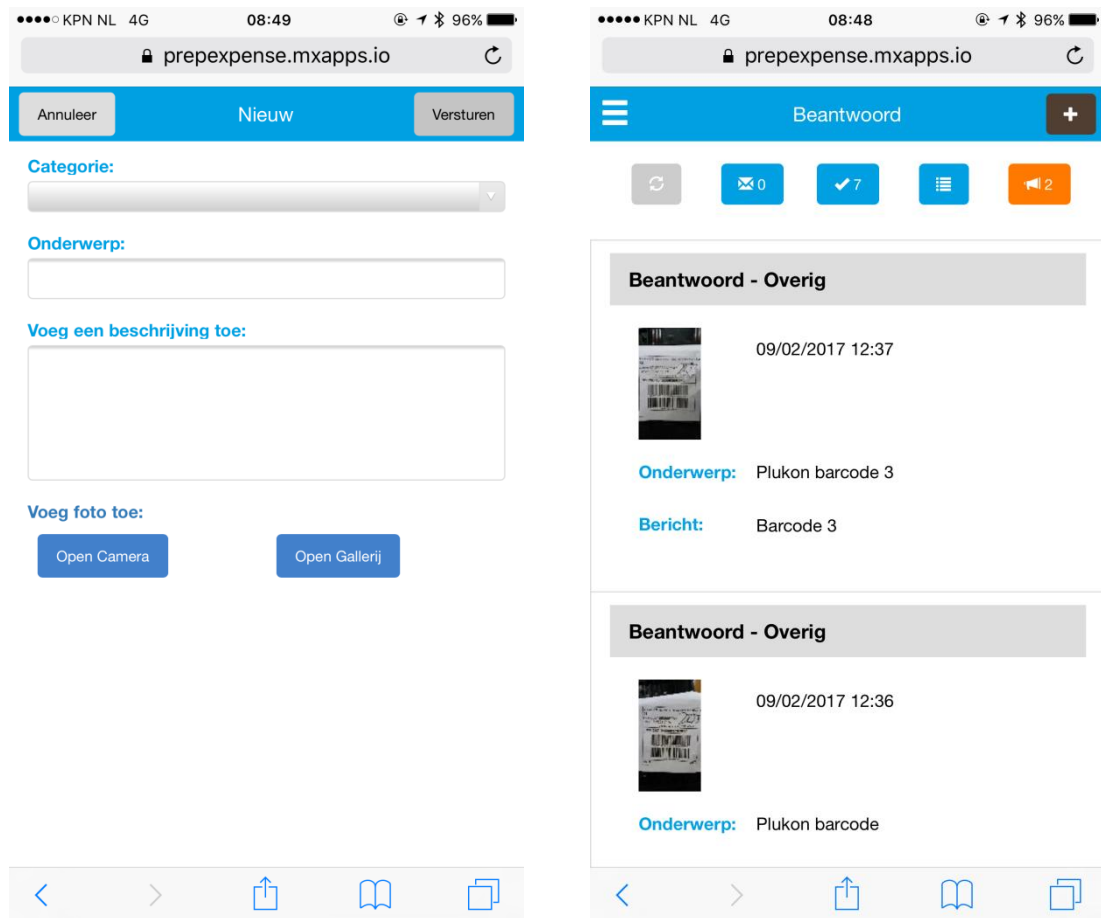
The logistics support department focuses on supporting the operational processes within the warehouses of Albert Heijn as well as the improvement of these processes and the introduction of new innovations. One of these innovations was the development and building of a mobile application which they called Prepchat. This application was tested with a pilot in the national and four regional distribution centers. Prepchat provided the employees on the warehouse floor with the ability to directly contact the support department e.g. the ability for sending pictures to explain their request and according to a user evaluation improves the feeling of contribution of the employees with their job. In **Error! Reference source not found.** three screens of Prepchat are displayed. In the upper left picture, the screen employees use to send a message to Logistics preparation is shown. In this screen they can select a category, subject, description and a picture. The answered messages are shown in the upper right screen. In the bottom screen the Helpdesk view is displayed. From this screen the helpdesk can reply to messages from the employee and export an overview of the questions asked.

An overview of more screens in Prepchat, such as the screen for all messages and the screen with

replying on a reaction are shown in Appendix A. A pilot of Prepchat was started in week 25 of 2016 and lasted 13 weeks. From this pilot the company got the following feedback; the employees perceived the application as easy to use, useful, fast and exciting. The named disadvantages are; the connection, the 8 megapixel camera on the provided phone, the application could not be run on their own phone and the application was relatively unknown amongst the other colleagues, this limited the input for the users and made it hard to get their colleagues enthusiastic. The positive effects of Prepchat resulted in the discussion if the use of mobile devices and applications can contribute to the daily operations. This discussion is one of the reasons to start this research.

The discussion on mobile applications initiated by the pilot of Prepchat developed further driven by the opportunities created by the platform, on which the application was developed. In this discussion, the question was raised: *“if the logistics support department should continue to develop applications or if this should be done by the information technology department”*. Within the logistics support department there currently isn't a structured portfolio on what they want to develop. They see a lot of processes which can be supported with the use of mobile applications but don't have an approach to do this. Furthermore they don't have clear guidelines on how to develop these mobile applications. With the information technology department they are currently working out a way which can help them doing this. The discussion also resulted in a number risks, challenges and concerns besides the missing guidelines such as; the efficiency of employees might suffer from distraction, the variety of employees based on experience with technology and age, the safety in the distribution centers. Besides these complications the management also is concerned about the security, reliability, maintenance and portability.





PrepChat

Mijn Berichten

Collega's

Mijn berichten

Vernieuwen

Nieuw bericht

Open bericht

Bekijk foto

Verwijder bericht

1 to 10 of 32

Status	Reden	Antwoord	Datum	Type	Beschrijving
✓	Beantwoord door Helpdesk Prep		23/08/2016	Slotting	Hallo, na meerdere signalen vanaf de vloer te hebben ontvangen hierbij ...
✓	Beantwoord door Helpdesk Prep		26/08/2016	Slotting	Deze frisdranken van ah basic steken links en rechts van de pallet enkel...
✓	Beantwoord door Helpdesk Prep		30/08/2016	Overig	Pallet slecht gestapeld/kolommen. Leverancier graag om oplossing vraag...
✓	Beantwoord door Helpdesk Prep	Beantwoord door Helpdesk Prep	27/01/2017	Overig	Gisteravond en vanavond stond er verkeerde informatie in de barcode bij ...
✓	Beantwoord door Helpdesk Prep		09/02/2017	Overig	Barcode 1
✓	Beantwoord door Helpdesk Prep		09/02/2017	Overig	Barcode 2
✓	Beantwoord door Helpdesk Prep		09/02/2017	Overig	Barcode 3
📄	Gearchiveerd door DCO (2)		03/08/2016	Overig	Waarom staat die kast hier?
📄	Gearchiveerd door DCO (2)		03/08/2016	Overig	Al geruime tijd zijn de achterkant van de geldermalsen labels slecht scan...
📄	Gearchiveerd door DCO (2)		03/08/2016	Slotting	Bij hoge omzetten zeer veel overstapelen. Met als gevolg breuk; ergonom...

Figure 1: Prepchat screen (Prepchat 2017)

### 1.3 Applications at Albert Heijn

Within Albert Heijn the logistics support department has the function to ensure complete and timely delivery of orders to the stores. The department is responsible for the tactical and operational planning of all distribution centers of Albert Heijn. To improve their performance the department is constantly investigating the existing processes to improve them. They also focus on improving their own way of working to adapt to demands of the warehouses. Due to the rapidly changing transport and logistics sector it is important to have the required information quickly available to the different users. Furthermore the use of this information has also impact on other departments and employees of the company. These can benefit from accurate information. In Figure 2 all departments are shown which cooperate with the logistics support department either by sharing information or using applications. The red arrow indicates email while the black arrows indicate intranet transfers. For example, the replenishment department, who are responsible for the store orders and warehouse inbound orders and the transportation department, who delivers the goods to the stores, can benefit from the access of data. Both of these departments are intensively cooperating with the logistics support department to ensure a steady logistic process.

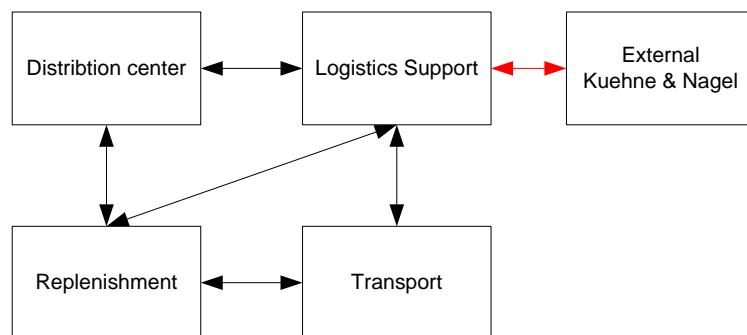


Figure 2: Departments within Albert Heijn Logistics (This thesis 2017)

Logistics support and the distribution centers use an Aptean WMS. This WMS is combined with a voicepick system. The transport department uses a system called transport in-uit and a system called multistop. The output of these systems is used by both the transport and the logistics support department. Replenishment uses a set of different systems to determine the store orders which are the input for both transport planning and the inbound orders for the distribution centers. Besides these departments also individual distribution center employees can benefit from the available information such as new pick sequences, changes in pick locations or improved stacking methods. This information can give them feedback on their way of working or help them to do their work better in terms of safety, intensity and productivity.

An example of how the logistics support department helped employees to improve the current process is by the introduction of the communication through Prepchat. Although Prepchat was built without prior research, researching the use of mobile applications in distribution centers several interesting aspects arise.

To be able to use mobile applications provided by the company, employees should be able to access them on a device either being mobile or stationary. GFK in 2015 calculated the total number of smartphone in the Netherlands was 10.000.000, and was still growing with 4% each year(GFK Rapport 2015). This makes the Netherlands an ideal location to use applications on a workspace,

although the question remains if a company should provide the phones if they require employees to use them for job related tasks. Albert Heijn Logistics is looking into different types of applications such as: mobile Warehouse management, applications to improve communication between departments which influences the accuracy of order delivery and timeliness, decision making applications and self-service applications for employees. For the use of devices each company has their own policy or must at least make a policy if they intend to make employees use their private phones. Examples of these policies are widely available and could be used for a company specific guideline (Employee Cell Phone Policy Template 2016; Brans 2016). Another option is to use a bring your own device policy to let employees use their own mobile phone for company purposes. This also applies for the use of mobile phones at work, since every company is trying to find the best way to deal with this, since a mobile phone is both convenient as well as a nuisance at the workplace. Albert Heijn logistics is currently in a pilot phase of using private mobile phones in the distribution centers. The potential benefits and constraints should be made clear. Currently a lot of use is justified by perceived usefulness, while some constraints are underestimated or not recognized at all. Another important part in the successful use of applications is the adoption of the technology. All of these aspects also apply to gamification which can be described as the use of video-game elements in non-video-game environments (Deterding et al. 2011). Gamification can be an extension to the use of applications in the distribution centers. These aspects also apply to serious gaming which can also be implemented without the use of mobile devices. The difference between gamification and serious gaming is the setting of the application. In gamification game elements are used while serious gaming is a game with elements which come from the business. Albert Heijn Logistics is interested in the use of gamification because it can contribute to the motivation and team building of employees. Furthermore Albert Heijn has always been leading in the sector with regard to the use of new technologies. To serve their customers better every day the company wants to remain this position. They are currently testing the use of gamification in the stores. These first tests of gamification in the stores of Albert Heijn are received well. The employees who were participating in the stores mentioned the competition element and the teambuilding as most important factors of gamification. The company is satisfied with the test due to the positive effect on customers. The goal of the gamification was to increase the employee service level to customers and customers responded on a survey that they mentioned a positive change in the stores with the pilot.

#### **1.4 Research setting**

We will perform a case study within the logistics support department of the retail company Albert Heijn. The logistics support department focuses on supporting the operational processes within the warehouses of Albert Heijn as well as the improvement of these processes and the introduction of new innovations. The department consists of members such as operational support, tactical support, specialist, project manager and team leaders of these different teams. To increase the interaction with the employees of the distribution centers focusing on slotting, process improvement and remodeling they started using a mobile application called Prepchat. This application is developed by the department and used as a test to gain experience with the development and use of mobile applications.

## 1.5 Research goal

As mentioned, the positive effects; contact with the warehouse floor, faster communication, more involvement of employees and more input for the logistics support department. These effects of Prepchat resulted in a discussion on the wider use of mobile applications. This discussion focuses on safety in the distribution centers, use of mobile devices, the potential of the use of applications and the value for the supply chain of using applications. The objective of this research is to contribute to this discussion by researching the possibilities of using mobile applications and gamification on the workspace in Fast Moving Consumer Goods distribution centers. To achieve this goal, first an exploratory research is held on the development and implementation of mobile applications at the workspace in a warehousing environment for Fast Moving Consumer Goods. Secondly, these findings from the exploratory research will be used on a case study in the distribution centers of Albert Heijn. In this research we will focus on both the current theory on the use of mobile applications in FMCG warehouses, the business case and actual adoption of mobile applications for warehouse operations within Albert Heijn. The research will consist of benefits and limitations, adoption, software quality and the organizational impact. Besides these aspects the use of mobile applications is limited by the following set of constraints;

- The applications have to be compatible with the currently used systems.
- No compromises to the safety and wellbeing of employees can be made as this is part of the overall strategy for Albert Heijn Logistics.
- The applications should be easy to use for all users involved.
- The applications cannot compromise the current efficiency of the employees.

