UHASSELT

Faculty of Business Economics

Master of Management

Master's thesis

The impact of Knowledge management on business process improvement throughout the role of business process modeling

Nour Khater
Thesis presented in fulfillment of the requirements for the degree of Master of Management, specialization Business Process Management

SUPERVISOR :

Prof. dr. Koenraad VANHOOF

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Abstract

BPM has become increasingly used this decade. Both knowledge automation and knowledge sharing are nowadays also considered as major factors for success in the business world. Decision makers rely increasingly on that slice of knowledge that helps them in their decision-making processes. Managing knowledge is about using tools to extract the needed information so managers can draw maximum benefit from the internal business process.

This study has used the KM cycle deployment as a business mechanism capable of extracting explicit knowledge and transforming implicit knowledge into explicit one. The aim of this thesis was to strengthen the understanding of the interrelationship between three concepts: KM, BPM and BPI. We wanted to find out whether BPM can be considered as a moderator variable to achieve BPI, as indicated in literature.

We used a case study methodology to examine the relationship among those variables. We opted to investigate one case in depth over comparing several ones. Our case study was conducted in cooperation with the Ministry of Health in Jordan. The Head of the IT department helped us in gathering the data.

We noticed that the Ministry of Health is by default using KM cycle as a basic platform for data gathering, dissemination and validation in order to develop certain electronic services to the public (as a project the automation of these processes/services was taken with respect to the development of a new electronic health insurance card). We developed the UML they use in developing this card. We noticed that the BPM role was fulfilled through the execution of texts (procedures in our case). It was paramount for them to make sure to test all those given texts before building a reliable business model. Several Key Performance Indicators were identified before the real integration and implementation phase started. Since the project is still not fully finished, we don't know whether the KPI were achieved. Finally we discovered that through the establishment of robust integration between the KM and BPM a positive impact on BPI could be achieved.

Through the use of BPM as a moderator variable there were tangible business benefits. We got an indication that there was for business managers a positive impact on BPI. But this is not achieved automatically. We discovered some factors that are needed to gain these tangible business benefits, such as synergy and intense communication with the stakeholders involved in such a complex system. This also indicates that the integration between BPM and KM can sometimes be used for the benefit of the organization, but that it lay also lead to a negative impact on BPI if and when these pre-conditions are forgotten or don't get enough attention.

Table of Contents

The impact of Knowledge Management on Business Process Improvement through the role of Business Process Modeling

List of Figures

List of Tables

This master thesis was written during the COVID-19 crisis in 2020. This global health crisis might have had an impact on the (writing) process, the research activities and the research results that are at the basis of this thesis.

Chapter (1) Introduction

Since the globalization of business started in 1980 an increasing demand for multi-national corporations and international business collaboration appears. This globalization triggered a revolution of the business environment which requires more accurate data gathering and processing in order to make the most effective business decisions.

Achieving more economic benefits indeed depends on the decision-making process used. Any well-organized business model relies on accurate data being gathered, interpreted and processed. In other words, business decisions within international corporations mostly rely on accurate data timely provided to decision-makers.

In addition, accurate and timely data have a significant impact on the productivity aspect of the organization. When internal employees would have accurate data, they would no more be wasting time in validating or correcting them. They would focus more on the core processes. Thus, higher business performance can be achieved. The more concrete business models are, the better decision-making processes managers can develop. Effective business models need a good mechanism to extract the needed data. Thus, within this decade many studies have been conducted to develop the best business practices for knowledge sharing that could be undertaken in order to increase business performance. Knowledge sharing is influencing business performance considerably these days.

The aim of this study is to strengthen the understanding of the role behind the relationship between knowledge management and business process management as a framework to gain so-called business process improvement.

In this section we present these concepts and how they are recently defined. Knowledge management has been recently defined as "a discipline that seeks to advance the performance of individuals and organizations by maintaining and leveraging the present and future value of knowledge assets" (Rai et al 2018). Business process improvement mainly can be any effort by any business management to increase business productivity, efficiency and the effectiveness of business processes. Business process management has been presented by "a dedicated generation of the information system that supports the design, automation execution, and monitoring of business processes." (Andrea, 2018).

The importance of this dissertation is thus to show how those three concepts can and should be integrated in such a way that it could lead to a so-called competitive advantage and whether the relationship between Knowledge Management and Business Process Management can also lead to business process improvement.

This dissertation is structured as follows. After the literature chapter, we have explained the methodology and data collection in the next chapter. This is followed by a chapter analyzing

the findings of our case study and finally a chapter stating our main analysis chapter and findings and conclusions.

Chapter (2) Literature review

The industrial revolution has been the major reason why people have changed their lifestyles. But the real information revolution only started in the eighties. Human needs have been extended beyond physical goods and products and become more fulfilled by services. Business strategies and techniques changed, and big corporations started to use digital devices or machines and technology in automating business processes. This revolution first described by Daniel Bell who published a book approximately in 1973 name "the coming of post-industrial society".

Industries shifted from manufactured-based to technological and informational-based. Labor is recently considered to be of a more mental nature rather than a physical perspective. Customer satisfaction, the reputation of organization, employee loyalty, and intellectual capital are all examples of new business concepts that were derived from this shift in perspective on business. Moreover, in the post-industrial society, information and knowledge have been used interchangeably. Service business sectors were developed and started to attract the largest segment of employment.

This chapter presents some of the previous studies related to the impact of knowledge management on business process improvement indicating the moderating role of business process modeling as well. It also examines the relationship between business process improvement and knowledge management as shown in actual literature and research.   The structure of this chapter is as follows; First definitions of the most important concepts are mentioned. Then the relationships between concepts as indicated in literature are described.

1.   Definitions

The post-industrial society experiences a shift from practical to "theoretical knowledge" which can be identified as "abstract knowledge and principles, which can be codified or at least embedded in systems of rules and frameworks for action."(Hislop et al. 2018, p. 4). This type of knowledge makes it easier to know why a certain technique in a certain process fails but also helps to re-plan for another strategy dealing with such failure in the future. It can be seen as a boost toward creativity. Obviously, the intensity of the knowledge-based and service-based economy prepares the way to the importance of theoretical knowledge in the workplace.

In this decade we can clearly observe two types of knowledge: practical and theoretical. Both practical and theoretical knowledge must be taken into consideration when applying any knowledge management strategy in any knowledge management topology. Combining both of them can increase experiential learning in business processes which encourages organizational learning. Moreover, employees can feel more confident about the system's outputs and business processes performance. Developing this strategy involves all four pillars that make the organization perform well: employees, processes, internal business culture and organizational objectives.

Combining both practical and theoretical knowledge in choosing the appropriate Knowledge Management (KM) approach will help employees in solving some problems they are facing with the IT system regarding their business operations. Therefore they will become more motivated and more responsible for this strategy. This chosen strategy will also increase the innovation level within the business processes. This will boost performance and affect business culture with new improvements in a way that this culture is used for the benefit of the applied strategy and the whole business organization. Finally, business objectives can be carefully adjusted to allow this strategy. That will add value to their results. The new strategy should, however, be developed in a way that compliance with those objectives is possible.

1.1. Knowledge

1.1.1. The concept of knowledge

The concept of knowledge itself is clearly multidimensional and merits some attention before tackling the concept of knowledge management. Kalpic and Bernus (2006) have developed taxonomy of knowledge forms an organization can acquire. It is mentioned in Figure 1 below.
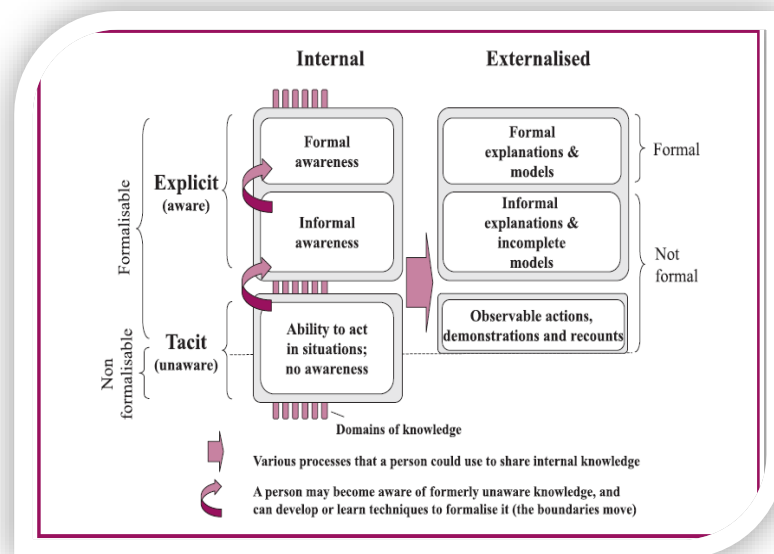
Figure 1: Knowledge categories

(Kalpic and Bernus, 2006, p. 45).

The concept of knowledge seen as two types also it can be transformed, Figure 1 indicates that one form of knowledge can be transformed into another one; tacit can be transformed into explicit. While there are other types of knowledge just discussed, this paper will focus on these two types: tacit and explicit knowledge. This will be discussed in the next section.

1.1.2. Topologies of Knowledge

The application of any selected KM strategy does not only have to take the mentioned four pillars of an organization (employees, processes, internal business culture, and organizational objectives) different KM topologies must be also taken into account. One can look at knowledge from two different perspectives: objective and subjective. Objective knowledge is related to how much we actually know about a certain task or process, while subjective knowledge is related to how much we think we know about it. The objective knowledge is the one that can be codified in a tangible form, and not related to an individual. It is thus reliable, while the subjective knowledge that individuals possess can't be translated into a tangible form. Objective knowledge is consequently easier to be shared than subjective knowledge.

However, when it comes to knowledge, analysts and scientists categorize it differently. For analysts, knowledge is considered to be the third level, growing from data and information. All three levels are considered different layers that have to be treated differently. Data can be transformed into information and information into knowledge. There is consequently an intricate relationship between data on the one hand and knowledge on the other hand (Frost, 2017). Paschek et al. (2017) indicate that knowledge only arises" when people consciously assign information by comparing, evaluating, linking and sharing with other meanings" (p. 184). Knowledge supposes the presence of a network of skills needed to interpret and use the information to solve a problem or execute a task. Therefore real knowledge can only exist within an organization managing these skills efficiently. In a digitalized world focus has to be put on data mining capabilities to transform the information into useable knowledge. Data management is thus part of KM (Paschek et al., 2017). This is indicated in Figure 2.
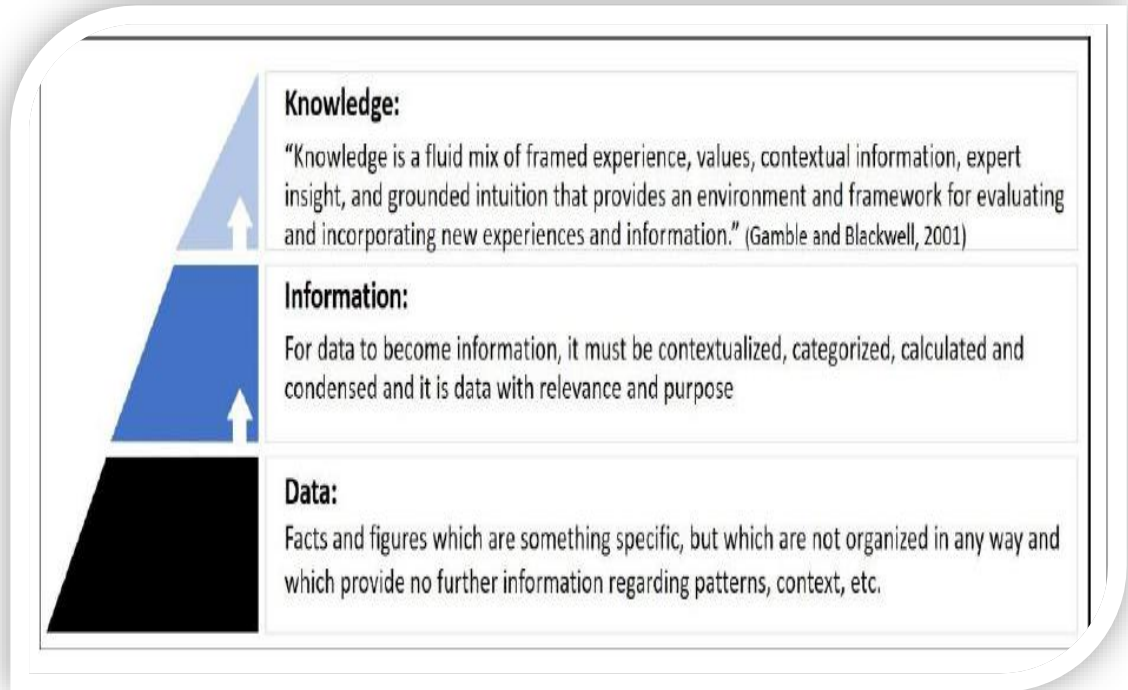
Figure 2: From data to knowledge

(Paschek et al., 2017, p. 184).