## 1.6 Research questions

In order to determine the possibilities of using mobile applications and gamification on the workspace several aspects have to be investigated. The first aspect is what will be the potential to both the company and the employees of using applications on the workspace. To answer this question this research will focus on what similar companies are using. This contributes to the found possibilities in literature and also enables us to learn from the experience of others. The term workspace is used to describe the operations area of the distribution centers. Results of this research may in the future be extended to other parts of the company. The main research question is;

*What is the potential value of using mobile applications on the Warehouse shop floor in Fast moving consumer goods?*

To answer this question, we use a set of five sub-questions. Each question addresses a part of the main question which will help finding an answer to this question. We start with identifying successfully implemented applications in other companies, which can help determine benefits and factors contributing to success.

*1. What are best practices for the use of mobile applications on the work floor in other companies in the FMCG sector?*

To narrow down the opportunities, it is important to find any constraints that might be in place; these can be laws, safety regulations or company rules which prohibit certain possibilities.

*2. Which constraints are in place for using mobile applications in the distribution centers?*

After finding the available applications, best practices and business case, the adoption of these systems need to be researched. For the adoption of the technology both the technology acceptance model (Venkatesh and Davis 2000) as well as the unified theory of acceptance and use of technology (Venkatesh et al. 2003) should be considered. The TAM model can be used to determine the adoption of the new technology by evaluating the perceived usefulness and ease of use. While the UTAUT model can be used to determine the influence of social influence and factors like; gender, age, experience and voluntariness of use of the new technology. Combining these two the adoption of the technology can be addressed. The TAM and UTAUT model address the adoption among employees while the organizational level of adoption can be supported using a business case view. In this research we will select the best model for mobile applications in a FMCG warehouse.

### *3. Which elements are required for successful adoption in distribution centers of FMCG?*

When the opportunities are identified the company should be able to track their impact on both the company as well as on the employees. If the effect is positive it can be a stimulus to continue while if the effect is negative the possibility should be evaluated and be adjusted or even stopped. Once the constraints are identified we should ensure that the possibilities can be fitted into the strategy of Albert Heijn, each possibility should contribute to at least one aspect of the strategy.

### *4. How can the use of applications improve the efficiency and be embedded in the strategy of Albert Heijn logistics?*

Finally the required organizational change needs to be investigated. Since the current structure is hierarchical people may be required to change since the use of applications might conflict with the current organizational structure.

### *5. Which organizational changes are needed to enable the use of applications in the distribution centers of Albert Heijn?*

With these questions an answer can be formulated to the main question. In the next paragraph the research approach followed to answer these questions is described.

## **1.7 Research approach**

The research will start with a literature study in which the main factors influencing the use of mobile applications in FMCG warehouses will be determined. This will be done by examining other industries in which the use of mobile applications is studied and using information systems technology adoption papers which can be applied to the warehousing environment. From this literature research a set of interview questions can be setup to compare the findings of the literature with the opinion of employees within different departments of the company. These interviews will be conducted on the management of different distribution centers and members of the logistics support department. Since this research has to be conducted in a limited timeframe this study focuses on the most influential factors of the usage of mobile applications. For the interview a set of questions will be setup based on the findings in existing literature. The questions will focus on the potential benefits and limitations in the warehouses of FMCG.

Besides comparing the literature with interviews the explorative study will also include a benchmark, setup by interviewing another player in the FMCG sector. This is done to compare the possibilities

and insights of Albert Heijn with other companies in a similar market. This benchmark will focus on the use of mobile applications in similar environments as the Albert Heijn environment.

Insights acquired from the interviews, literature and the benchmark will be applied on the existing case of Prepchat. Doing this the findings of this study can be compared to the experiences learned from Prepchat. This will show if the findings of this research are applicable, since Prepchat is used with satisfactory in the company.

The case study on the use of Prepchat is a useful method for this research since the research is in a niche field, where the theory being researched is novel. The use of the case study can be used to test the empirical validity of this research. The case study enables the building of theory independent of prior literature which in this case is little present (Eisenhardt 1989).

### **1.8 Scope of the research**

This research will be conducted in a warehousing environment of fast moving consumer goods sector in the Netherlands. In the study we focus on the benefits, limitations and other factors that influence the use of mobile applications. First a literature study will identify all factors which influence the use and the current insights in the benefits and limitations found in other sectors. The outcomes of this literature will be match with interviews within the company and a second company which is also a large player in the fast moving consumer goods sector. Finally the findings will be applied to the application Prepchat to verify the findings of the literature and the interviews. The comparison to Prepchat is relevant since this application is perceived as successful within the organization. The research will end with a recommendation to the management of the warehouses which they can use to develop a strategy for their company.

### **1.9 Research structure**

The research starts with conducting a review of existing literature. This can be done using a focus on concepts. Literature should be searched based on the topic, not on the research methodology. The review is effective when it creates a firm foundation for advancing knowledge (Webster and Watson 2002). To ensure the review is carried out correctly we use a structured approach using both forward en backward searches of the source material.

For this literature we select the most influential papers since we have a limited time to conduct de study. During the search a focus will be set on papers published since 2002. Although we can't exclude all papers before this year, since some influential literature is published before this date and we also might need to use out of other fields of research. The search will start with the key words; "mobile applications", "gamification", "serious gaming", "workspace applications", "applications in warehousing", "mobile", "apps", "warehouse management system" and "adoption".

After this initial search we identify the factors that influence the use of mobile applications in FMCG logistics warehouses. With these factors we can extend the search, to find the required literature to explain these factors. Also for these papers a forward and backward search will be used to identify other relevant papers. For some of the factors we may need to search outside the information systems research field. This will contribute to a total overview of literature for the defined factors.

The papers found in the literature search are presented in Appendix B in which they are related to the categories; adoption; gamification, workplace applications, information systems in logistics,

organizational impact and mobile applications. Using these categories, we can use the papers to answer the different research questions.

In Figure 3 the research approach is displayed. Starting with the background, proposal, problem definition, research questions and design in chapter 1. Following is the literature review with the outcomes in chapter 2. The interviews in chapter 3 and the results of chapter 2 and 3 integrated and applied on Albert Heijn in chapter 4. Next is the case study in chapter 5, to verify the findings of chapter 4. The research will end with the conclusion, discussion and implications in chapter 6.

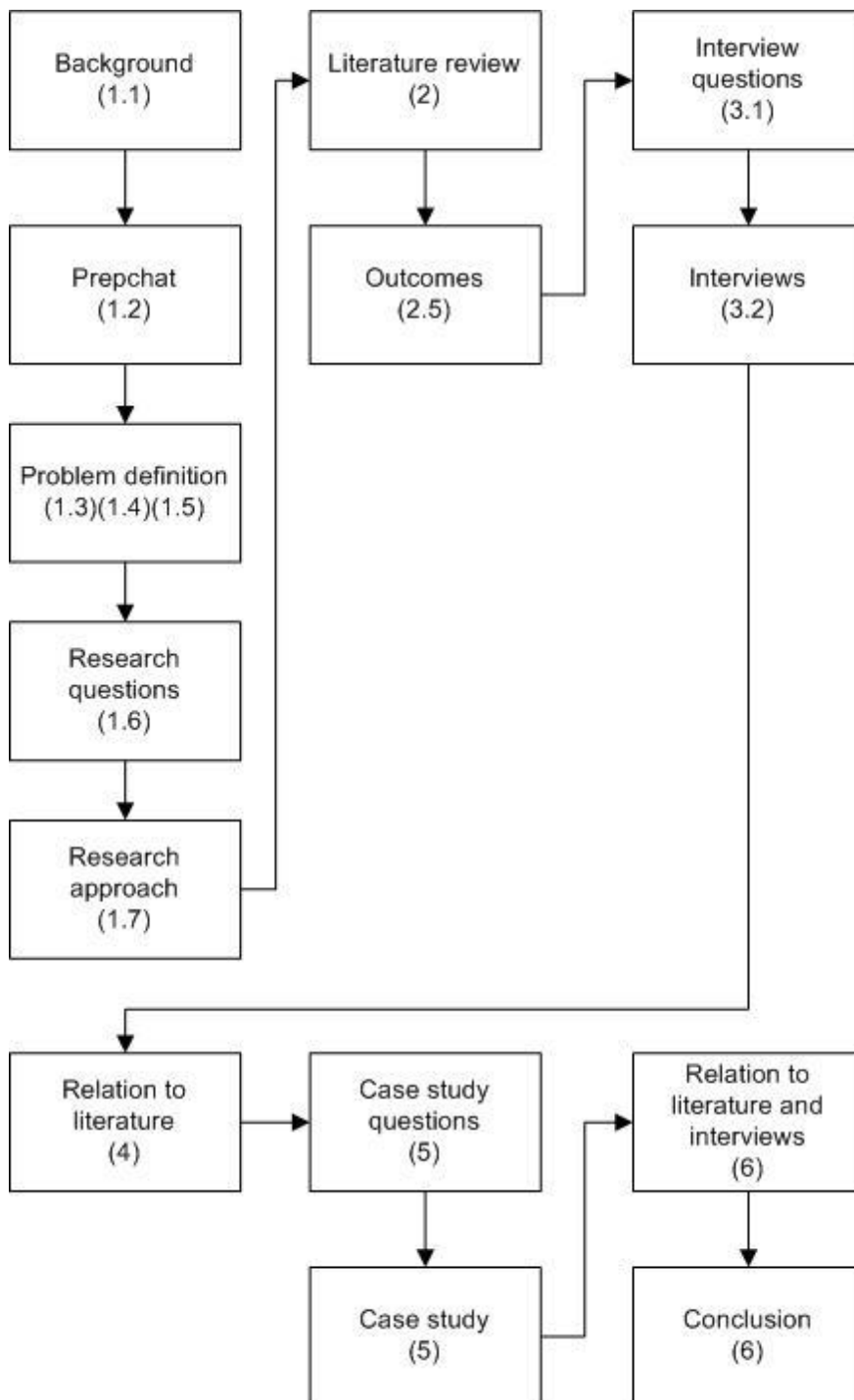


Figure 3: Research approach (This thesis 2017)

## 2. Literature Review

In this chapter we discuss the literature found about the value and constraints of the use of mobile applications. In section 2.1 we will discuss the benefits and constraints of mobile applications. Following with a business case view for the company in section 2.2 how to achieve the benefits mentioned in 2.1. To achieve the benefits, the adoption of technology has to be successful, in section 2.3 possible adoption theories are discussed to explain the usage of mobile applications and define which theory fits best to this research. To further enhance the use of mobile applications in section 2.4 the use of game elements is discussed, these are thought to have a positive effect on the use of mobile applications. In section 2.5 we will summarize the chapter and present the findings.

In previous research the use of applications on mobile devices and gamification has been tested in other industries such as education (Ibáñez et al. 2014), (Fitz-Walter, Tjondronegoro, and Wyeth 2011), Healthcare (McCallum 2012), government (Bista et al. 2014), software engineering (Pedreira et al. 2015) and online retail (Insley and Nunan 2014). In logistics, research has been done to test the effect of serious gaming and gamification on employees but there no studies could be found to decide whether or not to use an application with or without a serious gaming or gamification element. (Wood and Reiners 2012), (Hense et al. 2014), (Remi-Omosowon, Cant, and Langensiepen 2016). In these researches the usefulness of gamification is described for different sectors. Throughout all the results the contribution to improve learning capabilities and increased engagement of employees are shared. The main disadvantages of gamification pointed out are the maintenance to keep the game attractive and the use for all employees, since not every employee is triggered by this type of application.

Since this environment presents different challenges, such as safety on the work floor and low educated employees compared to other industries as mentioned earlier in this chapter, in this research a contribution will be made to address the lack of studies to the use of mobile applications and gamification in a FMCG warehouse environment. In warehousing, there is a rapidly changing flow of goods and additional procedures to cope with and even more important strict safety regulations.

A software development process consists of a number of phases shown in Figure 4: The software development process (What Everyone Is Saying About Software Development Process – Solidarity Online 2016) which starts with the project scope and ends with the delivery of the product.

This research will focus on the first part of the development process and the decision process before the actual development. This decision process focuses on the question if an application should be developed and which challenges come with the use of mobile applications at the work floor. This literature review will focus on the decision process, whether or not a company should build an application and what will be the goal and constraints of the application. Furthermore literature of adoption will be used to determine the influence of the application to both the company and the employees and discuss the technique of gamification of applications. The outcomes of this research can then be used to setup interviews within the company and with a benchmark company. Using the outcomes of the literature, interviews and the benchmark an evaluation of the decision process for the company can be made. The literature will be divided in benefits and limitations, potential for the company, adoption of mobile applications focusing on both the company and the employees and the use of gamification techniques in mobile applications.



## 2.1 Benefits and constraints

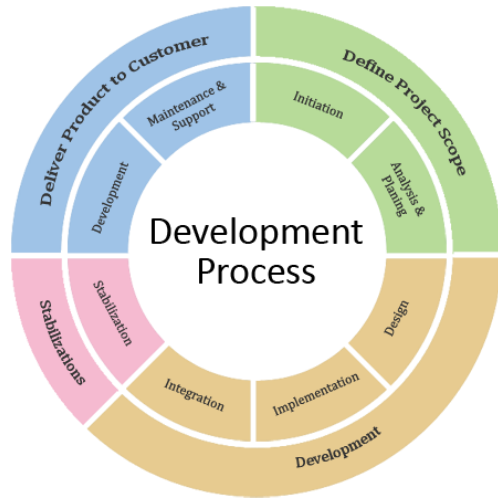


Figure 4: The software development process (<http://solidarityonline.org/what-everyone-is-saying-about-software-development-process/2016>)

In the decision process if the company should use an application, identifying the benefits of having an application for the specific purpose is one of the first steps in the process. It is important to identify these benefits upfront, to ensure that during the development the desired effect is clear to every stakeholder involved (Scheepers and McKay 2004). When defining benefits, there is a set of benefits related to the adoption of technology; the improvement of encouraging and motivating staff, efficiency gains often associated with reduced costs, effectiveness gains obtained through the use of mobile technology.