The middle section of this Figure highlights the importance of data management techniques in which data mining is one of the most important techniques.

For scientists, knowledge itself can be in one of two types: explicit knowledge and implicit knowledge. The difference is based on the fact of whether people in a company or organization are aware or not of the knowledge the organization possesses (Kalpic and Bernus, 2006).Put into an equation: **Explicit knowledge = implicit knowledge + awareness.**

Words used in explicit knowledge are notably more expressive than with implicit knowledge. Implicit is inexpressible especially with regards to codification. We can express the logic behind explicit knowledge much more easily than the logic behind implicit knowledge. If we can express (identify) and store the knowledge we possess, it will be considered as explicit knowledge. Therefore it becomes easier to treat (edit or retrieve). We can say that in order to reach and express explicit knowledge we indeed need to define implicit aspects underlying this explicit knowledge. (Ditmarsch, 2017)

One fundamental property when distinguishing between explicit and implicit knowledge is to consider explicit knowledge as implicit knowledge plus awareness. This means that when we as humans reach an ideal state in what we are doing (which is the "awareness" about the process or

operation currently at hand), then we should be capable of seeing and expressing implicit knowledge explicitly. And this is exactly what we need to extract knowledge within any organization. Business reality thus needs all types of knowledge: objective and subjective, tacit and explicit.

The first step to manage knowledge in any strategy will be to identify the knowledge the organization possesses. Any knowledge an organization has will sometimes be considered an organizational "asset". Both explicit and implicit knowledge have to be codified and stored within the system, often by an automation process. After this automation process, the second step is that knowledge can be disseminated using the right rules and privileges to the employees. According to their position and type of work, employees can be granted access to the specific types of information they need to work with. They will then be able to read, write, edit or delete the knowledge.

Providing a repository for both knowledge and best practices for using it, with the ability to edit retrieves or delete will help employees to foster their business processes and increase creativity in doing those processes. This can only be provided by ICT which possesses the appropriate tools to do so.

1.2. Knowledge Management (KM)

1.2.1. The definition of Knowledge Management

The definition of KM sometimes depends on the basis we use that can affect the presentation of the definition. Simply Iandoli and Zollo (2007) define KM as "a process that contains practices and techniques used by an organization to create, capture and use knowledge to enhance performance". This use of knowledge includes identifying, representing and distributing it. Know-how can also figure among the several forms of knowledge itself. Expertise and intellectual capital can be mentioned as examples here. Mohapatra, Agrawal, and Satpathy (2016) describe knowledge management as "a process-oriented approach used for identifying, capturing, storing, disseminating and then applying knowledge within the organization in order to make the finishing of business transactions faster besides reducing production cost and rework". Milton and Lambe (2016) believe that KM represents a way of managing work in parallel with paying attention to the value and effect of what they described as the intangible asset, namely knowledge.

1.2.2. The role of ICT in Knowledge management

It is important to transform individual knowledge into organizational knowledge in order to be able to re-invest this knowledge for the benefit of the organization. In such a way, existing errors and mistakes in the system or while employees doing any process can most probably be

identified correctly and solutions to them can be developed much more easily than before as well. The more existing knowledge is re-invested, the more innovative ideas to managing business processes will pop up improving the results the next time the processes are run. The more we are using this KM strategy within a carefully selected IT system to identify, store, share and apply more successful business strategies, the better the results that can be achieved.

Information and communication technology (ICT) can provide all the needed tools for the selected KM strategy. These include: databases where data, information, and knowledge are declared and stored; communication tools like emails and networks capable of sharing this information of knowledge; GUI (Graphical User Interface), browsers, dashboards that allow employees and managers to search for a certain needed data, present it and make comparisons and analysis with them. For group support, it can also provide groupware that would encourage work synergy and collaboration. Those tools can also provide confidentiality and secure data surfing or transferring among business departments and with others when needed.

From another perspective, we can see ICT plays the role of an enabler to manage the knowledge an organization possesses in a secure and reliable manner. We can thus say that the knowledge management process is highly dependable on ICT. This role has many drivers, like changes in the business environment, international political and economic challenges, massive business pressure, and new technological advancements.

Through the use and the application of ICT in parallel with a selected KM strategy, a business can achieve immediate rewards. Managers can obtain rapid positive changes in their business profits and improve the organization's reputation as well. It will also become easier to transform any local business into an international one. In response to current competitive pressures, companies can boost their business performance and keep up international communications with suppliers, governments and even competitors by the use of the internet, video and web conferencing platforms and other communication tools provided by ICT.

One example of how organizations can use ICT to keep up with the competitive advantage is when the decision-maker wants to submit a cost-benefit analysis as a trade-off method between two projects or even wants to determine the expected results for some strategically business changes. This kind of analysis can be performed much easier using any kind of spreadsheet program doing the needed calculations, seeing expected numbers and then presenting them to the stakeholder. Moreover, after doing all these calculations, the whole costs and benefits analysis in monetary terms can be entered into software, Monte-Carlo simulation for instance. This simulation will help to draw conclusions with regard to the results and consequences of these decisions. Decision-makers can use it as it can provide a solution to either a mathematical or optimization problem. As such, they can expect more accurately the net present value given several assumptions and perform a ranking among the business changes alternatives. (Teknomo, 2019)

Hence, the role of ICT with KM can be effectively used to the benefit of the business in general. Extracting the appropriate knowledge internally at the appropriate moment using the appropriate ICT tools for analysis and presenting the results to stakeholders will boost business.

Forecasting will guide the business in making better decisions, streamlining internal and external communications, leveling up the strategic thinking through the new valued and secured information the organization has, decreasing error costs and increasing earnings in the long run. Also due to the new communication channels business can break through international barriers and improve customer service and customer satisfaction, encourage joint ventures and international collaborations and decrease start-ups costs.

1.2.3. The Knowledge management Cycle

An effective knowledge management strategy should identify, generate, acquire and disseminate organizational knowledge benefits in order to provide it with the appropriate level of competitive advantage. Kalpic and Bernus (2006) already indicated several steps of the knowledge management process that are quite similar to the practices aforementioned in the first paragraph in page 7, namely acquiring, filtering, classifying, distributing and using the information gathered.

As previously mentioned the first step consists of considering the knowledge an organization has as a central core asset in such a strategy and realizing that an appropriate type/level of data is needed for an efficient decision-making process. Next, the organization should develop and use a trustworthy ICT system that automatically provides intelligent mechanisms in dealing with the performed internal processes in such a way that so-called organizational learning can be achieved.

There are many ways to develop an internal organizational learning process. One way is to integrate business processes thus allowing all organizational levels to be included in this learning process. This should be done on a per-transaction or on a daily basis certainly if some business processes are performed regularly. This will help each business unit to gain its own separate learning and development. (Dalkir, 2005; Lewis, 2014).

If the organization wants the organizational learning process to reach every single part of their business, so that it becomes an integral part of the company, deploying a real knowledge management cycle is necessary. Only then everyone in the company in any organizational function or part will be able to extract and deal with the available knowledge. Any knowledge management strategy thus has to apply an identical cycle to cover all needed knowledge, edit it and use it again on a regular basis in each business cycle.

The complete knowledge life cycle has to be covered by any strategy relating to knowledge management. Several authors have described such a KM cycle. (Dalkir, 2011, p. 33) and (Guus et al, 1999, p. 71) they are pretty comparable. The major activities cited by them are in general:

1. Identify which are the optimized knowledge sources, situated either inside or outside the organization.

2. Strategize what is the valuable knowledge and/or what are the best practices in which implicit knowledge has to be extracted, codified or transformed to explicit knowledge, in a format most needed in the future.

3. Facilitate the dissemination of the knowledge and/or best practices available to the business areas/units that need them.

4. Accelerate the deployment of the best possible knowledge to business processes to start solving problems and making decisions.

5. Validate and test the outcomes from the previous step.

6. Articulate the know-how for those best practices or knowledge, which should result in two parts: most useful and least useful. The least useful practices/knowledge should be disposed of while the most useful should be transferred to the organizational knowledge repository.

These activities are associated with a value chain of knowledge, as the following figure represents.
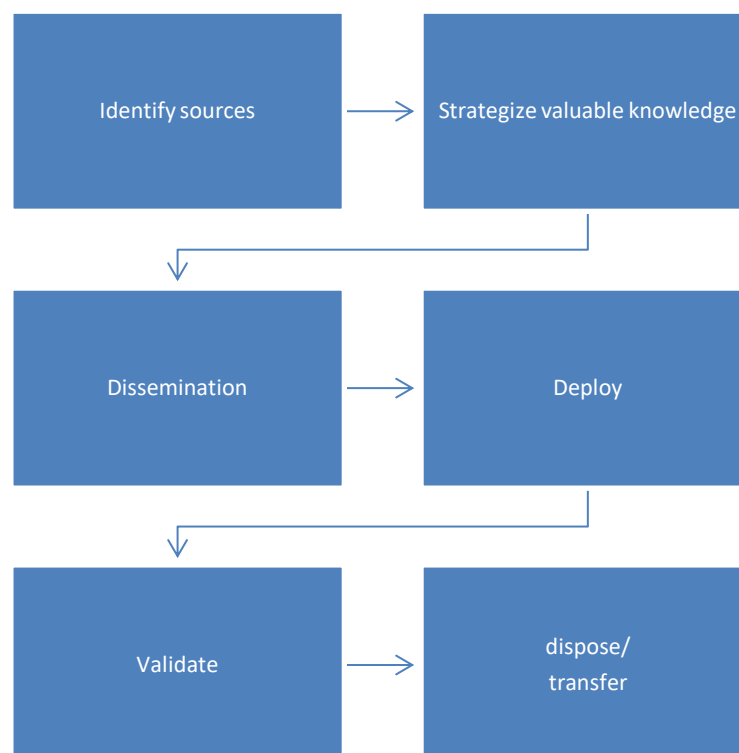
Figure 3: Knowledge management cycle and the associated value chain

(Based on Guus et al, 1999, p. 71)

As mentioned, ICT can provide tools and programs to foster the knowledge management process. Databases are the most important tools that can be helpful to apply the knowledge

management cycle shown here. Here we should distinguish between traditional databases and the databases that would be useful in our case. Relational DBMS, object-oriented and NoSQL databases are traditional types, whereas for knowledge management purposes using a knowledge base database will be necessary to create the link between these activities and databases.