To achieve the desired benefits the application should be designed to fit the firm's tasks. This ensures that the

applications improve the organizational performance and deliver the benefits they were developed for Figure 5 (Soh and Markus 1995). The results of developing an application often turn out less successful mostly caused by a lack of ownership and the change of requirements and specifications during the development. Another cause for not achieving a successful application is not setting a clear description of the final application. This may lead to ending up with a different application as thought off in the beginning of the development.

In previous research several benefits for work related issues were identified such as; flexibility, learn at own convenience, information relevant to location and current information, speed of communication, electronic brokerage, electronic integration and increasingly more integration with supply chain partners (Ally et al. 2013), (Malone 1987), (Auramo et al. 2005).

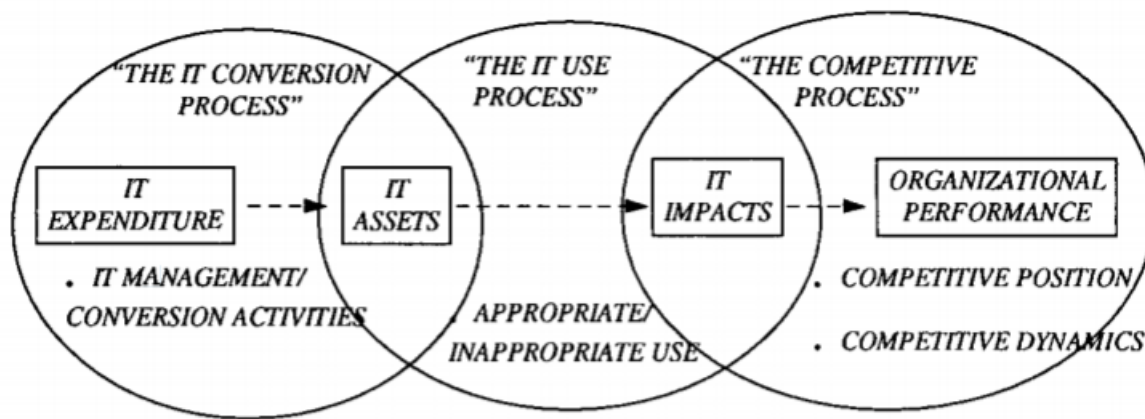


Figure 5: IT use (Soh Marcus 1995)

The study of (Radhakrishnan, Zu, and Grover 2008) shows two things, first a perspective of how IT can create superior process capabilities and second a reason to invest in information technology which can boost critical business processes. A remark has to be made to this, since every company differs in how IT is effectively used. They argue that organizations should do the necessary organizational process changes first after which they can benefit from the IT investments. These concerns about the productivity of information technology were first mentioned in the late 1980s, but since then research has proven that computers contribute far more too economic growth compared to the needed investment. This impact is even growing in the coming years (Brynjolfsson and Hitt 2000). Whilst both improved service and lower costs are significant reasons for companies to implement warehouse automation, it is the imperative of the need to accommodate growth that is found to be the main reason (Baker and Halim 2007). Automation is often associated with business growth, companies expect to gain supply chain benefits since they need less inventory but can maintain the other costs at acceptable levels.

In the research of (Sheng, Nah, and Siau 2005) they identify three strategic implications of mobile technology; *"(1) improve working process; (2) increase internal communication and knowledge sharing; and (3) enhance sales and marketing effectiveness."* For mobile applications they have identified six objectives which are; maximize customer service, maximize company image, maximize employee satisfaction, maximize efficiency, maximize effectiveness, and minimize cost. Mobile applications should maximize the sum of these benefits for the company to achieve the maximum overall benefit to the company. With Figure 6 the author's show how fundamental objectives can be achieved through means objectives, which is how company strategies can be supported or achieved via the use of mobile technology (Nayebi, Desharnais, and Abran 2012). found portability, location awareness and accessibility as the most factors influenced by mobile applications. In health care the use of mobile applications is extensively tested as mentioned by (McCallum 2012). In health care they found the contribution to personalized treatment and less hospital visits as well as improved diagnostics to be most positively influenced by mobile applications.

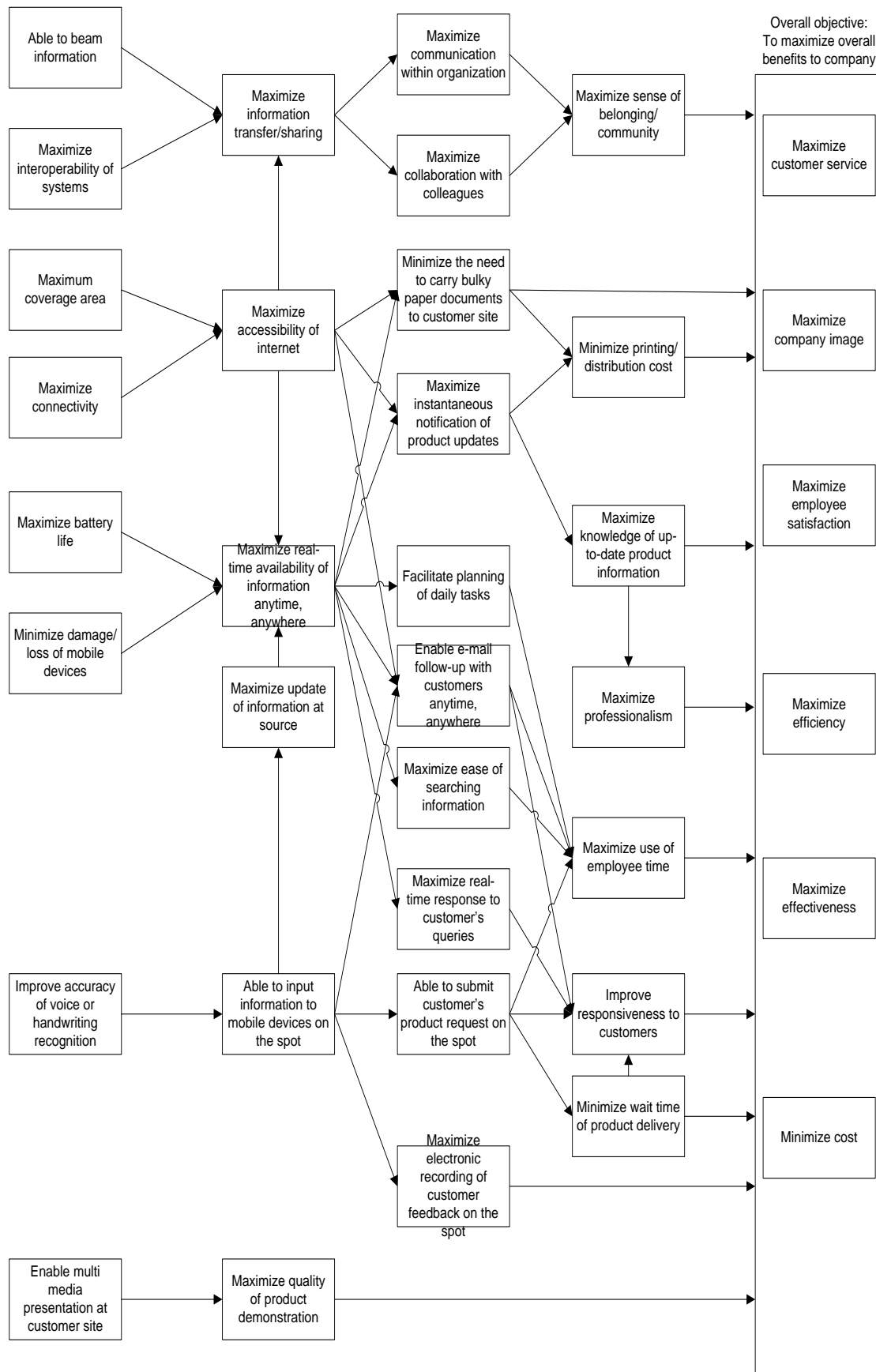


Figure 6: How to achieve fundamental objects (Sheng, Nah, and Siau 2005)

This figure is a representation of how fundamental objects can be achieved by an organization, which might be a good way to offer insight in how the use of mobile applications contributes to the strategy of the company. On the right side of the figure the objectives of the strategy of the company could be displayed while on the left side the contribution of mobile applications can be made clear (Orlikowski and Gash 1994). A company can construct such a figure for themselves by first defining the overall objectives of the company. These can be found in the vision and strategy of the company. From these objectives factors can be identified who positively influence the objectives. Working back this causal chain the company can identify all the means that positively influence the overall objectives.

In table 1 all the identified benefits are listed, divided in tangible and intangible benefits. For each company both are important, the intangible focus mainly on the effects on the employees and customers. While the tangible benefits focus more on the company's financial goals.

<b>Tangible benefits</b>	<b>Intangible benefits</b>
Reduced cost	Improved customer service quality
Improved productivity (i.e. amount of output produced per unit of input)	Improved organizational efficiency
Increased profitability	Quicker response to customers
Increased market share	Improved decision-making ability
Savings in labor	Superior product quality
Increased consumer surplus (i.e. the accumulated difference between consumer demand and market price)	Knowledge/information management and sharing
	Improved coordination/relationships with partners
	Other forms of competitive advantages

**Table 1: Tangible and Intangible benefits of mobile applications (Collection of literature findings in this thesis)**

Besides the benefits the use of mobile applications also has some limitations. In each company there are several aspects which influence the use of applications on the workspace. In distribution centers safety is the most important factor, whatever is introduced in the organization should not negatively impact the safety of the employees. In the most optimal case it should even contribute to an enlarged safety in the distribution centers. According to (Teizer et al. 2010) technology can be used to improve safety of employees; in their research they led technology be a barrier between humans and equipment.

The use of applications might influence the safety or at least the feeling of unsafe behavior which is caused by the impact on the awareness of employees. This is caused by the use of mobile phones or other devices that distracts the employees of their main tasks which will reduce their awareness to their surroundings (Hancock, Lesch, and Simmons 2003). In contrast to Baker and Halim, others conclude that there is no evidence that IT leads to an improved profitability. While it has severe impact on the organization, this can lead to a reduction in cost but this will be spend on IT to maintain the systems. So IT can be used to cost-leadership or quality or service improvements if the company wants to invest in IT (Hitt and Brynjolfsson 1996). The information needed for the applications has to be transferred from the company to the device; this can be done in different ways such as onsite installation, internet or local network. This should be in line with the installation of other devices within the company but is also dependent on which device is used for the application.

## 2.2 Potential for the company

Since each company needs to have a solid case for their investments, it is important to discuss the business case for the use of mobile applications. Besides the costs which might differ for each application other important factors to focus on as a company are; integration in strategy, perceived result both by the employee and by the company, organizational impact and the quality of the software. The integration in strategy is important for a company because if the application does not contribute to the strategy and is focused on productivity only it will not succeed since it can have enormous impact but misfires in the wrong hands (Powell and Dent-Micallef 1997). Therefore for each new application it is important to ensure that it contributes to the vision and strategy. This will also boost the involvement and engagement for the use of the application. A company in the FMCG sector that wants to use applications in their warehouses should thus ensure that the applications support elements in the strategy of the company. When starting to develop an application a company has to check how the new application will contribute to their strategy (Ives, Jarvenpaa, and Mason 1993). If this is done correctly for each application the strategy is enforced by the applications used in the company, this will lead to a positive effect for the companies goals.

For both the company and the employees each application has a perceived result. The perceived result for the employees is based on the function of the application and the expected impact on their job. While for the organization the perceived result can be based on the motivation of employees and their learning possibilities. The organization has to create an environment in which the employees can benefit from the full potential of the application. With regard to organizational learning it can be described like: If the right IT-enabled learning mechanisms are used for learning under the right environmental and organizational conditions, they can have a considerable benefit for organizational learning. If an organization uses the wrong type of IT-enabled learning mechanisms given environmental and organizational conditions, however, those mechanisms can be severely detrimental to organizational learning. Thus, IT can be a double-edged sword in relation to organizational learning either helping or hindering learning (Kane and Alavi 2007).

The perceived result of each application may differ since the relation between the ease of use, usefulness and usage may vary for each of the users, these effects are caused by factors like sophistication and experience (Adams, Nelson, and Todd 1992).

The introduction of an application does not only come with a perceived result it also has impact on the whole organizational level. For the organization changing the way of working comes with new challenges. With regard to the implementation of IT these challenges make the adoption of IT by the employees more difficult. Since each change affects the work and responsibilities of employees they will have to adapt to the new situation. This need for adaption is made hard by resistance to change because employees don't know what to expect and are afraid that the value of their job changes. Besides the change in job tasks the employees receive less information since the new way of working passes their position. To ensure the success of the application employees need to know what is expected of them in the new situation and how they can contribute to the new way of working (Delone and McLean 2003).

Furthermore for a company it is important to ensure a working information system. This is often done by the IT department; they are responsible for the hosting and maintenance of the application. This hosting and maintenance of the application is important; in most companies it should be integrated in the current IT infrastructure. The IT department often has a strict set of rules for an application to be supported; this ensures quality but also makes the development more complex. The software should be of high quality to ensure reliability and safety. In Figure 7 an overview of

external and internal quality is provided to which the software should comply to ensure acceptance by the ISO standard (ISO 25010 2016) .

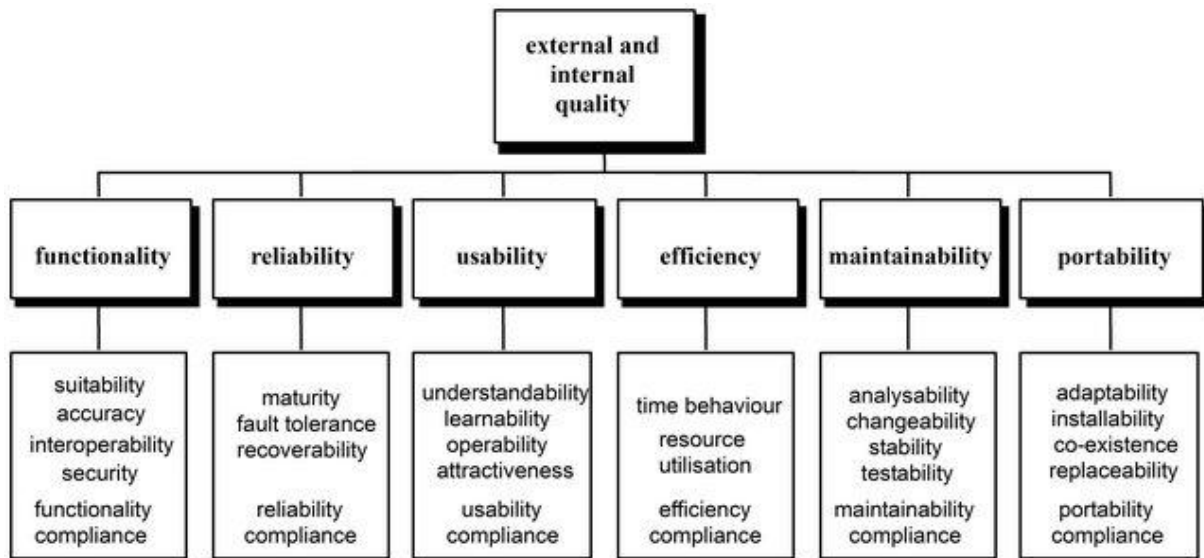


Figure 7: Internal and external software quality (ISO 25010 2016)

Besides the constraints the use of applications may involve several risks. These can be split in operational and development risks these can further be narrowed down based on likelihood, impact and type of risk. This can be used to prevent or mitigate the different risks (Markus 2013).

To ensure the alignment of the business and IT the perspective of both business units has to be considered. The business sees the opportunity technology offers them and expect IT to facilitate this (Peppard and Ward 1999). IT should thus facilitate the demanded technology, since the business is focusing on value added information. This facilitation can be done by facilitating the business to develop certain parts of IT them self or by adjusting their facilitation to fit the business demand.

## 2.3 Adoption

A business case consists of benefits, limitations, costs and impact on the strategy. A business case contains both tangible and intangible elements. The findings of this business case can be complemented with the results of benchmark companies to get a total overview of the possibilities to use applications and gamification in the distribution centers.

Besides the benefits and implementation of the software, the quality of the software itself should be ensured. Software quality can be divided in functionality, reliability, usability, efficiency, maintainability and portability (Kitchenham and Pfleeger 1996). The functionality and reliability have to be determined for each new application that is developed. The usability is covered with the use of UTAUT and TAM as mentioned above. To measure the efficiency of the software indicators for the specific software should be developed while the maintainability and portability are based on the current systems as well as the new application. To ensure that the application is meeting these requirements Albert Heijn can use the ISO/IEC 25010:2011 which specifies the requirements for software quality (ISO 25010 2016).

For the adoption of technology several theories have been developed during the years. When we combine them they give a good overview of all factors which influence adoption. These can then be taken in to account for each project to come. The first used here is the innovation diffusion theory,

according to this theory there are several factors that influence the adoption of information technology. The identified factors are; voluntariness, image, relative advantage, compatibility, ease of use, trialability, result demonstrability and visibility (Moore and Benbasat 1991). These factors focus on the information technology itself while the Technology Acceptance Model focuses on expected result by the users of the software. According to this TAM theory the adoption is influenced by the perceived ease of use, the perceived usefulness and the behavioral intentions to use (Davis 1993). Later this model was extended with the attitude towards using and external factors (Venkatesh and Davis 2000).

Since both of these models have different indicators for the adoption of technology we also use the unified theory of acceptance and usage of technology. This model uses expectancy as well as external variables and user specific attributes. The model was developed by (Venkatesh et al. 2003) and more extended in the newer version of (Venkatesh, Thong, and Xu 2012) this newer model also includes hedonic motivation, price value and habit as shown in Figure 8.

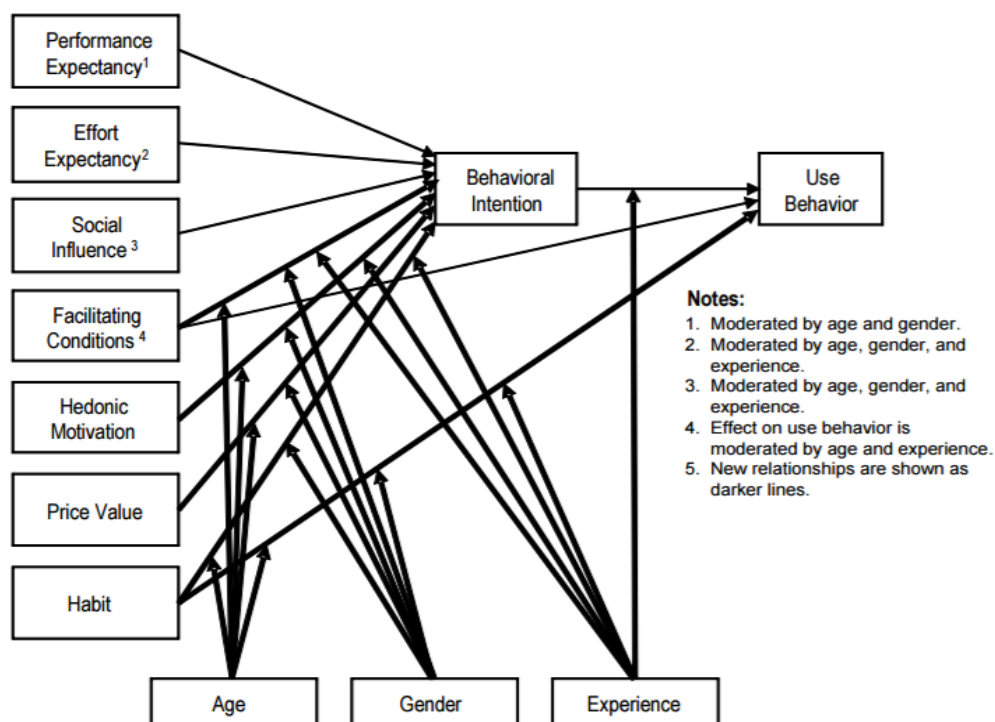


Figure 8: UTAUT model (Venkatesh, Thong, and Xu 2012)



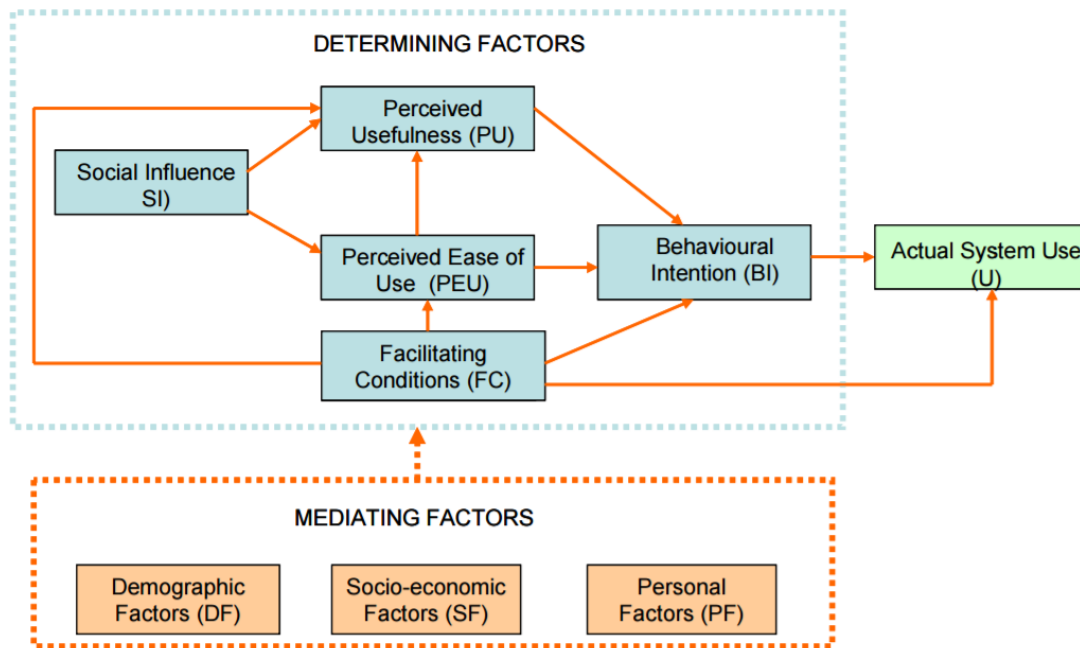


Figure 9: MOPTAM model (Van Biljon and Kotzé 2007)

(Van Biljon 2006) and (Van Biljon and Kotzé 2007) use both TAM and UTAUT to construct their Mobile Phone Technology Adoption Model. This model as shown in Figure 9 is more suitable for mobile phones compared to previous models since other models are built for general technology while MOPTAM is specifically built for mobile technology. MOPTAM uses both mediating factors like; demographic factors, socio-economic factors and personal factors which are wider than the mediating factors in UTAUT which could all be grouped under personal factors. The determining factors in MOPTAM are the social influence, perceived ease of use, perceived usefulness and facilitating conditions. These influence behavioral intention which combined with facilitating conditions determines the actual system use.

The mediating factor Personal factors include relative advantage, compatibility, complexity, trialability, observability, image and trust. While the demographic factor includes the variables also used in UTAUT like age, gender and technological advancement. The social economic factor contains job status, occupation and income. These are relevant since a certain type of job requires the use of mobile technology more than other jobs.

The determining factor perceived usefulness is based on inputs such as cost, time efficiency, enjoyment, mobility and content and while perceived ease of use is based on service quality, speed and simplicity (Phan and Daim 2011).

## 2.4 Game elements

In the design of applications game elements can be used to improve the experience for users. This use of game elements can be done in different levels. These are identified as: playful design, serious gaming, gamification and persuasive systems. If these elements are used it is important to match the type of element with the goal of the application.

Gamification can increase the internal motivation to complete different tasks (Nicholson 2012).

Besides the internal motivation, (Oprescu, Jones, and Katsikitis 2014) state that the loyalty,



productivity and wellbeing of employees can be improved as well. Gamification is a term often used to describe other types of games such as serious games or playful design. Serious gaming can be defined as; “The application of gaming technology, process, and design to the solution of problems faced by businesses and other organizations. Serious games promote the transfer and cross fertilization of game development knowledge and techniques in traditionally non-game markets such as training, product design, sales, marketing, etc.” (Susi, Johannesson and Backlund 2007). The difference between gamification and serious games is the amount of games elements in the application (Dijk et al. 2015). Where serious games are developed to model a problem in a game, gamification is the use of game elements in an application which is used during the work. In Figure 10 (Teunissen 2013) the difference between gamification and serious games is shown.

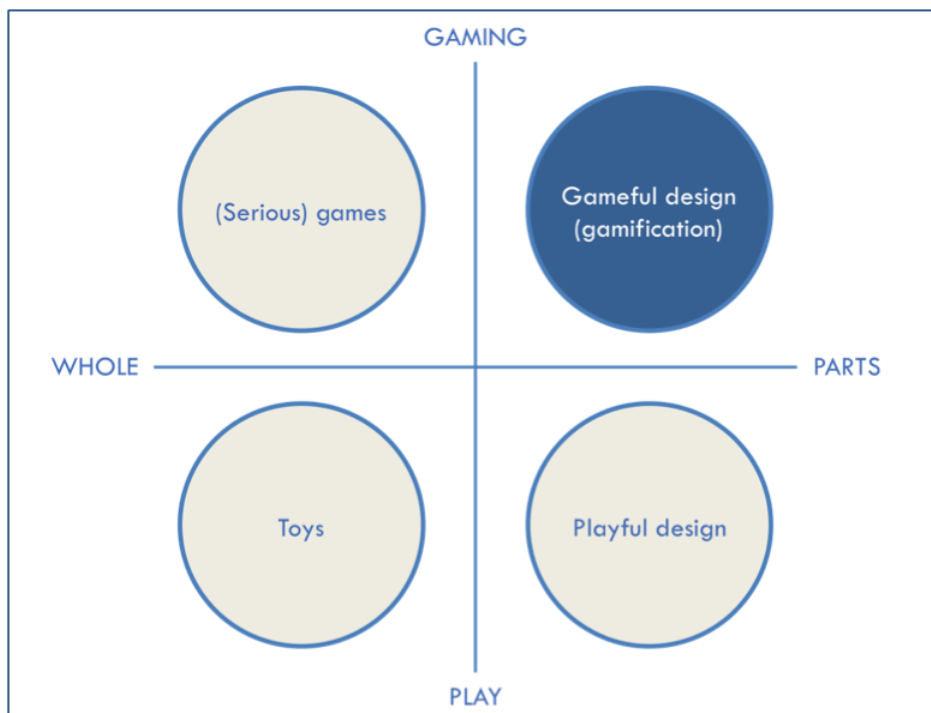


Figure 10: Type of game elements in applications (Teunissen 2013)

Both serious gaming and gamification can be usable in distribution centers they both can be used to change behavior of the employees. Both are already used in other industries like government, sales, healthcare, communication, software engineering and military. Besides different industries gamification also uses different stimuluses' this is based on the user and the type of behavior the game wants to influence. According to Hamari (Hamari, Koivisto, and Sarsa 2014) the results of gamification might differ from an increased motivation of employees, engagement of employees with their tasks to requiring a status in a company. However they also mention that the gamification effect might be time limited which might imply that the concept is based on a novelty effect. This is largely dependent on the type of gamification and the activity support by the gamification. In a production environment like the distribution centers of Albert Heijn the increase in production as well as the wellbeing of employees, which might be improved by the use of gamification are two important elements. Besides the use of applications, researching gamification and serious gaming may give important benefits to the company.