1.3. Business process modeling (BPM)

Havey (2005) labels Business Process Modeling as Business Process Management and says that BPM "refers to the design and execution of business processes". Mendling et al. (2013) Defined BPM as:" the art and science of overseeing how work is performed in an organization to ensure consistent outcomes and to take advantage of improvement opportunities". Weske (2007) established the characteristics of business processes and adopted a few definitions of BPM:

- "This definition includes concepts methods and techniques to support business processes in administration, analyzing, configuration and enactment."
- "It can also be seen as a generic software system that is driven by explicit process representations or graphical notations."
- "A model consists of activity models and execution constraints between them."

Montali et al. (2018) pointed out how core computing principles are underlying BPM, by referring to the use of novel languages and functionalities, advanced theories, algorithms and methods for (conceptual) modeling of processes and their (formal) analysis in BPM. It is important to mention this because data management was also mentioned before as a defining capability for knowledge creation and management in the previous paragraph.

1.4. Business Process Improvement (BPI)

Harrington (1991) highlighted the effort of launching BPI, considering it as a major event within a company or organization. He defines it as a decision that will impact habits, attitudes, systems and even technologies. Page (2016) sheds light on the fact that BPI is an effort that can be launched in order to improve the ability of the organization to meet its customers' need, eliminate errors, identify opportunities to yield more effective and efficient processes, assist in learning and even to end processes that are inefficient. It makes the relationship clearer between the departments, makes the roles and responsibilities themselves among departments more transparent and boosts an organization's productivity. It also eliminates redundancy.

2.   Relationships between the concepts of KM, BPM and BPI.

2.1.1. The relationship between KM and BPM

In general, a positive relationship between KM and BPM is already mentioned by Valmohammadi and Almady (2014). They showed by numbers that there is a positive and meaningful impact on overall business performance through KM. KM practices have a significant effect on growth and on the learning dimension of organizational performance. But which factors play a role in this process?

Regarding the relationship between KM and BPM, Stieger and Alesky (2009) showed that there were reasons or success factors for the adaptation of KM within a company. The most important one of these was the culture which should be considered as an enabler of business process management. The paper mentioned that the culture of an organization is a critical success factor, especially when it comes to knowledge sharing (which resembles the third step in figure 3) as the sharing enables the re-utilization and creation of knowledge. Adapting KM can considerably adjust the business process environment.

Kock (2005) pointed out that knowledge sharing as a significant component of KM was a crucial enabler through business process improvement. He studied the use of virtual groups as a technique for e-collaboration and showed that KM has a positive influence on business process improvement.

Culture was also mentioned by Wong and Aspinwall (2005) as one of the defining factors of successfully implementing knowledge management in the processes of SME's (Small and Medium-sized Enterprises), it was the second most important factor after management leadership and support factor, next to several other factors such strategy and purpose, resources, processes and activities, training and education, HRM, IT, motivational aid, organizational infrastructure and measurement. It is important to notice that both processes and data management techniques are mentioned here, indicating the intricate relationship between KM and BPM. More recently, Lückmann and Feldmann (2017) came to nearly identical conclusions using case analysis in SME's.

2.1.2. The relationship between KM and BPI

There is also an intricate relationship between KM and BPI. Bhatt and Troutt (2005) have supported the hypothesis that BPI directly affects customer responsiveness and product/service innovation. In addition, data integration and communication networks flexibility are found to significantly affect customer responsiveness and product/service innovation via BPI. Communication network connectivity, however, did not have any significant effect on the same variables.

Yet the relationship is not always positive. Kohavi et al. (2009) have found that many improvement ideas based on newly acquired knowledge do not necessarily lead to real business process improvement results. About one third only proves to be beneficial. This is in line with the

findings of Ebrahimi et al. (2013) which suggest that the efficiency of KM and its integration in a BPM System or Enterprise System largely depends on the level of common knowledge and the level of coordination within the adopting organization.

Vanwersch et al. (2016) have tried to find out why this is happening. They have identified a couple of reasons. Firstly, comprehensive methodological support for practitioners wanting to improve their business processes is not available, amongst others due to the lack of uniform concepts and definitions (BPI is mingled in literature with Business Process Redesign, Change, and Re-Engineering for instance). Secondly, there is a lack of knowledge of practitioners of the different types of information and knowledge they are confronted with when generating business process improvement ideas (LimamMansar et al. 2009).The consequence is that they just start brainstorming about process improvement ideas from a set of process improvement goals, often guided by an external consultant (LimamMansar et al. 2009) and in a workshop style. These sessions, if they really lead to choices and new practices, may lead to biased choices and have a tendency to neglect attractive process alternatives (Chai et al. 2005). This is certainly the case when new ideas are situated outside the company and have to be developed together with outside partners such as suppliers or so. Many opportunities for reducing cost and throughput times as well as for improving customer satisfaction is thus missed (Recker and Rosemann, 2014). Both reasons can clearly be seen as hampering the efficiency of KM.

The major conclusion is that a method ensuring more efficient KM in the sense that a more systematic exploration of all potential solutions by employees having to implement BPI is absolutely required if an organization wants to generate process improvement ideas more creatively and effectively and be successful at BPI. Vanwersch et al. (2016) have developed a model containing six fields of interest that have to be investigated systematically for doing so. They are:

1) The aim that explains the objective of the BPI initiative.
2) The human actors that are invited to participate in the improvement process.
3) The input that specifies the information that is collected prior to the BPI.
4) The output that describes the result.
5) The technique that prescribes how to generate different process improvement ideas.
6) The tool that is defined as the software package that is able to support these techniques (p.46 - 47).

Apart from having the right tools and techniques, management style, training and efficiency and the stimulation of soft skills stand out in this list.

Ebrahimi et al. (2013) agree with this. According to these authors, a clear management process attitude, proper training, improving BP Modeling skills, unified organizational goals, improved interdepartmental communication, and cross-functional teams are the means to increase the efficiency from the human actor side. They have to be complemented with the use of proper

techniques and management guidance. Some authors also suggest shadow testing of the knowledge-based ideas on the basis of Business Process Modeling to verify whether KM ideas really lead to BPI (Satyal et al., 2018).

2.1.3. The relationship between BPI and BPM

The relationship between BPI and BPM is more complicated. In order to explain it properly, we first have to investigate the factors influencing BPM in a positive way.

In this respect Trkman (2010) mentions : the fit between the business environment and the business processes (considered as of strategic importance, training of employees, the appointment of process owners and employee empowerment), the effort to try to continuously improve (installed quality improvement processes) and the fit between business processes and technology (level of IT investment, informatization of processes). The presence of an efficient quality improvement system has been mentioned consistently by many authors looking at factors making BPM work positively (Zairi, 1997; Hung, 2006; Pourshahid et al., 2009). These authors mention that quality improvement systems are cyclical processes following a clear plan-do-check-act cycle (a typical Deming cycle) in which improvement stems from the fact that based on correct data the improvement ideas, which are part of the process are checked for their efficiency in the third part of this process. As such BPI is part of the process leading to a more efficient BPM. It is an important step-in the BPM process. Thus there will be a positive relationship between BPI and BPM, but BPI cannot be considered as a variable influencing BPM, it is a moderating influence in the BPM process itself (Zairi, 1997; Pourshahid et al. 2009).

3.   Problem statement

From the previously mentioned literature, we can derive the problem we want to tackle in this dissertation.

Business process management proved to be an easier and better solution than the past options to get to improve organizational effectiveness. Using BPM as a business approach has recently reached maturity within many business projects. However, when organizations apply a certain BPM strategy or program through any of their projects, it doesn't mean that they will gain the expected business benefits automatically. The success of BPM is like any other program depends indeed on several factors such as employee skills, organizational culture and internal control.BPM is more about implementation and about execution.

Knowledge management can help the organizations by enabling their employees to extract and monitor the necessary data. Using these data will increase the effectiveness level of the decision-making processes. Selecting the most appropriate decisions has a strong positive impact

on organizational performance. A mechanism for selecting the necessary data by the organization is not enough. For instance, within process-centered organizations it is crucial to improve the processes before automating them. Knowledge accuracy and data quality can act as the preliminary step before any improvements. (Jeston, 2008, P. 15)

Just as BPM can't execute any business strategy on its own without sufficient data, the application of KM alone cannot simulate business effectiveness. The completeness, correctness and accuracy of the data cannot be determined without the use of BPM and using BPM as a stand-alone program will not help managers to assess the value or the benefits of the business project. Synergy of BPM and KM is essential to be successful. Like Edwards in 2003 introduced Business processes as a way how we can implement KM.

In this dissertation we will try to illustrate this synergy more clearly by investigating one important process. The purpose is to go deep and not to compare with many other cases, as explained in the methodology chapter. Thus our problem statement is to investigate how BPM and KM can synergistically create improvement in business processes, and thus constitute a building block for BPI.

3.1. Research Questions

This problem statement leads to the following research questions:

1. Is there an effect of KM on BPM in business terms?
2. Is there a link between KM and BPI?
3. Does BPM have a positive effect on BPI as a moderator variable?
4. Can the integration between BPM and KM achieve tangible business effects?
   - Which are those tangible effects?
5. Does the integration between KM and BPM have a positive or negative impact on BPI?

Chapter (3) Methodology

This chapter presents the method used to examine the relationship between Knowledge management, Business process management, and Business process improvement. It shows several indications for the link between the KM cycle and the case.

1. Case Study Method

In order to examine whether there is a positive impact on Business process improvement from Knowledge management through business process management, the real-world organizational and environmental context should be taken into account. Exploring and investigating reality beyond those variables can be easier using this method. Although there are many other methods can be used but for this case, qualitative methods will be more reliable. Merriam (2009) has indeed defined qualitative research as research focusing on "discovery, insight, and understanding" by locating the observer in the outside world. "It explores issues and answers questions by analyzing and making sense of unstructured data (p. 25-26)".

In the qualitative research field, we opted to select a case study method, which is very well suited to address research areas that have not been extensively researched before (Eisenhardt, 1989). Yin (1994) defined a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". According to Eisenhardt (1989), a case study strategy is "a research strategy which focuses on understanding the dynamics present within a single setting". A case study can consist of just one case, as well as multiple cases (Graebner and Eisenhardt, 2007).

Case study research is specifically indicated as a research method when: (a) the focus of the study is to answer "how" and "why" questions; (b) you cannot manipulate the behavior of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study (Baxter and Jack, 2009).The use of the case study method fosters and strengthens the examined key results. The preconditions are present in this research as the link between KM and BPM has to be treated more from the how and why the angle of an observation than from the angle of how frequently it exists.

Moreover, this method carries the opportunity to combine more than two other sub-methodologies to collect the needed data. Direct observation, personal interviews, and some other stored data which directly relates to the examined relationship can be used to highlight the basic variables within the concluded framework. Those sub-methods can make key concepts and key results closely related to the involved parties within the selected case, thus more quality-oriented (Yin, 1994, p. 45-48).

Through the use of this case study method, a deep insight, and intensive exploration of the main variables can be manifested. The hypothesis will be formulated better so it can give a chance of conducting further research (Stake, 1998).