## 2.5 Summary of the literature review

In the literature research we discussed the benefits, business case, adoption and gamification of the use of mobile applications. For these factors we found a set of attributes that influence them. In Figure 11 the attributes are listed for each factor. From this figure it can be noticed that the attributes learning, motivation, image, effectiveness, accommodate growth and efficiency gains all influence more than one factor. Learning and motivation influence both benefits and gamification while image, effectiveness, accommodate growth and efficiency gains influence both the business case and the benefits. All attributes shown in the figure influence the usability of mobile applications according to the literature and should thus be considered by a company.

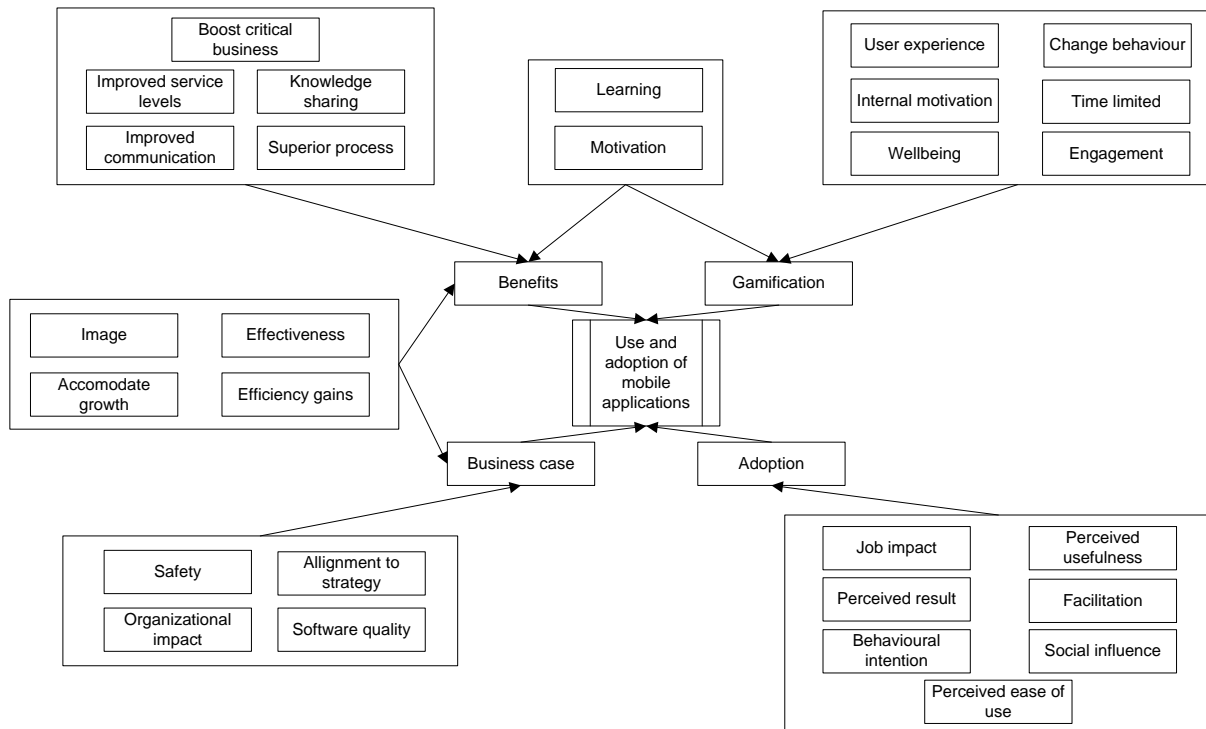


Figure 11: Overview of factors influencing mobile application usage (Constructed from the findings in this thesis 2017)

From the literature we found the benefits and limitations of mobile applications on the work floor. Although we found a significant number of factors influencing the use and adoption of mobile applications as mentioned in Figure 11, researching this field is useful since the use and adoption of mobile applications is not specifically researched in this research. From the literature we also learn that we can divide the factors influencing the use of mobile applications in four categories; benefits, business case, adoption and gamification. This last category, gamification, is not required for the use of mobile applications by a company but can contribute to the use of specific applications. The benefits and business case are required to make the use of mobile applications attractive to the company and the employees. While the adoption factor is important to make the implementation of mobile applications succeed.

### 3. Interviews

Albert Heijn logistics has several demands for the development of an application. Within logistics there are different stakeholders, to get insight in their demands they were interviewed. With these interviews, we want to get an insight of the view of the stakeholders on the benefits, constraints, adoption, fit to strategy and organizational changes. The results of these interviews contribute to answer research question 1,4,5,6 and 7. The identified stakeholders for this research are; the VP logistics, the logistic support department, the five management teams of the sites and the employees both Albert Heijn as well as the temporary workforce.

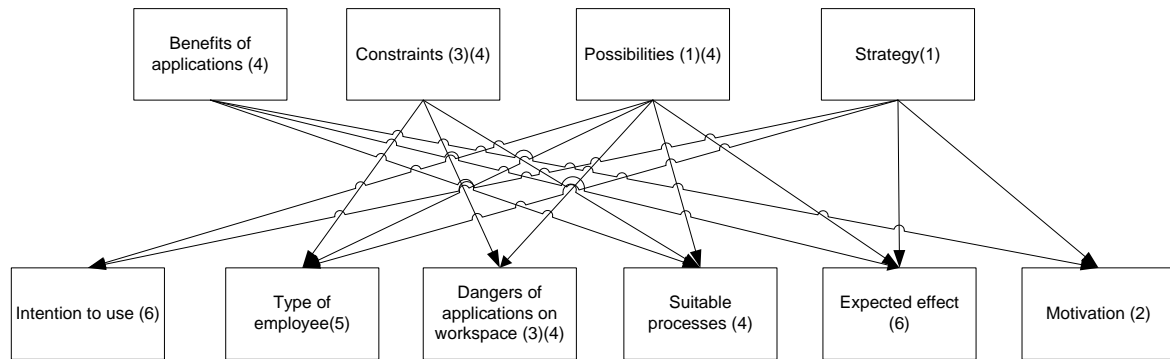


Figure 12: Interview question setup

At the start of the case for Albert Heijn, four main topics which influence the use of applications in the distribution centers were identified. The formulated topics are; benefits, constraints, possibilities for the use of applications and implementation in the strategy. From the literature research and an informal discussion with a set of the stakeholders it was found that these relate to several objects shown in the bottom part of Figure 12. To get an insight in the current vision, rules and use of mobile phones and applications in the organization, a number of interviews will be conducted. These interviews will be held on several levels in the organizations. In the interviews the questions will focus on the four research questions; the benefits, the constraints, the possibilities and the strategy. In Table 3 the relation of the questions to the research fields are displayed. In Table 2 an overview of the questions is represented linked to literature as well as the relation between questions.

#### 3.1 Questions

To obtain a better insight in the demands of all the stakeholders a series of interviews will be conducted. For these interviews a set of questions is composed based on the model shown in the figure 11. The relation of these questions to the objects in Figure 12 and the corresponding literature can be found in Table 3. In Table 2 each question is linked to one or more elements. These elements correspond with the element id in Table 3. This link relates the questions to the literature fields used in chapter 2.

Questions	Question Id	Question related to	Type	Time	Linked to element	Reason
What is your vision on the use of applications on the workspace?	1	Site MT / Support MT / VP	Open	During	1.1, 1.3, 1.4, 4.1, 4.3	Background
Do you see possibilities to use applications on the workspace?	2	Site MT / Support MT / VP	Closed	During		Background
Which possibilities do you see?	3	Site MT / Support MT / VP	Open	During		Background/input
In your view what are the limitations of applications on the workspace?	4	Site MT / Support MT / VP	Open	During	1.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8	Background
How can applications support the vision of Albert Heijn?	5	Site MT / Support MT / VP	Open	During	1, 4.1, 4.2, 4.3	Control
Do you know examples of applications which can be used in the organization?	6	Site MT / Support MT / VP	Open	During		Background
Are you known with the concepts gamification?	7	Site MT / Support MT / VP	Closed	During	2	Lead in
What is the perceived result of gamification?	8	Site MT / Support MT / VP	Open	During	2, 6.1, 6.2, 6.4	Background
What companies can be useful benchmark companies?	9	Site MT / Support MT / VP	Open	During		Input
Are there currently problems with the use of mobile devices on the workspace?	10	Site MT	Closed	During	1.1, 3.5, 3.6, 3.8, 6.3	Background/input
Which processes can be supported with applications?	11	Site MT / Support MT / VP	Open	During		Background
What type of employees work in the distribution centers?	12	Site MT	Open	During	5.1	Background
What triggers the motivation of these employees?	13	Site MT	Open	During	5.2	Background
Does the organization need to change to enable applications on the workspace?	14	Support MT / VP	Closed	During	1, 4.1, 4.2, 5.1, 6.3	Background/input
What changes will be needed in the organization to enable applications?	15	Support MT / VP	Open	During	1	Background/input

Table 2: Questions linked to literature (This thesis 2016)

Name	Element id	Elements
Albert Heijn Strategy	1.1	Safety
	1.2	Healthy
	1.3	Fun
	1.4	Durability
Gamification	2.1	Motivation
	2.2	Types
	2.3	Elements
Internal and External Quality	3.1	Functional suitability
	3.2	Reliability
	3.3	Efficiency
	3.4	Operability
	3.5	Compatibility
	3.6	Security
	3.7	Maintainability
	3.8	Portability
Information Systems	4.1	Organizations
	4.2	People
	4.3	Information Technology
Employees	5.1	Types
	5.2	Motivation
Adoption	6.1	Perceived result
	6.2	Ease of use
	6.3	Facilitating conditions
	6.4	Intention to use

Table 3: Elements linked to literature (This thesis 2016)

These questions address mostly the desired effects by the organization and an indication of the expected benefits and constraints. These can be linked to the expected benefits and constraints from the literature.

### 3.2 Interview Results

#### **Annemarieke Koster (Project manager, responsible for DC van Morgen)**

*What is your vision on the use of applications on the workspace?*

The use of mobile applications fit perfectly in the strategy of “DC van Morgen”. This strategy is focused on; healthy to your retirement, it is cool to work here, logistic craftsmanship and the safest DC of the Netherlands. This strategy and thus the use of mobile applications are not only about tangible benefits but also contribute to these other values.

*Do you see possibilities to use applications on the workspace?*

Yes, advantages of the use of mobile applications are the motivation of employees, increasing the trust we give to employees to responsibly use mobile devices, increase the involvement of employees with the company, making learning on the job more attractive and increasing productivity both effective and efficiently.

*Which possibilities do you see?*

All type of processes can be supported by the use of mobile applications; it helps people in their work and can give them more feedback compared to the current situation.

*In your view what are the limitations of applications on the workspace?*

Between the different site management teams there are mixed feelings about the use of applications on the workspace. Some teams think people are able to handle the use and it offers a lot of opportunities. They also think they can give trust and empowerment to employees by introducing the mobile devices on the workspace. Other site teams think the use of mobile applications will compromise the safety on the workspace and employees in a production environment shouldn't be distracted by mobile applications. They are convinced the employees should focus on their daily tasks and mobile devices won't give them a substantial benefit.

*How can applications support the vision of Albert Heijn?*

As mentioned before the use of applications fits in the strategy "DC van Morgen", since it empowers employees and can make their tasks more fun.

*Do you know examples of applications which can be used in the organization?*

Not existing example but a lot of applications have functionality which can be useful in de distribution centers as well.

*Are you known with the concept of gamification?*

Yes we are currently researching the possibilities to use it in the distribution centers.

*What is the perceived result of gamification?*

The use of game elements could be a good contribution to the learning and development of the different types of employees in the distribution centers. One of the questions I have about gamification is how we keep it interesting after the initial phase.

*What companies can be useful benchmark companies?*

Companies in the same sectors as well as other sectors with the same kind of strategy and market conditions.

*Are there currently problems with the use of mobile devices on the workspace?*

Disadvantages can be the impact on safety, distraction of daily tasks, not everybody has a suitable mobile devices and not everybody may be willing to use their own device for work related tasks.

*Which processes can be supported with applications?*

Each process can be supported in my opinion; the question should be which process benefits most from the use of mobile applications. I think the most benefits can be obtained by the use of information we have. We need to find ways to make it relevant and share it with the employees to improve their daily work.

*What triggers the motivation of these employees?*

Some employees also don't see the added value of these kind of applications this is partly based on the fact that previous technological innovations decreased the fun in their job.

*Does the organization need to change to enable applications on the workspace?*

Yes we need some changes but this is mostly on the way of thinking, which I think we already started with the “DC van Morgen”.

*What changes will be needed in the organization to enable applications?*

Besides the way of thinking as mentioned before, we should also find a way to build the applications and deploy them much quicker as we are used to now.

**Stefan Derksen (Operational Site Manager, DC Tilburg)**

*What is your vision on the use of applications on the workspace?*

They can be a contribution but we should have a good goal in mind which we want to achieve with the applications.

*Do you see possibilities to use applications on the workspace?*

Applications can contribute to the involvement of employees. With regard to the use we should be careful not to push the employees too much. This might create resistance to the actual use.

Applications can also be used to send information to specific employees or make it available on demand, in my opinion this last option is more preferably.

*Which possibilities do you see?*

All possibilities to get the knowledge of our employees into the process since they often have a lot of experience but we aren't able to use it in the right way.

*In your view what are the limitations of applications on the workspace?*

For the use of applications there is one limitation which is safety. When we consider the use of mobile applications we can't compromise on safety at all. The safety in the DC's should at least remain at the current level and preferably increase.

*How can applications support the vision of Albert Heijn?*

Use them to enhance the logistical craftsmanship since this can be supported for our employees by enabling them to share their vision and knowledge.

*Do you know examples of applications which can be used in the organization?*

A good example of a type of application employees could use is Flitsmeister, this is an app that provides information I want at the moment I want it. The app is also easy to use, quick in response and only shows what is want to know.

*Are you known with the concept of gamification?*

I heard the concept a couple of times but not enough to call it knowing.

*What is the perceived result of gamification?*

-

*Are there currently problems with the use of mobile devices on the workspace?*

No but it is in my site still restricted to use them with exception of the one Albert Heijn provides for WMS orders.

*Which processes can be supported with applications?*

I think we can use applications to give feedback to each other as well as to our management. When

we have an application like this we can manage the employees more personally and also guide the lower management based on the feedback of employees.

*What type of employees work in the distribution centers, what triggers the motivation of these employees?*

Among our fulltime employees of which some work in the DC for more than 30 years there is a lot of knowledge. We are able to retain these employees due to our good conditions, but the question is how we put their knowledge into value for our DC's.

*Does the organization need to change to enable applications on the workspace if so what changes will be needed?*

For the implementation it is important to consider the different layers of management in the DC's since it might impact their work as well. This impact is different for every layer and might not always be wanted.

**Jeroen Duijndam (Operational Manager Operations, DC Pijnacker)**

*What is your vision on the use of applications on the workspace?*

Applications should be used to automate routine daily tasks especially for team leaders and shift leaders. This can save them a lot of time which can then be used to invest in their employees.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

I can think of possibilities as touchscreens but I don't know how we can use them effectively. Also I don't know how we can get the added value out of this kind of investments. For all types of applications we should focus on informing the employee without creating an overload of information.

*In your view what are the limitations of applications on the workspace?*

Applications shouldn't be used on the work floor since they have impact on safety and concentration of employees.

*How can applications support the vision of Albert Heijn?*

Applications can be used to make the way of working more lean which reduces the time we spend on tasks other than our core business.

*Do you know examples of applications which can be used in the organization?*

-

*Are you known with the concept of gamification?*

Not at all

*What is the perceived result of gamification?*

-

*What companies can be useful benchmark companies?*

Companies that process a lot of goods in their logistics department and have a variety of employees both in age and in education.

*Are there currently problems with the use of mobile devices on the workspace?*

Strictly forbidden so no problems at the moment.



*Which processes can be supported with applications?*

Planning, day-off registration and hour registration for the hired employees.

**Rene Huijgens (Specialist of Logistics support)**

*What is your vision on the use of applications on the workspace?*

For the use of applications i see a lot of possibilities, for example to connect to databases, give feedback based on data and simplify the information flow in the warehouses.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

The use of applications should be supported by the IT department to ensure support where needed. They are also responsible for the network and the maintenance of the servers within the network. As logistics support we should focus on making simple connections with the servers, but shouldn't make queries which request a lot of information from the database. The databases are very complex and extensive, the databases are also critical for the production in the warehouses.

*In your view what are the limitations of applications on the workspace?*

We should constantly consider the possibilities but also the limitations such as security, privacy and standards within the organization.

*How can applications support the vision of Albert Heijn?*

The power of developing our own applications should be the speed and adaptability of the applications to the change in the organization. This can be much quicker and more efficient than the current process. In the current process IT has to do the changes after a request for change, this makes the process long and expensive.

*Do you know examples of applications which can be used in the organization?*

The quick development as done with Prepchat makes the application more suitable for the organization and the application can be easily tested and adapted.

*Are there currently problems with the use of mobile devices on the workspace?*

The biggest problem I currently observe is the decision if mobile devices should be used. This differs for each site which makes the process less effective.

*Which processes can be supported with applications?*

We currently already support a lot of processes this can be extended by mobile functionality. We can also extract more data from the system available to mobile devices so employees can interact with a workstation.

**Benno Jaspers (Manager Logistics Support)**

*What is your vision on the use of applications on the workspace?*

We can use applications much more in the daily tasks to make them more efficient, easier, lighter and more fun.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

There are a lot of possibilities, we should not limit ourselves to the narrow list of standard possibilities. Also think about using VR which is technology of the near future, we can't ignore the technological possibilities anymore. Another interesting possibility is the use of wearables such as the Apple watch or Samsung wear. These technologies offer a lot of possibilities which we maybe can

apply in the warehouses.

*In your view what are the limitations of applications on the workspace?*

A common misunderstanding is that the productivity always has to go up in the warehouses, while we should also focus on doing the same work with less effort. This can be supported by the use of technology which might help us working smarter instead of harder.

*How can applications support the vision of Albert Heijn?*

As mentioned it can make the work more fun but also contribute to the health of the employees and the organization.

*Are you known with the concept of gamification, what is the perceived result of gamification?*

I heard about the concept and think it can be a very useful contribution to the standard applications especially for the motivational component.

*What companies can be useful benchmark companies?*

I think we should focus on companies with a same set of employees and with the same ambition and promise to their customer.

*Are there currently problems with the use of mobile devices on the workspace?*

We don't have problem since we don't use mobile devices with exception of the mobile terminal for WMS orders. In the pilot we did in Geldermalsen we found that it was hard to control if someone was working or someone was doing personal stuff on their mobile phone.

*Which processes can be supported with applications?*

For the use of technology like mobile applications we should closely listen to the demands of the organization. We have to be able to adapt quickly to changes in the demands of the operation.

*Does the organization need to change to enable applications on the workspace?*

We definitely need to change but this is a process we are constantly going through since our customers are rapidly changing we have to do so as well to keep up with changing demands.

**Antoine Wijsman (Operational Manager operations, DC Zaandam)**

*What is your vision on the use of applications on the workspace?*

The use of mobile applications has a lot to offer to us.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

When we want to turn this offering into value we have to ensure the backup of IT which comes with several demands. These demands are based on the maintenance and hosting of the applications as well as the compatibility with other systems in the organization.

*In your view what are the limitations of applications on the workspace?*

For the use on the work floor we have to define a strict set of rules to guarantee the safety of employees and visitors in the DC's.

*How can applications support the vision of Albert Heijn?*

Depending on the type of application we it can be used to improve the vision and strategy of Albert Heijn. By contributing to one or more concepts named in the DC van Morgen strategy.

*Which processes can be supported with applications?*

The usability of applications is very wide; we can use it to supply employees with all kinds of information. This enables them to make individual and better decisions. Most of the employees know very well what is expected of them but they lack the information to make the decisions themselves.

*What type of employees work in the distribution centers, what triggers the motivation of these employees?*

The type of employee that can use the applications should be based on the demands of the individual employees, not on our thought about the employees.

*Does the organization need to change to enable applications on the workspace, what changes will be needed in the organization to enable applications?*

For IT there is a change needed to be less strict in the IT rules so the departments can easily develop the applications themselves and test them with the support of IT. Maybe not even all rules of IT are applicable to each application and should thus be revised for each individual application.

**Erik Smit (Operational Manager Production, DC Overijssel)**

*What is your vision on the use of applications on the workspace?*

The possibilities of the use of mobile devices can't be ignored. Although we work in a challenging environment we should definitely investigate the applicability for our distribution centers.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

Personally I would like to use mobile applications for both the employees and the management. The applications can be used for both daily tasks as well as incidental tasks. Even in the learning process of employees we can use applications.

*In your view what are the limitations of applications on the workspace?*

The limitations are in the amount of data we want to share with the employees. We should prevent an overload of information and of course don't share sensitive information. Besides this we need to be careful where and when to use the mobile applications.

*What companies can be useful benchmark companies?*

You could use or partner Kuehne Nagel who is also using mobile applications and is active in the logistics sector.

*Are there currently problems with the use of mobile devices on the workspace?*

At the moment the hardest is the connectivity in our building. The terminals disconnect and are sensitive to specific input. When this is just a bit off the systems does not recognize the voice input.

*Which processes can be supported with applications?*

For the current employees I think the most value can be created by supplying them with real time information about their job. This way they can perform better and even use the information to make autonomous decisions.

*What type of employees work in the distribution centers, what triggers the motivation of these employees?*

We have a wide variety of employees, in age, education and experience. In our distribution center we

have a hands on mentality and often are the latest to adopt a new technology. This is also due to the fact that employees don't think the change is necessary.

**Bart Hofmans (Project Manager Gamification, Albert Heijn Stores)**

*What is your vision on the use of applications on the workspace?*

For every application we can build a gamified system. The question should be what is the goal of the application and does gamifying help to achieve this goal.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

It is important to find a way how the change can be sustained, since keeping the change embedded in the mindset of the employee is harder than initiating the change. The question should thus not be if we can use gamification in an application but in which applications we want to use gamification.

*In your view what are the limitations of applications on the workspace?*

The limitations are often not that limiting if employees are instructed well, with a good set of rules we can ensure, safe, responsible and useful usage of mobile applications on the workspace.

*How can applications support the vision of Albert Heijn?*

As mentioned an application can be designed to do anything so if an application should support the strategy it can be designed that way.

*What is the perceived result of gamification?*

Gamification is very useful for creating change in a way of working or reaching the desired behavior of employees. If this is not the goal of gamification we should not gamify an application, since this won't contribute to the goal and does impact the effect of other gamified systems.

*Are there currently problems with the use of mobile devices on the workspace?*

In the stores we made the choice to use gamification without devices, because our research showed that the customers were not familiar enough with our employees using their mobile phone for their benefit. This might change in the future but for now the focus is on the gamification without mobile devices.

*Does the organization need to change to enable applications on the workspace what changes will be needed in the organization to enable applications?*

For the introduction of each application the stakeholders have to be identified. Besides the stakeholders each development project has a problem owner. The problem owner and the stakeholder demands should be met to create a successful application.

**Yvonne Poels (Operational Site Manager, DC Geldermalsen)**

*What is your vision on the use of applications on the workspace?*

Applications can contribute more and more in current times since even more systems are suitable to interact with devices this makes them more useful for our operation.

*Do you see possibilities to use applications on the workspace, which possibilities do you see?*

In our site we are currently doing a test with the use of mobile phone on the work floor. This test is received very well by our employees but also by the management of the site. We can communicate more efficiently and exchange information more clearly.

*In your view what are the limitations of applications on the workspace?*

We see in the test that even more processes than we originally thought could be supported by the use of mobile devices. But currently we lack the speed of development to respond to these opportunities. At the moment the development takes too long and gets too complicated with the result that the application is outdated at the moment of introduction.

*Are there currently problems with the use of mobile devices on the workspace?*

We don't see more unsafe situations which is also a result of the strict rules we use for the use of mobile phones at the work floor.

*Which processes can be supported with applications?*

Distributing the information gets more important but is frustrated by our legacy systems; these aren't available for everyone and lack compatibility with newer applications.

*What type of employees work in the distribution centers what triggers the motivation of these employees?*

When we develop new applications it is important to focus on a certain type of employees because this will enable us to make the application specific and arrange things like support the right way.

*Does the organization need to change to enable applications on the workspace what changes will be needed in the organization to enable applications?*

Each application should fill a gap in the current needs of the DC, this can be done by the support department but DC's shouldn't lose all the possibility to develop applications themselves. In the ideal situation I can imagine that the start is widely communicated so employees and management in the DC's can contribute in an early stage of the development.

**Cees van Vliet (Chief Operational Officer, Albert Heijn)**

*What is your vision on the use of applications on the workspace?*

In our stores we observe an increase in the use of mobile devices. In my opinion we as a company should follow this trend and use the positive effects of this trend in our own operation. This means adapting to implement applications and use them to improve our existing processes and way of working.

*In your view what are the limitations of applications on the workspace?*

Each new development has limitations that also hold for mobile applications. We should be aware of these limitations such as security of both our data and the data of the users and customers and the willingness of customers and employees to use the application.

*Are you known with the concept of gamification, what is the perceived result of gamification?*

Yes we are currently doing a pilot with gamification in the stores. With regard to gamification it should be used to change the behavior of employees. The key success factor is how to retain the changed obtained by gamification. For the stores we are currently testing different kinds of applications and game elements, these tests are currently received very well both by the employees as well as the customers. In these tests we didn't use devices since our customers aren't used to experience employees using their phones. This is different in the DC's, maybe we can even test elements in the DC's which can later on be transferred to the shops.

*Are there currently problems with the use of mobile devices on the workspace?*

I think our customers will change as well and get more common with the use of mobile phones; it might even improve their experience as we enable our staff to increase their service level. For some customers we aren't even using our phones enough, they require information which is available on the internet but not in the stores so this might be a possibility as a first test in our stores. This also highlights the changes in our sector with regard to the customization of our customers with mobile devices.

*Which processes can be supported with applications?*

The use of applications can definitely contribute to several processes within our organization. Within logistics I can think of processes like, communication, safety, awareness and education.