We have selected the one-case research method, going as deep as possible to explore our research field. Going deeper can allow increasing the knowledge a lot, without necessarily making generalizations of the results possible (Merriam, 2007). Yet the data can be generalized more easily within the case and this, in turn, will add a more comprehensive understanding of the framework (the KM cycle in Figure 3 of the previous chapter) to be tested (Stake, 1998).We believe indeed that our understanding can best be increased by an extensive description of a case, not necessarily by comparing multiple cases. Thus, we hope that this can be the start of increased knowledge within the field of Knowledge Management on its impact on business process improvement.

2. Selection of the one case sample: The Ministry of Health in Jordan

The selected case study will be conducted in the central branch of the Ministry of Health in Amman the capital of Jordan. This branch is responsible for applying and approval of establishing new health insurance projects across all other branches. Feedback on those projects will be carefully taken into account. Sustainability in providing insurance services to the public within the available means and rising up health standards is indeed depending on the quality level of the health management controlling process. The first figure below represents the organizational chart of the Ministry of Health and where the branch is exactly situated. It is followed by a second figure explaining the organizational levels of the Ministry of Health.
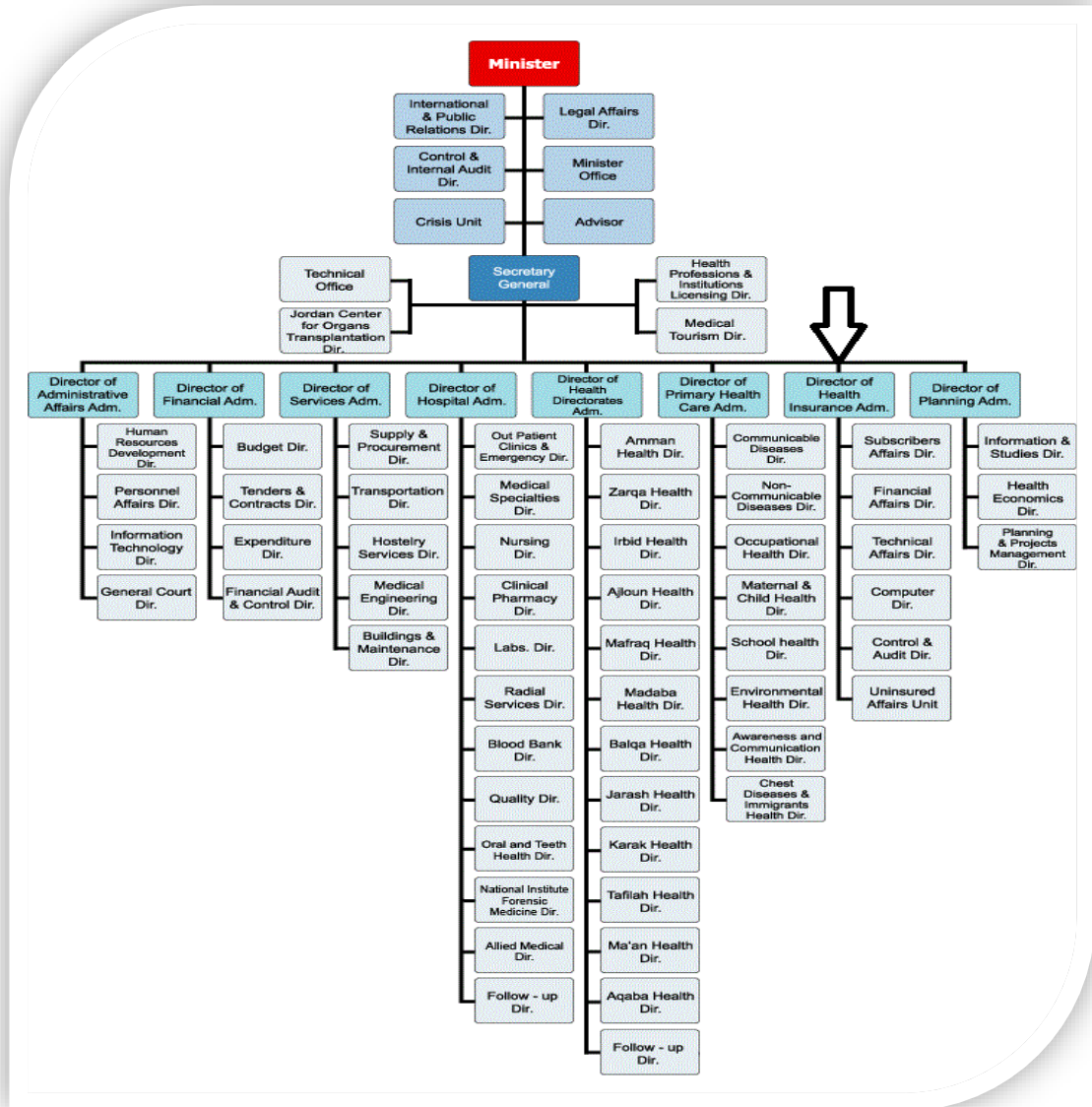
Figure 4: The organizational chart.

(Ajlouni, 2011, P.26).
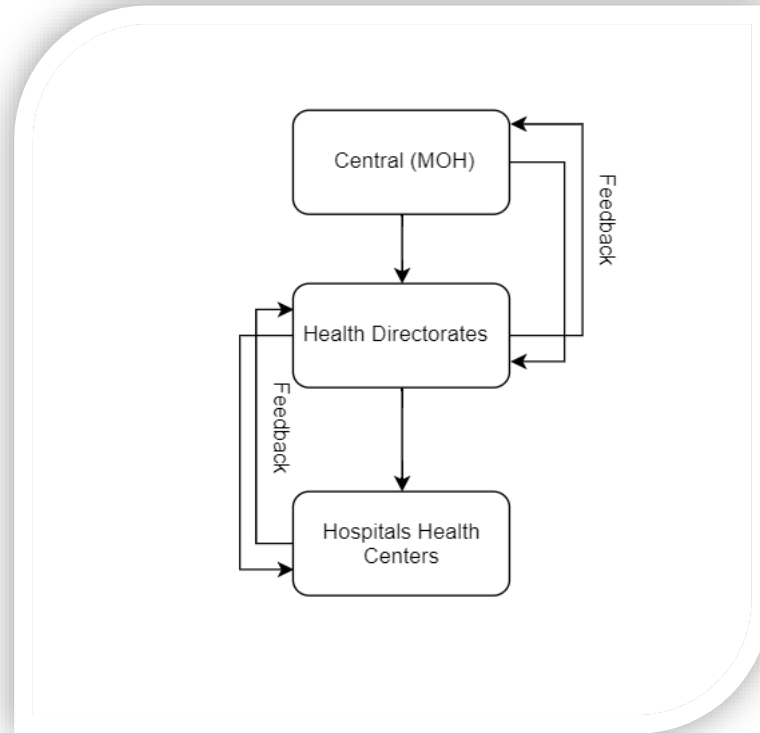
Figure 5: The organizational levels of the MOH of Jordan.

This figure represents a translation of the "hierarchal system" by which the Ministry of Health wants to implement the new health program. The highest level takes the final decision on the new program and decides when and how it needs to be executed. The directorates' level receives and applies the project and then launches it in different hospitals and health centers.

The strategically position of the Directorates level (where we obtained the data for this case) ensures the existence of feedback loops, which indicate opportunities for learning and training. That fits excellently with our objective of examining the main concepts of the KM cycle. In this research venture concepts as feedback and trust-worthy management are two factors that need to be analyzed as well. We will analyze the process at the level of the Ministry of Health on the basis of one recent project this branch has executed. This example will be discussed in the next chapter on data collection and analysis.

Chapter (4) Data collection and analysis

This chapter presents the recent project undertaken by the central branch of the Ministry of Health in Jordan. It is organized along with the different steps in the KM process developed in chapter two.

1. Description of the Project

The new project undertaken within the current period is the automation of issuing health insurance cards. The main goal for such a project is to simplify health insurance service to the public by obtaining the services without the need to individually come to the responsible department and apply for the service wanted. It will also reduce the time and effort in doing so for both customers and employees. In addition to improving the quality of the services, applying the highest levels of information security is also a goal and will be achieved by reducing the number of paper transactions used to complete health insurance transactions.

Through the project, it will become possible to request health insurance cards automatically and online via the website of the Ministry of Health. There will be no need for the customers to come and apply by filling specific forms to request those cards. The project will enable members and non-members to deal with health insurance cards online. Starting from registration procedures, successfully create an account and choose the online services they want. Those services mainly are an insurance card issuance service, insurance card renewal service, insurance card cancelation service, a lost insurance card replacement service and a damaged insurance card replacement service.

The data of this case study, conducted within the central health section of the Ministry could be obtained due to a personal connection with the Ministry. Furthermore, the accessibility to the project's main steps and data was thus easily obtained, which increased the level of readiness to pursue the research study.

The current online system of this branch is supporting very few services. Those services are almost only performing as a back-end system. After launching the targeted services, end-users will be able to deal with the insurance system much easier. The figure below shows a comparison between the current and the future system and as such the desirable new system interfaces with the public.
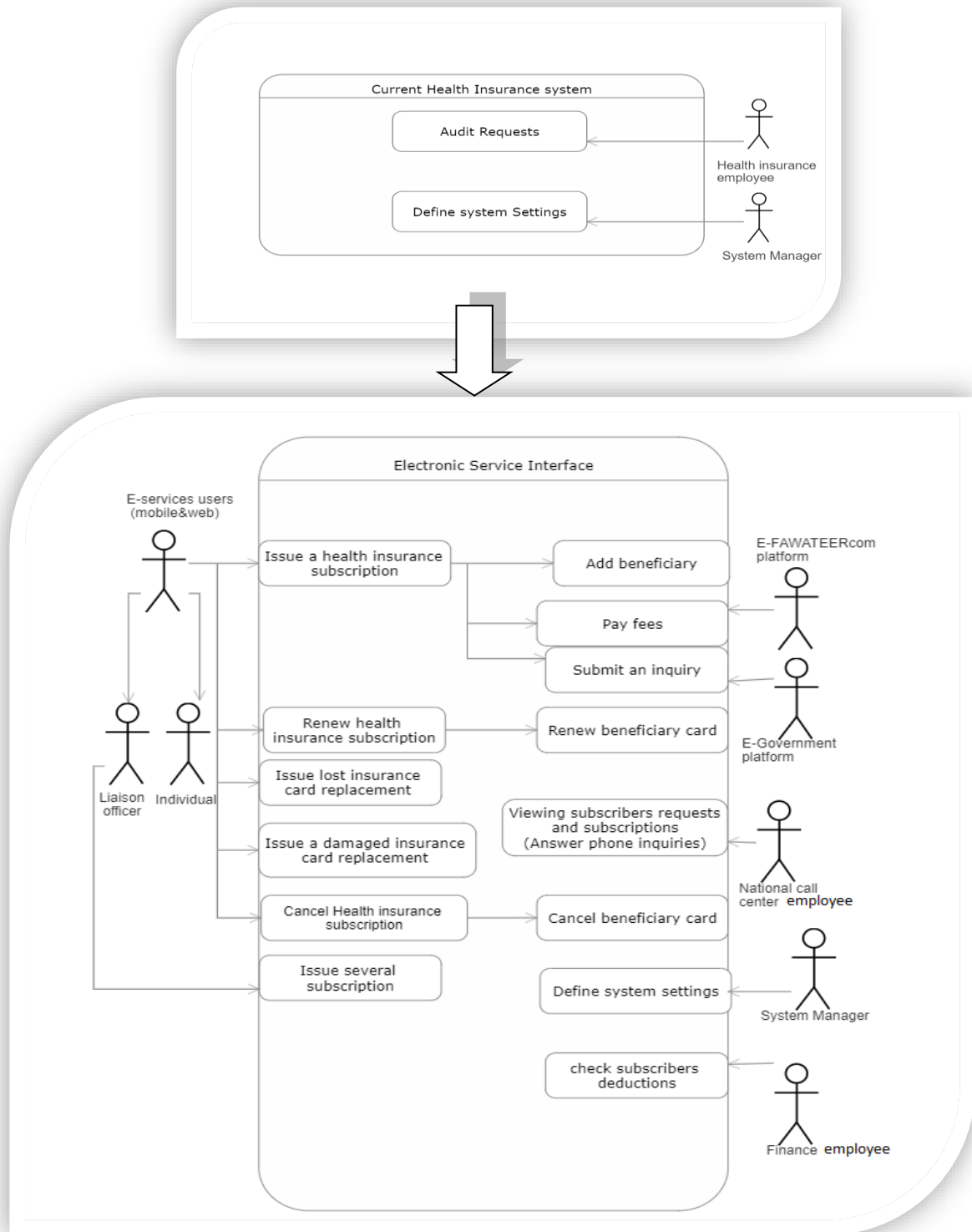
Figure 6: Use case for the current and desirable system services.

(Author's own design).

2. The Deployment of KM cycle

As mentioned before we will try to find the relationship between KM and BPM through the deployment of the KM cycle mentioned in Figure 3 of the Literature Review Chapter. A project of issuing a new service into the Ministry of Health, of course, relays on somehow applying the KM technique to better achieve the business objectives. As such the KM cycle will directly address the main factors used within the case study.

2.1. Strategize valuable knowledge

However contrary to the process flow described in this KM cycle, we will first describe its second step, the strategization of the valuable knowledge.

The project managers applied logic in going through the several steps of the project in order to achieve their overall business objectives within the framework of achieving the results with the lowest efforts and costs possible. Yet is was absolutely necessary for them, even before gathering essential knowledge (the first step is the KM cycle as described), that two strategic elements were also taken into account in order to be able to achieve the competitive advantage level the project wanted to obtain. Those factors are the involvement of all stakeholders and the quality management of the data. We describe them in the next paragraphs.

The involvement of all stakeholders with regards to KM includes knowledge sharing and communication among all business levels both internally as well as externally. This communication was clearly established immediately and comprised of the business project, the outside business partners and other governmental institutions. It was done through the SGN (Service Government Network). Amongst the external partners were, for instance, the Ministry of Digital Economy and Entrepreneurship, some local law consultants to keep them up to date with few law cases that might arise in the meantime and are not already covered by the health insurance internal policies.

In general, explicit data were selected, collected, analyzed and used and implicit data were analyzed and used as well. We will mention here some of those data that were considered as valuable data by the project managers and team. They classify the following data under the name of "requirements specifications". These specifications were almost treated as data.

Explicit data: first of all, the online system of the MOH will be used by four different major categories of both internal and external end-users of the system. They are:

1. Individuals: The data necessary to complete the transactions will be entered by a subscriber, after registering via an account in the system. Most of his/her data will be relied upon by different liaison points according to the chosen insurance category. The table below shows the connectivity points that already used after been approved to confirm individual data:

Table 1: Connectivity points.

No.	Connectivity points
1	Civil Status And Passport Department
2	Social Security Corporation
3	Civil Service Bureau
4	Greater Amman Municipality
5	Ministry of Social development
6	National Aid Fund
7	Military Insurance
8	Ministry of Higher Education
9	Ministry of Education

2. Entry points: An entry point signifies that a liaison officer is present in every institution concerned where someone may be a customer of the health insurance system. They provide him/her with a special account for the agency that he/she is affiliated with. These entities are responsible for authenticating subscriber information and they do not have a ready link to do so, taking into consideration the authority mentioned in the Department of the Authority of the Entities, which specifies for each entity the affiliated people who may issue, amend or cancel a health insurance card.

The table below shows the entities that will be approved to enter subscriber information.

Table 2: Entry points.

No.	Entry points
1	Political Development
2	Health Center to diagnose disabilities
3	Blood Bank
4	Prime Ministry
5	Private subscription companies
6	Jordanian Writers and Literature Union
7	Jordanian Writers Association
8	Ministry of Municipals Affairs
9	Ministry of Health
10	Ministry of Local Administration

3. National Call Center users.
4. Health Insurance Administration user: To view reports and statistics and to approve requests (if necessary). The user account may be on the current health insurance system already. In that case, there will be no need to create an account on the electronic health insurance system (the new one).

Another example of explicit data is pre-specified insurance types. A card will be granted to users and its validity will be determined based on the type of insurance the person belongs to. The following table shows the main types of insurance.

Table 3: Insurance types.

NO.	Insurance type	The main types of insurance (Examples)
1	Private subscription	• Pregnant women category • Article 30 over 60 years • Cancer patient • …
2	Civil retirement	• The rank and salary of a former minister • The former head of the Judicial Council • The heirs of the minister's rank • Municipal retired • …
3	Social Security	• Social security pension • Retired daily social security • Social security pensioners • …
4	Health insurance employee	• Deposit at his request • Deposit without request • An employee without a contract
5	Amman Municipality employee	• Day laborer • Day Laborer/On vacation Laborer
6	National aid	• National aid beneficiary

Some types of insurance are associated with entry agencies. These types were not the consequence of the individual's choice when issuing a card and are limited to the authority concerned with entry only. The following table shows some examples:

Table 4: Insurance types accruing to connectivity points.

No.	Entry point	Insurance type
1	Political Development	• Deputy Parliament • Senator (Upper house)
2	Health Center to diagnose disabilities	• Disabilities law (under 18)
3	Blood Bank	• Blood donor
4	Prime Ministry	• The highest class / first group • Rank and salary of a minister • Head of the Hashemite Royal Court • President of the Judicial Council • President of the Constitutional Court • Prime Minister • Former Prime Minister • Minister of the Royal Court • Current minister
5	Jordanian Writers and Literature Union	• Jordanian Writers and Literature Union
6	Jordanian Writers Association	• Jordanian Writers Association
7	Ministry of Municipals Affairs	• Mayor • The head of the local council
8	Ministry of Health	• excellent doctor • Employee / Trainee

Implicit Data: the new proposed services are easily expressed and able to be communicated with all included parties. However, how these services will operate and look like within the Information system and online interfaces is not readily expressed and not all parties can be or are aware of it.

The health insurance system will allow users to issue government insurance cards to different community segments, depending on the type of insurance they have (employee, retired, judge, minister ... etc). Each type of insurance has conditions that must be met in order for the card issuance to be approved. Therefore some implicit data had to be recognized and analyzed by the project team in order to create an application process for the new process that functions correctly. Some examples of such implicit data are related to:

1) Cases of using the electronic services system for health insurance

2) User Cases (Individual and Liaison Officer)

- Create a health insurance subscription
- Renewing the health insurance subscription
- Adding a beneficiary
- Issuing a replacement card
- Issuing a replacement for a damaged card
- Cancellation

3) User Cases (Liaison Officer only)

- Creating a health insurance subscription for more than one subscriber in a specific entity
- Creating a health insurance subscription for more than one subscriber (private companies)
- Renewing the health insurance card for more than one subscriber

4) Support cases (individual and liaison officer)

- Completing a saved request
- Paying off
- Submitting an inquiry
- Completing the subscription creation requests after checking

Quality management of the data involves first and foremost focus on the testing phase. Later in this chapter, the types of testing the project managers focused on will be mentioned. By focusing on testing, the project team can maintain the sustainability of the services and the quality of the data, which are both very important factors for KM as well. Figure 7 shows how project managers identify and assure data quality to services to be established. Therefore it is called a quality management process by the project team.

The impact of Knowledge Management on Business Process Improvement through the role of Business Process Modeling
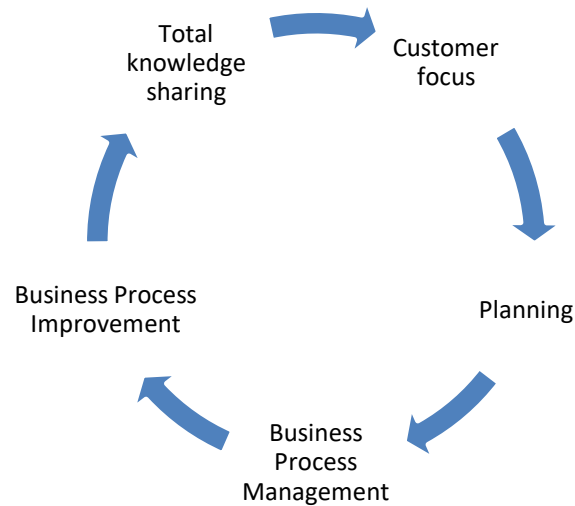
Figure 7: Total quality control

(Author's own design).

As the previous figure shows, the KM cycle is already taken into account while establishing that project. This is logical as strategization of the process is likely to influence all the data related steps in the KM Cycle. Through the use of a selected KM strategy approach, the valuable data gathered and approved can indeed be translated into use cases and schemes (which is actually a Business Process Modeling process). Afterward, those data will be applied in order to assure reaching processes improvements. Finally, this strategic approach will also enable to choose a pre-specified knowledge sharing technique to inform other business partners(stakeholders) and\or other project workers in the data dissemination process of the KM cycle.

The total quality control system is a comprehensive and complementary system that is obligatory to be followed in all business departments and business units that are responsible for working on the project. All the following steps are conducted due to the total quality control cycle. They are moreover clearly present in the KM cycle as well. This is described below.

2.2. Identifying data sources and data types

Including all internal and external resources to the project, data were obtained through tapping from several sources. They are:

1. Scheduled meetings with certain outputs and tasks to be done in order to get to that needed data.
2. Brainstorming: to classify data (from where to get them and how to transfer them into words and sometimes graphs).
3. Service partners from which some other implicit and explicit data can be queried.

4. Internal control systems responsible for internal business policies.
5. Data managers and few other experienced data entry operators, who are already members of the project team.
6. Legal advisors for certain types of contracts and legal data needed.

The health insurance system has to take into account its own governance (controls). They ensure that the system directly adheres to the international ethical standards and complies with the local governmental policies. This has some consequences with regard to treating the data sources.

Since the processes established for the new project will create new data types, new IT and business cases, parallel to the initially applied business models, have to be installed before issuing the aimed services. The internal controls cannot identify and cover all those data (especially the implicit data)and yet one has to take care of the governance rules. That's why for instance the legal advisors or an internal agreement between data managers and data entry instances from within the project team has to be arranged. The result from that agreement would be a decision on the data transformation (implicit to explicit) pattern needed. With regard to the data gathered, several types have to be mentioned.

Few files were discussed during the meetings. These files were initially made during the first stages that identified and described the project. Most are Excel files that contain sprint notes. These are a visual tool for representing, analyzing and tracking a list of tasks or improvements that need to be done or executed, each with a specified date and the necessary status remarks. Those sprint notes also point at the data needed and/or gathered. Also, word files and emails showing some minutes of the meetings (MOM) are part of this. On the basis of that information, explicit and implicit data types were selected, analyzed and got the approval to be used. The table below shows an example of sprint notes and the tasks included in it.