*Does the organization need to change to enable applications on the workspace, what changes will be needed in the organization to enable applications?*

The organization is currently changing as we constantly are. The use of applications might have its own demands but is not the sole purpose of changing. For applications we should think about bring your own device, security and development time. Mobile applications probably have different demands than our current applications.

### **3.3 Interview summary**

From the interviews we find different factors that are considered important for the use of mobile applications in the FMCG warehouses. The factor that was mentioned the most is the safety, this is factor is an important issue at the moment in the distribution centers which might explain the amount of interviews in which the safety was mentioned. Another factor which is mentioned as a positive aspect is the information sharing, which enables employees to improve their daily tasks. A remark to this sharing is that the employees shouldn't be pushed to use the information and not create an information overload.

The fit to the strategy of DC van Morgen is also considered to be important by most of the interviewees. The use of mobile applications can contribute to executing this strategy by making the employees do their work smarter. This will contribute to the wellbeing of employees and get them to their retirement healthy which is also an ambition of the strategy.

Another benefit mentioned in the interviews is the elimination of daily tasks for the middle management. Using applications, the tasks like signing day off forms and illness registration can be simplified or even eliminated which gives the team leaders more time to directly invest in their people.

The use of mobile applications designed by logistics support also contributes to the speed of development. In the current development, there are a lot of departments involved which slows down the process. This makes it hard to adapt to changes quickly, which can be eliminated by developing the mobile applications in the support department. Doing this also brings the possibility of rapid prototyping and adjustment which makes the applications fit better to the operational process.

Mobile applications can be combined with the use of gamification if the goal of the application is to change the behavior of the user. Gamification can be used in a lot of different ways, but the application should be kept attractive to employees to ensure a maximum result. Another aspect is

that a lot of gamification can be done but it is only effective when it meets the goal of the application (Werbach 2014). State that the use of gamification should be voluntary to be successful. Furthermore, he argues to see gamification as a process without a strict boundary so that serious games, persuasive games and gamification can all be applied under the name of gamification. Since this is the commonly used name, although different authors contest the used definition.

Concluding when we summarize the interviews by the elements in Table 3 which are; gamification, adoption, strategy, quality, employees and information systems, we find that the interviews agree that the use of mobile applications can contribute to the strategy of Albert Heijn logistics. They all see challenges in adoption of technology in warehouses. This is mostly caused by the variety of employees. According to the interviews there is a group of mainly older employees who don't see the benefits of the use of applications. This is based on their previous experiences and view on the type of work they are doing. The quality of information systems is according to the management of distribution centers a responsibility of the developer together with the IT department. IT has to have rules and test if the applications apply to them. The developer is responsible for the quality, reliability, speed and operability. Gamification is seen as interesting development and should be considered but due to lack of knowledge and experience the interviews can't give examples of processes in which this could be used. With a brief summary of the concept they see opportunities in the field of training and learning which can be supported with gamification.

## **4 Possible usage of mobile applications at Albert Heijn**

The findings of this research will be used to evaluate the possibilities for Albert Heijn to use applications in their distribution centers. From the interviews the demands of Albert Heijn became clear. In this section, these demands will be compared to the literature. Besides this match also the limitations as found in the literature will be discussed. In the literature four main factors were described we will use these to evaluate the findings for Albert Heijn. This evaluation will be done by comparing the outcomes of literature with the outcomes of the interviews on both pros and cons for the use of mobile applications.

### **4.1 Benefits and constraints**

The benefits identified in the literature can be matched to the demands of Albert Heijn. Applications can make a contribution to the strategy defined in “DC van Morgen”, by improving the encouragement and motivation of employees. Furthermore, there is a potential contribution to the employee satisfaction. Albert Heijn can also benefit from saving costs, improving flexibility and a better integration of different processes. Albert Heijn can use this to boost their critical processes which lead to a better service of their customers (shops). The use of applications can also contribute to the growth of the organization within the current distribution centers, this can be achieved by the improvement of processes and increased communication of critical information. This in turn can improve the efficiency and effectiveness of the supply chain. The overall objective is to increase the sum of the benefits which can be categorized in; customer service, image, employee satisfaction, efficiency and effectiveness with the minimum cost to do so.

From the interviews a number of specific constraints for Albert Heijn can be identified. The number one is safety in the distribution centers for employees, visitors and environment. To ensure that the application won't negatively affect the safety rules of usage should be defined to ensure that employees will not be distracted during their job. The use of applications can also contribute to safety of employees for example by giving additional warnings for certain tasks or making the reporting of safety issues more easily. While safety is considered most important, other constraints such as; no disturbance of the production environment and available hardware should also be taken into account. Besides the availability of the hardware the safety of both the hardware and software used is important to consider. Some of the applications may contain confidential information which should be protected while the hardware should be protected so that the network of the company is not compromised. Another constraint mentioned in the interviews was the distraction of employees, not each employee is capable of using their mobile devices wisely. This can be a safety issue but also a productivity issue which is a risk for the company as well. In a distribution center an average of 250 employees are present. This requires certain demands to the hardware available. These demands differ for each application but should be managed up front to ensure a smooth adoption and integration of the new technology. The production environment is complex and should thus only be used after thorough testing in a test environment. If the production environment is disturbed the whole supply chain will not be able to serve the shops which causes a serious revenue and image damage. The current system is used very intensively and any delay in the production can't be restored.

### **4.2 Potential for the company**

Albert Heijn is an organization with a wide variety of employees, each has their own experience, expectations and thoughts about their job. When applications will be used, this may impact their job



since tasks may disappear or their responsibilities change. For Albert Heijn it is thus important that they manage the change in the organization, this has to be done on different levels. The employees need to understand their new responsibilities and the value of their new tasks; they may even need to rethink how their job contributes to the overall process when the change is really large. While the management needs to manage the expectations of the employees they also must consider the impact on their own function since this can be impacted as well. For example, they may see less of the communication flows, this means that the communication between layers in the organization is different but not everyone who is involved now will be when applications are used.

In the distribution centers Albert Heijn has a goal for 2020 which is explained in “DC van morgen” this strategy contains several factors that influence the work in the distribution centers. It consists of the parts: The safest of the Netherlands, No waste, It is nice to work here and healthy till our retirement. In this vision, applications can play an important role to achieve or contribute to several aspects.

The strategy is displayed a drawing which include all the aspects of “DC van morgen”. To integrate a single application in the strategy Albert Heijn can determine if the application contributes to aspects of the strategy displayed in this drawing. For the total landscape of applications Albert Heijn can develop an additional strategy based on the overall “DC van morgen” strategy. The strategy should consist of a translation of the overall strategy in requirements and prioritize the areas in which applications can be used. This strategy can then be used as a guideline for the development of applications. The strategy consists of four main topics which are; *‘We are the safest distribution center of The Netherlands’*, *‘We don’t waste anything’*, *‘We like to work here’* and *‘We reach or retirement healthy’*. This is reached by two ways of working, which is winning together by sharing success and dare to do instead of thinking through everything. The rest of the picture is filled with all topics which can be related to one or more of these topics. Examples are: “the peanut butter can’t get more expensive, automatic moving order pick truck, on an earlier age out of the night shift and cooperate with other departments. A lot of ideas can be supported by the use of mobile applications such as the cooperation with other department and making the work more fun.

Within Albert Heijn there is a policy which software has to comply to. This policy is setup and maintained by the IT department. To receive support and maintenance of hardware all applications should be in line with the applicable policies. Besides the internal regulation for each application the requirements for reliability, usability, efficiency, maintainability and portability should be defined. These are important to ensure a stable production environment now as well as in the future. While each application has its own set of requirements a larger set of overall requirements should be made in which the policy of IT should be integrated. This set can then serve as a guideline for each individual application.

### 4.3 Adoption

At the start of each application design the final product should be clear; this can be done by making a use case and describing the perceived result and specifications of the application. The following results should be taken into account; the possibility to reach the desired benefits, the environment in which the application will be used and the impact on the job of employee. By considering these benefits upfront the result for the users will be clearly stated and be measurable.

Adoption of applications is an important factor to make them a success. For Albert Heijn several factors contribute to a successful adoption. As found in the literature the type of user is an important

factor to adoption. In the warehouses of Albert Heijn there is a wide variety of employees. These employees differ in; age, gender and education as also mentioned in the interviews. These users are similar to the users in the distribution centers although the average user in the distribution center is older compared to the user in the stores. Albert Heijn can make use of this knowledge by assigning ambassadors who take the lead in the use of new applications and assist their colleagues with the introduction of the application. These ambassadors have to be a reflection of all the types of employees, this way others can be inspired to use the application as well. Furthermore, the facilitating conditions, the expected use and expected result should be managed well. The conditions include the hardware as well as the instructions which should be managed by the department developing the application in collaboration with the IT department. If employees don't see the contribution to their job, they are less willing to use the new applications, while if the applications aren't working well at the introduction the application will have imminent set back in the expectations of the employees. The results of the application and the impact on the daily tasks have to be communicated so employees are well informed and know what is expected of them and how the application can contribute to their work.

#### 4.4 Game elements

Within the organization the first pilots with gamification have successfully been finished. From this pilot the company learned that the use of gamification helps to engage employees in their desired behavior and creates a new way to look at daily tasks. These results can be useful for the distribution centers as well. The approach followed in the stores can be used in the distribution centers as well. This approach consists of an analysis of the desired effect and a mockup of the game tested in a few stores which were involved in the analysis as well. In the stores the company is now deploying the gamification to all stores to enhance the employee's customer service level. In logistics, this development is observed with a lot of interest. Since gamification can be supported by applications this section will focus on gamification through applications. This is different than the gamification used in the stores because there the choice is made to start without the use of any mobile device. From the interviews, we learned that gamification can be a useful addition to the use of mobile applications with the remark that the goal of the application should be changing the behavior of the users.

#### 4.5 Summary

From the findings applied to Albert Heijn we learned that the use of mobile applications is supported in all layers of the company. The findings identified in this section are; the improvement of employee satisfaction, the efficiency and effectiveness gains, the opportunity to create a superior process, the engagement of employees and the cost savings. Although safety and productivity is a concern according to the site managers, they think that the information sharing and improved communication will be able to improve the current processes and even have a possible impact on the safety. Furthermore the accommodation of growth as mentioned in the literature is received positively since some of the sites have limited space to expand their operations. The interviewees replied that the adoption of technology is mostly influenced by the facilitating conditions and the job impact. Their experience is that these factors have the most impact while factors as social influence, usefulness and intention are less important among the employees. The mediating factors age and experience as described in the UTAUT model are also perceived as important for adoption. The variety of employees is large and there is a group of older employees who have less experience and

belief in the use of technology for their job. For gamification the site managers are interested in the benefits for their employees. They can think of different applications in which this can be used; these are focused on learning, motivation and behavior which is in line with the findings in the literature. The use of gamification elements for user experience and engagement aren't shared among the interviewees and the literature. The factor of wellbeing is not heard in connection to gamification but is mentioned in some interviews as part of the strategy.

The findings in the literature of most of the factors influencing the benefits, gamification, business case and adoption are in line with the interviews. The factors as improved communication, knowledge sharing, efficiency, growth, job impact, facilitating conditions, change behavior, wellbeing, motivation and learning are fully supported by the interviews while the other factors are not mentioned or mentioned as even more important than literature suggests such as safety, effectiveness and perceived result. The use of mobile devices on the work floor is still an important question to answer as well as the guidance of the development process. Who is doing the development and maintenance in the organization and who is the project owner for the application development? In the benchmark the relation between the results of the literature and the interviews will be an subject of investigation as well as the concerns regarding the employees who use the applications and which rules the company uses to guard the safety on the work floor while using mobile device.

## **5. Benchmark interview**

The findings of the literature and interviews are compared to another company in the same sector. This company agreed to cooperate with the research anonymously; furthermore, they couldn't be specific on all questions since this can be sensitive information to their competitors. The company is a large retailer in the Netherlands with their own warehouses and logistics network. They have several warehouses with a similar type of employees as Albert Heijn. The interviewee is responsible for the integration of applications throughout the organization. For the interview at the company the following set of questions was used to acquire the desired information for the benchmark:

Does your company currently use mobile applications in the warehouse?

### **IF YES**

Which kind of mobile applications does your company use?

Which type of employees use these applications?

Which rules are in place with regard to the use of mobile applications?

Do you intend to increase the use of mobile applications?

### **IF NO**

What is the reason that you currently don't use mobile applications?

Do you see possibilities to use mobile applications in the warehouse and which?

Do you think a warehouse is a suitable place to use mobile applications?

What are the intentions of the company with regard to the use of mobile applications in the warehouses?

The response of the company was:

*Does your company currently use mobile applications in the warehouse?*

Yes, we recently started using mobile applications on a small scale. With doing this we want to test the possibilities and define where we could use the applications on a larger scale. In other departments of the company these kinds of applications are already used on a larger scale.

**IF YES**

*Which kind of mobile applications does your company use?*

In the warehouses we started with the use of two applications, one to improve the communication between employees and another application to improve the sharing of knowledge and information among the employees. With these applications, we try to establish the effects of the usage and the response of the employees to the use of these applications.

*Which type of employees use these applications?*

Since we are currently in a startup phase with the use of applications we selected a variety of employees to get the best overall insight in which effect the applications have on different type of employees. With the application used for information sharing the type of employee is also restricted by the authorization of the employee. Thereby not all employees need the same information thus in this application an additional selection was made out of the wider group for other applications.

*Which rules are in place with regard to the use of mobile applications?*

Currently the use of applications is restricted to selected zones in the warehouse. We are looking to extend these zones but also have to take in to account that not everyone is already used to the use of mobile devices in the warehouse. When all employees are familiar with the use, we think they are also more aware of the risks and thus will be more alert for coworkers using their devices. At that moment, we will do more tests with extending the zones for device use.