After several meetings, the meeting minutes and the sprint notes were classified as tables containing tasks (explicit and implicit data to be obtained), each of which with pointers (columns). Some other notes and tables indicating the sources the data had to be obtained from, the project team members responsible for it and the current status. The table below shows an example of some of those tasks:

Table 5: Task examples.

No.	Notes	Response	Importance	Status	Date
6	There is no separate member profile page (work-place and carrier).	This information is already displayed on the main page.		Under discussion.	Nov. 25, 2019
8	If the international code for the phone number is required, it is better to have a field for the country name.	The available international code is for Jordan only. It will be fixed in a separate field.	L		Nov. 25, 2019
14	Add details of password specifications upon registration.	Will be modified.	M	Done	July 11, 2019
18	Notify the user of the date he/she will receive the card when selecting the delivery companies. Notification is done via a message that appears after sending the order. (If the request has been sent successfully, the card will be delivered within a maximum of 24 hours.)	Will be modified.	M	Done	July 11, 2019
19	When adding a beneficiary, the form of	Will be modified	H	In progress	July 11, 2019

	payment always appears, also in certain situations where this should not be the case.

An example is, for instance, a son on a free study seat. | | | |
| **23** | If the participant is female, adding the husband or one of the children, must be linked to social security data.

The request to add a document proving that he or the children are not insured by any other insurance company is necessary. | Waiting for H the link with social security. | | July 11, 2019 |

Then finally after completing all the tasks, the adjusted data (both explicit and implicit) could be highlighted. Best practices were established to start working with them officially.

Examples of best practices could, for instance, be the answers to the following questions:

- How efficiently can the SGN (Service Government Network) be used to ensure the sustainability of the project?
- What are the best linking techniques either with the social security corporation or other institutions?
- How effectively can the system acquire and retrieve specific valuable data from internal or external databases ?; and
- What does the branch of the Ministry have to take into account while working on the system to achieve the targeted level of competitive advantage?

2.3. Dissemination and first testing

The best practices and the valuable data were then reliably spread to and communicated with the members of the project team and the service partners involved. Using communication tools such as emails, further meetings, graphs, use cases, and other information technology tools like schemas.

At the same time, first testing was performed to guarantee data quality and data integrity and also to make sure these best practices incorporated the necessary correctness and completeness. This kind of testing was conducted through the interconnection between the initial application of the business model, service partners, and the back-end system.

2.4. Deployment

After the testing phase in the previous stage, the valuable data and/or best practices are entered into the system. Then a few new cases will appear. At the current moment, the system is responsible for the decision making process for each case. Some of those cases may need further special requirements, thus a decision has to be made about them. This means that deploying the selected data/practices should lead to certain outputs based on those decisions.

Let us illustrate this by a few examples of new case situations. The system may request extra documents rather than those already requested from the end-user. They can be obtained through the SGN (Service Government Network) which is a web-service environment for exchanging data between local governmental institutions. Those documents may include for instance:

1. Passbook (bank book statement); and
2. Proof of employment book/Employment verification book.

2.5   Validation: other testing phases applied

Finally, when both the dissemination and the deployment process, including the respective testing phases are completed, validation is needed. This means supplementary testing in different ways. Deployment indeed indicates other areas that also need to be validated. This signifies that the process needs other testing types by the responsible project team. Other main testing phases should be as follows:

1. The testing by the overall Ministry of Health.
2. The Ministry Digital Economy and Entrepreneurship testing.
3. Third-party testing (the company that provided the bid).

After passing all those tests, the first live testing stage should take place. The real application of the new services is offered. While the system/website is actively running, feedback and complaints are gathered from users to improve the whole process further. Thus the project team makes sure that the data are all following the comprehensive total quality model.

3. The Link with Business Process Management

As the KM cycle identified, all the valuable data that are needed have as a consequence been carefully selected. It is, of course, necessary to put the services the project will provide to the customers in relation to their business processes. Developing the right models for these business processes is the first step. Spreading them within the departments and the responsible units and with the responsible employees, as well as with the other business partners or other external institutions that are all involved is the next and second step. Only then the incorporation of those services into the new system and developing the user interfaces are possible. This incorporation should follow a couple of procedures, which will identify the suitable steps for each of the services to be enabled within the website.

In this section these procedures (texts) will be transformed into flowcharts and other computer schemes (models). These transformations are considering as a modeling process. Let us go through two of the major service procedures as examples. They are related to issuing and canceling a new health insurance card.

3.1. Procedures for issuing a new health insurance card

This process goes through a number of steps. They are:

- The user logs into the system, fills in the necessary data and chooses the type of health insurance.
- Depending on the type of insurance, either the request does not need verification, in this case, the system completes the procedures for issuing the card. Or it needs to be checked, so it needs approval from the health insurance employee to complete the procedures.
- The employee checks the application whether it matches the health insurance system regulation.
- After the completion of the checking process, the application is either accepted or rejected amongst other on the basis of the completeness of the application.
- If rejected (as it is incomplete and the user cannot move on to the next step of the application because of this or because the employee still has to check whether the selected insurance type is accepted due to their regulations). The system will notify the user that the request is rejected or incomplete after clearly indicating the reason for not completing the transaction and stating the information required to be modified or filled in.
- Upon completion, it proceeds to the payment stage, where the user can choose between two payment methods: cash or withholding (deduction of fees to be paid out).
- All applications will have a cash payment for card fees. As for insurance fees, they can be cash or deducted from fees to be paid out.

- Note: The payment will be approved for the issuance of cards either in the health insurance centers or through the E-*FAWATEERcom*[1]system. The user can also print the receipt and pay at the nearest payment center.
- Print out the health insurance card, of course only when the application status becomes active. The system will then show the user that the card is ready and underway for delivery.
- The subscriber can receive the card either by delivery; by one of the delivery corporations (such as Aramex or by the traditional mail), or by coming to one of the health insurance centers to receive the card personally.

Written procedures such as these are a bit complex. BPM tools can make them more understandable in business terms and also for IT developers. In order to build IT schemes and understand the targeted system behavior, other advanced graphs, UML diagrams (based on Unified modeling language) , use cases or simple flowcharts are used. These can describe the whole business processes needed to achieve the project objectives. The following flowchart can be communicated among several parties involved, such as the business partners and IT developers and can describe the service more deeply and much easier.

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[1] E-fawateercom is "an Electronic Bill Presentment and Payment (EBPP) service. The system is under the supervision of the central bank of Jordan. People can pay their bills at their convenience." Based on Efawateercom website : https://efawateercom.jo/Portal/About/
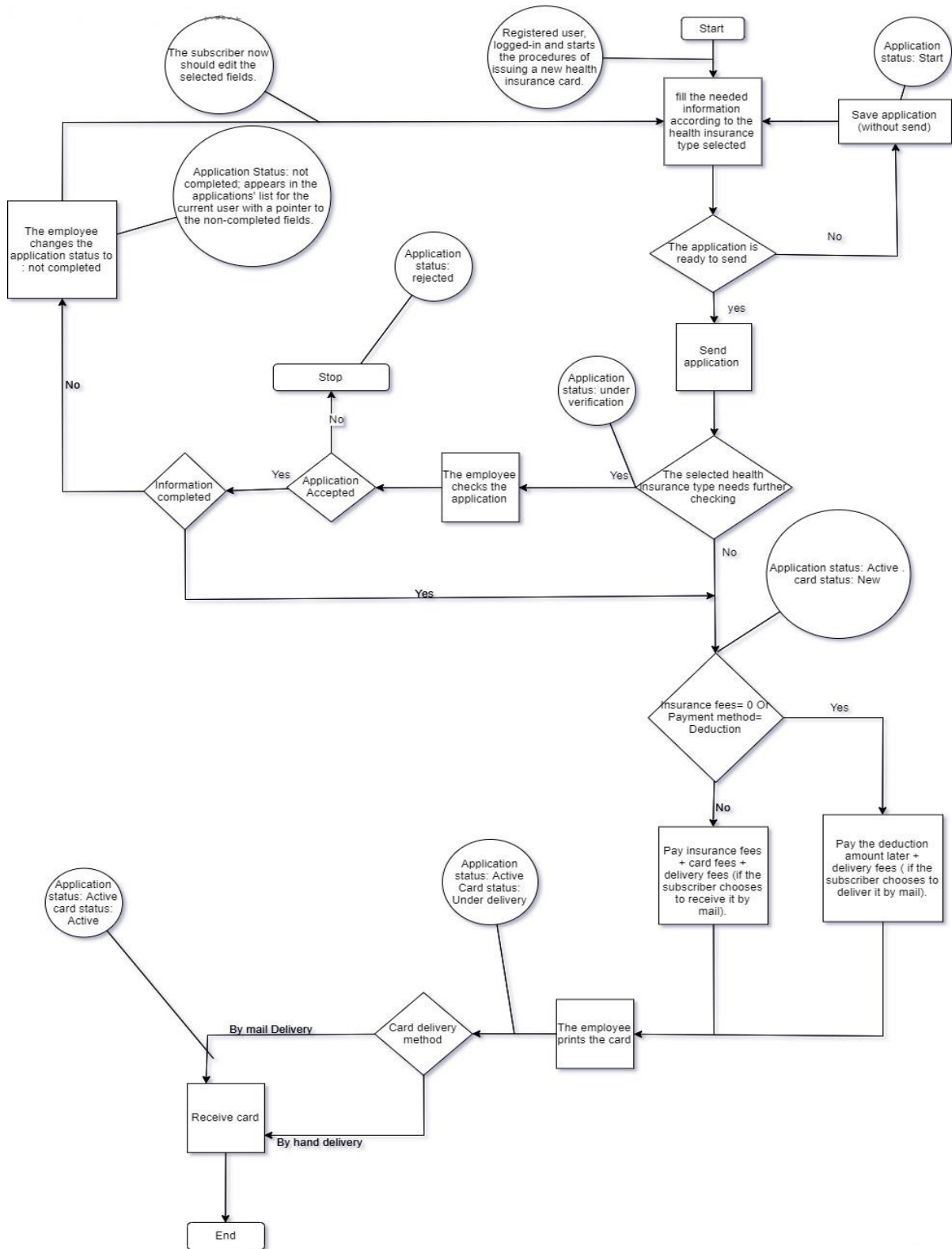
Figure 8: Process flow chart for issuing a new health insurance card

through electronic services.

3.2. Procedures for canceling the health insurance card

This process goes through a number of steps as well. They are:

- The user logs in into the system and selects the card to be canceled
- Based on the cancellation case, the system will consider whether an audit is required or not
- If it does not need a check, the user will complete the procedures and if checking is needed, the system will transfer the request to the responsible insurance employee. After completing the checking process, the application becomes either rejected as the procedures for completing the application stop or accepted, so it is allowed to move on to the next
- The system has to check for the standing cancellation fines and will let the user choose the delivery method to hand in the card or both. After that, it will move to the payment stage. In the case that the user wanted his card to be handed by mail or if the user has to pay fines, in both cases the process will move to the payment stage
- In case the card is required to be handed in, the subscriber must submit the card to the Health Insurance Administration either by mail or Aramex or through the personal attendance to one of the health insurance centers.
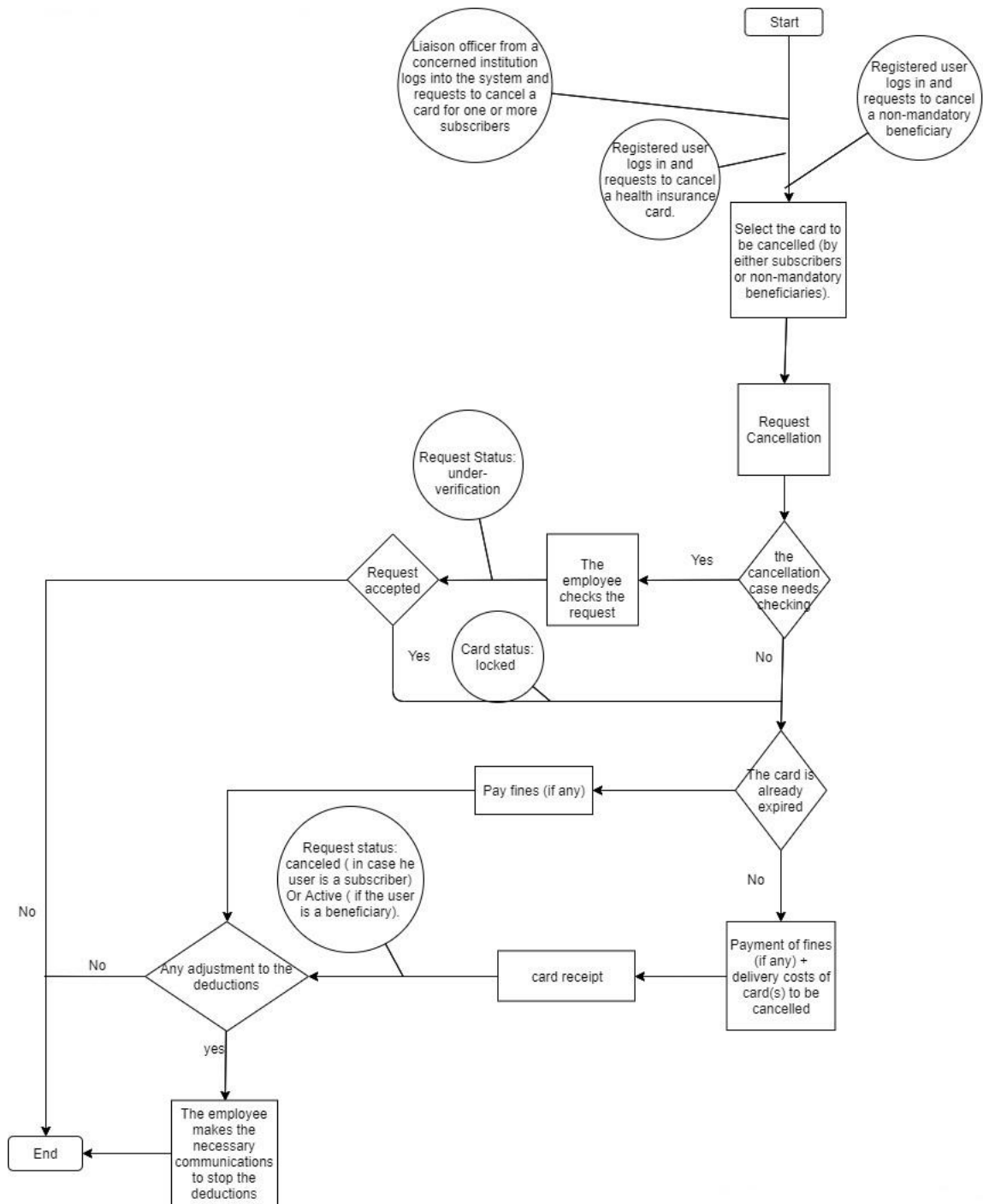
Figure 9: Process flow chart for requesting the cancellation of the health insurance card through electronic services.

Chapter (5) Analysis: the link with Business Process Improvement

In this chapter we will look at the impact the BPM approach for the Jordanian citizens' health insurance card has on Process Improvement. According to the literature this impact should be positive. We will first give some examples of BPI and then discuss the preconditions under which this improvement was possible.

1.   Impact of BMP on BPI

The data flows among the different implementation processes actually stop at the moment the testing phase's outputs and main results are achieved. The project team was during this implementation relying mainly on the total quality management process approach adopted and described in Figure 7   The process team also reached business process improvement goals however. In this section we will show some examples of how they kept an eye on the organizational learning and customer satisfaction aspects.

This part is subdivided into two sections explaining two different stages where business process improvement was achieved in this project. The first stage is situated before the technical testing phase starts. The second stage is situated after the conducting of several tests, especially after the compatibility tests. Those two stages are both depending on all the flow charts that described the system behavior as shown in the previous chapter. Each one of the stages contains different examples.

1.1.   BPI examples situated in the stage before the actual testing phase.

These examples refer to the types of users who can log into the system, the conditions and terms of reference for cancelling the insurance card and the authority of the entities and individuals affiliated with them to issue, amend or cancel the health insurance card.

1.1.1. Types of users and how users can Log into the system

First, there are two types of individuals using the online services system: Jordanian and non-Jordanian individuals, as they were approved at the beginning as the main users of the system. Data were collected about the users' types and how they are included in the system, and then process flow charts were drown to log in. After several meetings with the system developers and business partners, and based on preliminary analysis of the plans, the second type of system users was suspended.

The IDM system (Identity management) which is a platform lunched by the Ministry of Information and Communication Technology and recommended to be used for all electronic governmental services was used to verify the identity of the account within the procedures the user is required to perform. This should ensure the verification and the authorization processes for creating an account.

At the beginning, IDM system was approved by the project team as the only option for all accounts registrations for Jordanian individuals. The procedure includes two elements:

- The necessary information of the user is entered to create an account on the online services portal Jordan.gov.jo. Upon completion of the request a new, inactive account is created.
- One-time personal attendance is required only to verify the person's account via fingerprint and complete the account-activation procedures.

After analyzing this system and after adding the previous two procedural elements, the project team decided that the user could enter the system through the unified electronic portal site Jordan.gov.jo or through the health insurance site directly and approve the two options for the first type of users (Jordanians).

As for users of the second type (the non-Jordanian individuals), it was not possible to complete this step due to the lack of a unified and approved personal number. In addition to that, the system was also unable to identify the individuals linked to the (beneficiary) person, unlike for the Jordanian individuals. These hold indeed a national number that identifies their identities and the possibility of linking their beneficiaries also in civil affairs. This lead to the exclusion of Non-Jordanians using health insurance online services from the card system.

This example proves that in different stages and through communication with the different stakeholders the system gradually was refined (Business Process Improvement) and extra information turned into knowledge about who is temporarily not included in the system (non-Jordanian residents) and why. It can be used later to eventually amend the system in a way this would make it possible and which information has to be gathered to do so (eventual future Business Process Improvement).

1.1.2. Deductions as payment method

As shown in figure 8, the employee has to check the application. This refers amongst others to the health insurance deductions and the choosing of a deduction as a payment method. In some cases when adding a beneficiary, a mechanism for reversing it on the civil retirement system was discussed and later the project team agreed to create an inquiry screen containing deductions for employees of the Civil Retirement Directorate. This way the employee will be able to perform inquires and make adjustments for any additional deductions in their financial system. This screen contains information such as: subscriber's national number, subscriber's name, deduction amount, history of the movement and movement type (start or stop).

The new screen is an example of how again through refining the information the Business Process was improved and the employees get additional valuable information on the customers.

1.1.3. Conditions and terms of references for canceling the health insurance card

Terms and conditions for completing the cancelation process of the health insurance cards have also been applied to the system. Due to the sensitive nature of this process and to ensure that no abuses by the users will occur, a list of authorities and people carrying them, have been approved by the project team from the very first stages.

The following example is related to business process improvement alongside the cancelation process. After conducting back-end system tests the project team decided to add the following new policies in relation to the list of authorities:

- While working through the subscriber's account, no amendment can be made unless the card that does not meet the insurance conditions is canceled.
- Re-adding a beneficiary after a card cancellation is only permitted by a direct decision from the Health Insurance Department.

They also decided to avoid future logical errors by identifying all main cases that may happen in relation to cancellation conditions. The following table shows some examples where the card cancellation is either mandatory or optional.

The table is another way in which part of the process, namely in this case the cancellation procedure is clarified and clearly made better in terms of avoiding errors in the future. Fewer errors can be considered a key performance indicator of the system in general. So this is a way the system is improved (Business process Improvement example).

Table 6: Cancellation conditions.

Cancellation condition	Mandatory	Optional
Current subscribers who got another health insurance	✓	
Adult male children (over 18 years of age) who are not in school; between (18-25)	✓	
Current subscribers with optional health insurance		✓
Daughters, widows, and divorced women with sons over 25 years of age	✓	
Jordanian students	✓	
Working female daughters		✓
The death of one of the beneficiaries	✓	

1.1.4. The authority of the entities and individuals affiliated with them to issue, amend or cancel the health insurance card

Our last example here is that the project team later defined pre-specified privileges for the services provided in the system. The main goal was to make it easy to track some errors and avoid them electronically without the need for direct communication between the agencies and the employees.

As previously mentioned in figure 6, two main users for the electronic services were considered. An account for individuals and entities (through liaison officers) was planned to be created for issuing, canceling, renewing, modifying subscriber(s) cards. A pre-specified privileges table thus had to be built into the system. Accordingly, the authorities of the entities and individuals affiliated with them were determined for working on health insurance procedures to facilitate the checking process by the responsible employees. The following table provides as an example on this some lines of the table identifying the entities. It shows the name of entities and the authorities granted to each one of them.

Table 7: Entities 'authorities.

Entity name	Entity privilege					
	Issue	Cancel	Renew	Modify	Damage replacement	Lost replacement
Political Development	✓	✓		✓	✓	✓
Health Center to diagnose disabilities	✓	✓	✓	✓	✓	✓
Blood Bank	✓	✓				
Prime Ministry	✓	✓	✓	✓	✓	✓

And for individual users, the following few rows shows an example followed with a written example to explain how those authorities are now working:

Table 8: individual's authorities.

Entity name	individual privilege					
	Issue	Cancel	Renew	Modify	Damage replacement	Lost replacement
Political Development				✓	✓	✓
Health Center to diagnose disabilities						
Blood Bank		✓			✓	✓
Prime Ministry				✓	✓	✓

Both tables are essential in understanding the Business Process in full and the way different stakeholders are linked to it. The second table is an example of clarifying the tasks and authorities of several entities linked to the system, so that they understand their role/authority better and can execute the powers invested in them more correctly, which indicates again how the Process increases the reliability of the whole system by making it more obvious if errors would occur and thus limit the number of them.

The liaison officer who works in The prime minister's office has an authorized account by which he/she is allowed to cancel, renew, amend and issue a damaged or replacements of the cards lost by subscribers, whereas the individual subscriber is allowed only to amend the card and to issue a damaged or lost replacements by using his/her own account.

1.2. BPI examples situated in the stage after the actual testing phase.

Several tests are conducted to evaluate the system performance. According to the quality control approach that the project team followed and that was explained in the previous chapter, tests were performed to the Web and Mobile applications, such as: Unit testing, Functional testing, security testing, Load/stress testing and compatibility testing.

The project team decided to develop a table of tasks for the testing, indicating a certain date and required outputs. Using the back-end and the computer experimental environment for

conducting such tests on each one of the new services, for instance testing the performance and the security when the user enters the system through the website or mobile applications (both Android and IOS operating systems was tested). The table below shows some examples of a few technical errors that appeared during some of the tests.

Table 9: Technical errors (examples).