*Do you intend to increase the use of mobile applications?*

Depending on the results of the test we will evaluate our experience with the use of mobile applications and also the experiences of the employees using them. Based on this evaluation we will decide if we continue to use the mobile applications. For now we are positive about the use of mobile applications, especially on the information/knowledge sharing application. If the test will end positively we strongly consider extending the use of mobile applications.

From this interview we found that the company is as Albert Heijn researching the possibilities of mobile applications and the use within their warehouse. They focus on different kind of applications and employees to find the best usage for the mobile applications. While doing this the company is constantly evaluating the results to improve the performance of mobile applications in their warehouses. Albert Heijn is currently also investigating the use of mobile applications in the warehouses but on a smaller scale and with a more limited user group. Albert Heijn also identified benefits for the use of mobile applications in their warehouses which led to the pilot with Prepchat. Furthermore Albert Heijn is also struggling with safety issues instigated by the use of mobile devices on the work floor and the possible effects on the productivity of the employees. From this interview

we can thus conclude that in the sector different pilots are performed to determine the effect of mobile applications on the work floor. Although the parties in the sector see the advantages of the use they are also concern with several aspects as safety and productivity of the employees.

## 6. Conclusion and Discussion

*In this chapter the results and conclusions of the explorative study will be presented. Furthermore, the contribution of this research to theory as well as practical implications and future research are discussed. The content of this chapter is the combined result of the literature study, the interviews and the benchmarking.*

### 6.1 Conclusion

The main research question of this thesis is: *What is the potential use of mobile applications on the Warehouse shop floor in Fast moving consumer goods?* This question has been answered using literature, internal and external interviews and compared to the case of Prepchat. The case of Prepchat is selected because this is the application that is currently used in a satisfactory manner at Albert Heijn

Albert Heijn is interested in the use of mobile applications in their warehouses. The company is already applying the game technique in their stores. In the stores the choice is made to not use applications since this is not accepted by the customers yet. For their warehouses Albert Heijn is considering to use the same technique but with the support of applications. This consideration is based on the possibilities of applications such as connections with databases and the five locations of the warehouses. Besides the use of mobile applications, the company is also interested in extending the use of other type of applications by introducing mobile devices. In this study, the possibilities for the use of additional types of applications in the warehouses are explored. We found that the most benefits can be gained from making information accessible quickly and bring the information to the employees to improve their performance.

Currently the company is using Aptean WMS, this system does communicate with and support mobile applications in which some information can be retrieved from the system. Some applications can also give input to the system such as received goods or shipments loaded by employees. This currently is not used by Albert Heijn, the only integration is with a voice pick system and a mobile terminal in the distribution centers. Furthermore, the company uses several applications in the support departments of the distribution centers but not on the work floor.

The first conclusion is that the use of applications in the warehouses of fast moving consumer good industry has an interesting potential. In the literature as well as the interviews several benefits were identified which support the claim to this potential. The benefits identified are; the motivation of staff, efficiency gains, effectiveness gains, speed of communication, electronic integration of business units, integration with supply chain partners, knowledge sharing, accommodating growth, improved decision making and contributing to a superior process. These benefits can be split in tangible and intangible benefits as done in table 1. To achieve these benefits, it is important to align the IT use to the business processes and identify the interests of all stakeholders. To ensure a good alignment with the business processes the software has to comply with the strategy of the company. This can be done by setting up guidelines for the developers and in each phase of the development the software should be matched to the strategy to see if it still is in line with the defined goals. Furthermore the software should focus on providing employees with accurate information in time which helps the employees improve their daily tasks.

The warehouse environment of FMCG has a special set of limitations to the use of applications compared to other industries and environments. This is caused by the safety regulations in the warehouses; these are in place to prevent harm to employees, visitors and the environment. Furthermore, safety in the warehouses contributes to less accidents and damage to the equipment. Factors influencing the safety are awareness of employees, distraction and the arrangement of tasks and workspace. Furthermore, the warehouses nowadays are active 24 hours a day to ensure a complete and timely delivery of the customers. This has an impact on the implementation of applications since this process cannot be interrupted. To ensure a successful implementation it is important that the applications have a rigid internal and external quality. The quality of applications and other software involved can be guard when the software applies to the ISO 25010 standard (ISO 25010 2016).

The use of mobile applications in Albert Heijn warehouses is challenging due to the limitations as described above. These challenges can be managed by increasing awareness of employees and strict safety guidelines controlling the use of mobiles where employees have the responsibility to be aware of the impact on their tasks. All these actions still need to be beneficial. Measuring the organizational impact is therefore a key performance indicator as is described in chapter 2.3.

The introduction of each application will change the current way of working one way or the other. In some cases this may cause negative feelings by the users of the applications since their job is changed by the introduction. To prevent employees from feeling unheard the company should start with engaging them in the early stage of the development process. When this is done, the employees will be more committed to the application and understand the choice made and the impact on their own job. These changes will often simplify their daily tasks but without this commitment it will feel as a depreciation of their job.

The next step in the use of mobile applications is to ensure a good adoption strategy for each application being developed. Using the MOPTAM model of (Van Biljon and Kotzé 2007) the important factors for adoption were defined as perceived usefulness, perceived ease of use, facilitating conditions, social influence and behavioral intention. The impact of these factors is influenced by demographic factors, socio-economic factors and personal factors. This model is also in line with the TAM model of (Venkatesh and Davis 2000) and the UTAUT model of (Venkatesh et al. 2003) which both are leading models in the field of technology adoption.

As an addition to existing applications companies can use game elements in their applications for non-game environments. This technique is called gamification (Deterding et al. 2011) and especially useful for learning and motivational applications. Gamification is used to change the behavior of the users into desired behavior. When a company is considering the use of gamification it should be aware of the users who will use the application. Different users are triggered by different elements which can be explained by the different user types as mentioned in chapter 2. Not only the trigger is important in gamification also the desired behavior and how it can be reached should be taken into account, the desired situation should be clearly described and be measurable and reachable for all users. This will support the commitment of the users which in turn will have a positive effect on the outcome of the gamified system.

In this thesis, a first exploration of the use of mobile applications in the warehouses of FMCG is done. It is shown that there is a potential for these applications specifically focusing on efficiency of

business processes and the motivation, engagement and learning possibilities of employees. To achieve these benefits Albert Heijn should develop a strategy for the use of these applications which matches both their overall strategy and their existing processes. The use of mobile devices can even extend the potential benefits of these applications but comes with several challenges. These can be overcome by applying a strict set of rules with regard to usage and by discussing the challenges with employees focusing on their role in the usage. The employees should be aware of the risks involved and how they can help to prevent these risks. Concluding the company should develop a strategy with special attention to the role of all users involved and be aware of changes in the environment which may ask the company and their strategy to adapt to these changes. In this strategy, the role of IT in the development should be taken into account. To ensure a fit with the organizational goals the IT department should be closely connected with the business department, or the IT has to facilitate the development of applications by the business themselves. By doing this the fit between the development of IT and the demands of the business can be met.

## 6.2 Contributions

This study contributes to the research of mobile applications in several ways. First there currently is little research available on the use applications in the warehouse environments focusing on mobile devices used by shop floor employees. Research on the use of applications on mobile devices in other sectors is combined with the insights acquired from the interviews with employees on different levels and positions. This led to an overview of the desired effects and limitations to the use of mobile applications in the warehouses.

Applying these insights to the case of Prepchat we learned that the type of application and the goal it achieves is a key factor to the successful adoption of the application. This is in line with the models used in other sectors like the UTAUT model of (Venkatesh et al. 2003) and the MOPTAM of (Van Biljon and Kotzé 2007). Besides the adoption of applications in warehouses another important finding is that the use of mobile devices in a warehouse environment needs special attention. This is due to the fact that the awareness of employees with regard to their surroundings can be compromised by mobile devices. This awareness is important to ensure a safe working environment for visitors, suppliers, the environment and the employees themselves.

Concluding this research contributes to the investigation and explanation of the use of mobile applications in the warehouses of FMCG, by focusing on the benefits and limitations of this usage. It also investigated to adoption of these applications based on existing models by the use of the Prepchat case. This research shows that there are distinct possibilities for the use of applications in the warehouses of FMCG if companies use a strict policy with regard to the use of mobile devices to ensure a safe work environment.



### 6.3 Limitations and future research

This research knows several limitations that need to be mentioned. Although it is an explorative study the research is conducted on one case in a company. According to (Eisenhardt 1989) and (Yin 1981) a case study is very useful for this kind of research. This case study can be used to strengthen the theory with empirical findings. Furthermore we tried to strengthen the findings of this study by interviewing other companies in the industry but due to the competitive nature of the industry they were not always willing to share the needed information. The lack of knowledge of the use of mobile applications in warehouses of other players in the industry limits the way in which the findings for Albert Heijn can be compared to other companies. Since a good comparison isn't possible, statements about the possibilities and usage can be applied to the whole sector but with certain limitations.

In this research the focus was on the usage of applications in the FMCG warehouses. As mentioned in this study we focused on both the organization and the users of the system. The impact on the environment is not taken into account. Also the impact on supply chain partners is not evaluated in this study. We chose to focus on the internal stakeholders being employees, management, IT and the organization as a whole.

The findings of this study can be generalized to other FMCG warehouses, since they often have the same set of demands to applications. This is supported by the results of the case study, in which the company recognized the factors and their attributes influencing the use of mobile applications. A remark has to be made to the findings on the strategy topic since every company has its own strategy and should determine if they want to use these applications. Furthermore, note every company culture is suitable for the use of applications in a warehouse environment. According to (Yin 1981) although we only use one case study this can be useful to confirm the findings in both literature and the interviews. The use of this case study is well suited for an explorative study like this, since it not only confirms other findings but also contributes to new insights for the research.

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## Appendix A

PrepChat

DC berichten

Collega's

ITIX

Berichten om te beantwoorden

Alle Berichten

Alle Reacties

Publiceer nieuwsbericht

PopUp bij opstarten

Zoeken

Vernieuwen

Open bericht

Verwijder bericht

Export to Excel

1 to 10 of 315

Status	Status bericht	Datum	Medewerker	Beschrijving	Antwoord
	Gearchiveerd door DCZ (1)	27/02/2017	DCZ (1)	Graag geen facings aan het begin van e...	
	Laatste reactie door DCZ (1)	27/02/2017	DCZ (1)	Horen de appels op 386-630 & 632 niet...	
	Gearchiveerd door DCZ (1)	27/02/2017	DCZ (1)	Op locatie 384-415/417 staat witlof in kl...	
	Laatste reactie door DCZ (1)	27/02/2017	DCZ (1)	Voor ons gevoel lopen de volgende loca...	
	Gearchiveerd door DCZ (1)	27/02/2017	DCZ (1)	Gang 388 is vrij leeg, behalve 2 grote fa...	
	Gearchiveerd door LDC (4)	24/02/2017	LDC (4)	De mijne is op	
	Gearchiveerd door DCP (5)	20/02/2017	DCP (5)	Beste, Op locatie 262-113p staat nu een...	
	Gearchiveerd door DCP (5)	20/02/2017	DCP (5)	Beste, Op locatie 307-367p staat tussen...	
	Gearchiveerd door DCP (5)	18/02/2017	DCP (5)	Zoulijst een orderpicker langsgereden m...	
	Gearchiveerd door LDC (4)	16/02/2017	LDC (4)	Wat goed	

Feedback

### Nieuw bericht

#### Beschrijving

Graag geen facings aan het begin van een gang zetten. Vooral de nacht part-timers komen hier mee aanzetten. Oo de laatste 2 nachten is het zo druk dat de ingang van de gang geblokkeerd blijft. Gang 383 begint nu net een facing. En mensen wachten vannacht al in gang 382 voordat ze erbij kunnen. Marij

#### Onderwerp

Facings begin gang

Typ hier een reactie

Reactie plaatsen



#### Antwoord

**Datum:**

27/02/2017 13:15

**Beantwoord door:**

Helpdesk

**Bericht:**

Beste Marijn, Je hebt gelijk, excuses, ik heb dit inmiddels aangepast. groeten, Annemiek



## Appendix B

Title	Author	Category
Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication	Adams, Dennis A., R. Ryan Nelson, and Peter A. Todd	Adoption
Use of Mobile Learning Apps in Workplace Learning	Ally, Mohamed, Mohammed Samaka, Loay Ismail, and John Impagliazzo	Gamification Workplace applications
The Roles of Information Technology in Supply Chain Management	Auramo, Jaana, Aimo Inkiläinen, Jouni Kauremaa, et al	Information systems in logistics
An Exploration of Warehouse Automation Implementations: Cost, Service and Flexibility Issues	Baker, Peter, and Zaheed Halim	Information systems in logistics
Gamification for Online Communities: A Case Study for Delivering Government Services	Bista, S.K., S. Nepal, C. Paris, and N. Colineau	Gamification
Beyond Computation: Information Technology, Organizational Transformation and Business Performance	Brynjolfsson, Erik, and Lorin M. Hitt	Organizational impact
User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioral Impacts	Davis, Fred. D	Adoption
The DeLone and McLean Model of Information Systems Success: A Ten-Year Update	Delone, W.H., and E.R. McLean	Adoption
From Game Design Elements to Gamefulness: Defining Gamification	Deterding, Sebastian, Dan Dixon, Rilla Khaled, and Lennart Nacke	Gamification
Present or Play: The Effect of Serious Gaming on Demonstrated Behaviour	Dijk, Tom van, Ton Spil, Sanne van der Burg, Ivo Wenzler, and Simon Dalmolen	Gamification
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