Service name	Problem short-description	Corporation reply	MODEE[2] reply
Issuing a subscription from the agency	When searching for a payment inquiry. There is no electronic payment number for the subscription requests.	It will be modified	It will be checked after modification.
Renew subscription	if the card status is ended, the service must be disabled instead of lost and damaged	It will be modified	It will be checked after modification.
Renew subscription	Changing the name of the "Login via" IDM "button to" unified Sign-In "	It will be modified	It will be checked after modification.
Renew subscription	When clicking on a new registration, the user must be transferred to a "unified registration".	There may be citizens who have not activated their unified registration.	Done.

In the end the quality check concluded a number of important results:

- Crash does not appear in the program or any empty or old pages while browsing the screens.
- After installing new procedures in the new version, the level of performance and response speed remains stable.
- A gap or errors that were previously detected in previous versions of the program, were corrected and didn't appear anymore.
- There is no significant gap in the program (Stopper Bug[3]) after installing the new version: maybe a few small and minor errors that will not affect the system, thus the

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[2] MODEE: stands for the Ministry of Digital economic and Entrepreneurship.

new version is to be installed so the end users will benefit from the new service and its features.

- The user acceptance test was successfully passed in addition to the security and protection check test.

1.3. Key Performance Indicators for quality checks in the future

The availability of performance indicators for quality checks is an essential and important factor to ensure the quality of the developed systems and programs. The following are some of important indicators for quality checks, which will be used in the future to evaluate the process improvement of this project. Results are at the moment not available yet, as the project is in its early implementation stages.

1. Active Defects / problems: Tracking active or existing faults is a simple indicator and should always be monitored. The indicator is better when the values are at the lowest. The word "active" for this KPI may mean that the condition is either new, open, or resolved (and awaiting retest).

2. Covered Requirements: It is intended to track the percentage of requirements covered by at least one examination. The examination coverage should be 100 percent of the system requirements.

3. Defects Fixed Per Day: The efficiency of the development team in solving problems that arise for each day should not be overlooked. The indicator of defects resolved every day confirms the effectiveness and validity of building programs within the required standards and solving problems without affecting existing jobs.

4. Average time and average costs: It can be expected that the expected needed costs and time to issue, amend, cancel, and renew health insurance cards will be reduced compared to the previous system. As using the online platform will not only help in reducing the time for the service to be offered (by the government) and obtained (by the customer) but also giving the customer all the time to do so when he/she wants (the available time will not only be related to the business/opening hours).

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[3] Stopper bug is a computer software bug that kills the execution of a certain task.

1.4. Outputs of Quality Management in the future

Several future outputs are to be expected. Some of them are:

- Quality Control management plans.
- Test plan.
- Project quality policies and standards, including quality assurance.
- Quality control roles and responsibilities.
- Test cases and procedures.
- Document test results and quality reports.

2. A Precondition to reach BPI?

In the literature we referred to Kalpic and Bernus(2006). They mentioned that the difference between explicit and implicit knowledge is based on the fact of whether people in a company or organization are aware or not of the knowledge the organization possesses. And this has put into an equation: Explicit knowledge = implicit knowledge + awareness.

In our case the communication however proved to be an essential element as well. The presence of different stakeholders involved in several aspects of the UML's prove that this communication element is really important to achieve the results the project team wanted to reach and to get approval of all the stakeholders and authorities involved. The tables in the BPI examples support this idea. They indicate the involvement of the different stakeholders in getting the whole process in line with all their authority, so that they can still execute the power invested in them and yet implement the new card system.

Thus we could say that frequent and efficient communication is a kind of prerequisite to transform implicit knowledge into explicit knowledge and even to create awareness. The equation can thus probably be improved by adding communication in our case: **Explicit knowledge = implicit knowledge + awareness + communication**. The complicatedness and vastness of the project under study might be an explaining factor for this, but this would need further verification in other cases.

Chapter (6) Findings and Conclusion

1.   Findings

After analyzing our case study, we can formulate some answers regarding the literature framework we are examining. Some points were clearly clarified.

The positive link between knowledge management and business process modeling is visible. If companies can create a better level of alignment with customer needs, in our case the MOH can. The single insurance card, as proven in this thesis, will positively influence the continuity and support the sustainability of the system (just as for a business)in the long run. The Ministry of Health has indeed enabled some electronic (online) services for their customers, which will strengthen customer relationship management system through establishing a larger network of customers. The synergy between KM and BPM has encouraged the decision makers in our case to apply it widely in their organizations as it helped them to avoid list of errors could happen if they not implement both as an imperative strategy.

Some findings related to Knowledge Management, Business Process Management and Business Process Improvement can be presented. From them we will try to draw some conclusions.

The findings after the analysis of the used case are:

1. KM is basically about management and was used here mainly as a mechanism to extract explicit data from the previously existing systems and people. This was done through the deployment of the KM cycle as the first step of the process. The KM cycle has created a base level comparable to the one in our framework.
2. BPM was in this case more than just modeling software. It was actually an integral part of the management process and also (in our case) of KM itself. It helped the project team to see some errors, both logical and technical ones. This allowed extracting new data or performing some other required changes to the models (or the tested stages). BPM was the middle level of our framework as indicated in Figure 10.
3. Integration between KM and BPM is needed. The project team needed KM (the KM mechanism) to extract data or to manage texts (that the project team originally had) and made it comply with governmental policies. Through this well managed integration between KM and BPM better models were created thus better key performance indicators achieved. Section 2 of the previous chapter mentioned some of them. They will be used in the future, but the results on them are still to be gathered in detail.

4. Better quality control indicators for the current version are acting as a competitive advantage. This can be proven by comparing the used case study with other governmental institutions in Jordan. Actually proving that the MOH performance compared to other Ministries is more competitive cannot be achieved here. A full enquiry among customers

about their satisfaction with the new system once established and introduced would be necessary. However, the future management plans for quality controls, test plans and document test results and quality reports can all be considered as examples that will lead to competitive advantage. They present added value to the current and future versions from the online system.

Thus if KM is well modeled (by using a well-designed and well tested BPM model) better decision making can be achieved. These better decisions positively affect the business project. Collaboration or synergies are essentially needed in all of the mentioned factors. They are mainly achieved through communication. Without the ability to communicate the data an employee has, the system can't translate it to explicit knowledge, the project team will not have all the data needed, and thus the team will not be able to extract all the necessary data as well.

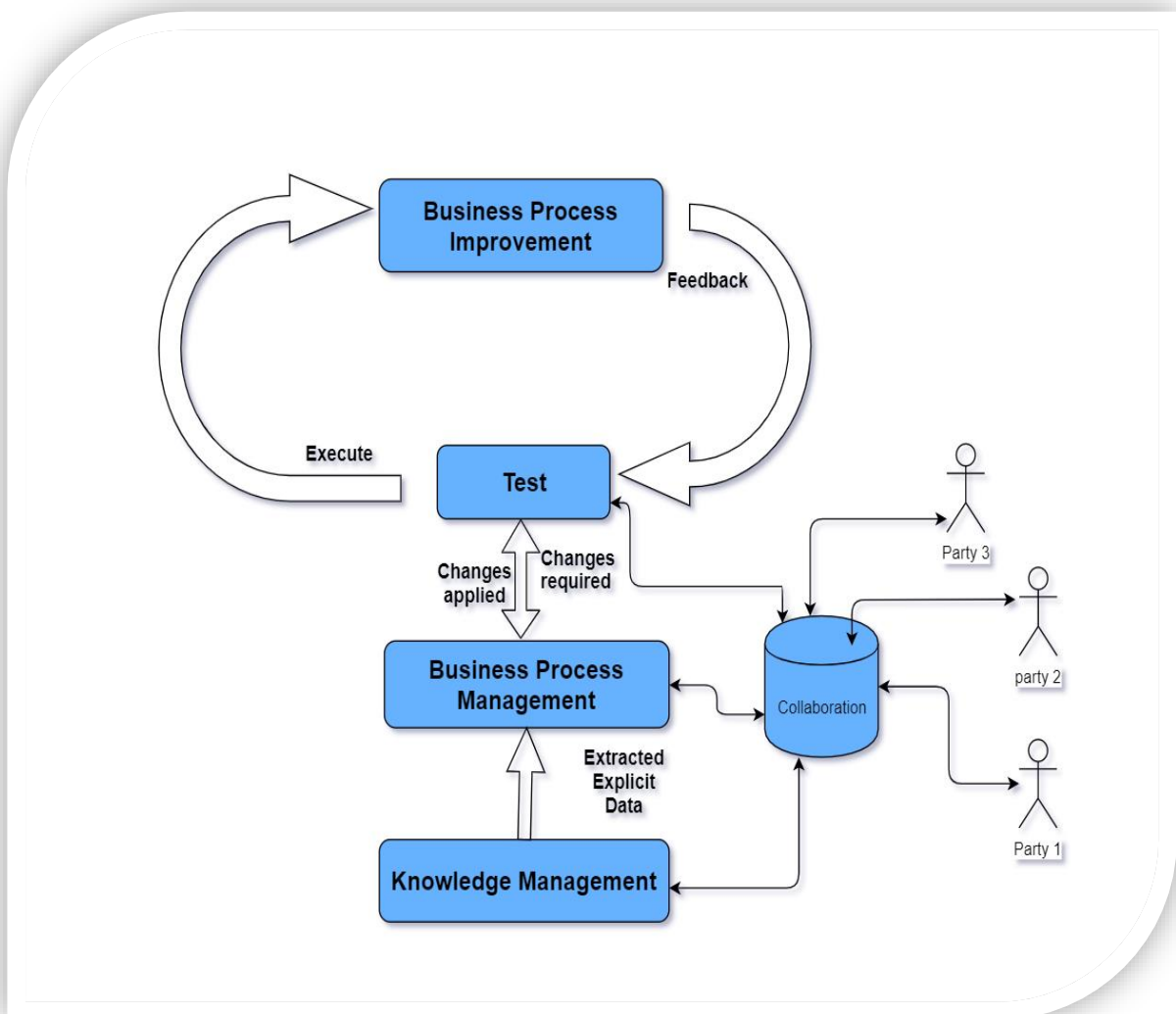The following two figures will illustrate those findings:

Figure 10: The Impact on BPI through the integration of KM and BPI.

Figure10 shows the framework we reach after examining the impact of the integration between KM and BPM. The down-side level is KM as a mechanism used to extract the necessary data for the current case study. If we extract the real needed data then the first step is executed. The next step (level) in this integration is to create a business model to explain the business processes needs to enable the electronic services. After that the model will be tested sometimes by using several tests to insure that the business processes are well modeled. Finally the approved model will be executed and the new services will be launched so that the customers could benefit from those automating services. Through the website the MOH will encourage their customers (end-users for the project) to contact them in case any complaint exists or any further questions/opinions.

Furthermore, the collaboration/communication within the project parties (or in general the business parties) was essential to build the well modeled business processes. Sometimes the collaboration is about funding issues so a certain models can/not be applied depending on the mutual agreement and approval. Sometimes a certain process or case needs further approval from the government. Thus before implementing it there should be this approval based on the agreement via the communication platform (this has been established).

In other words, the bottom level (KM) is an independent level where KM is proposing the extracted "explicit" data. This creates a platform for the second level (BPM) to build and execute the model. This model has to be tested and validated or checked (actually they have conducted several tests). That in return can reflect a positive or negative feedback. In this case we learn that if the two steps (here as levels) are well organized and managed and if we have a good level of synergy and communication among different several parties that would lead to a positive impact regarding the business process improvement.
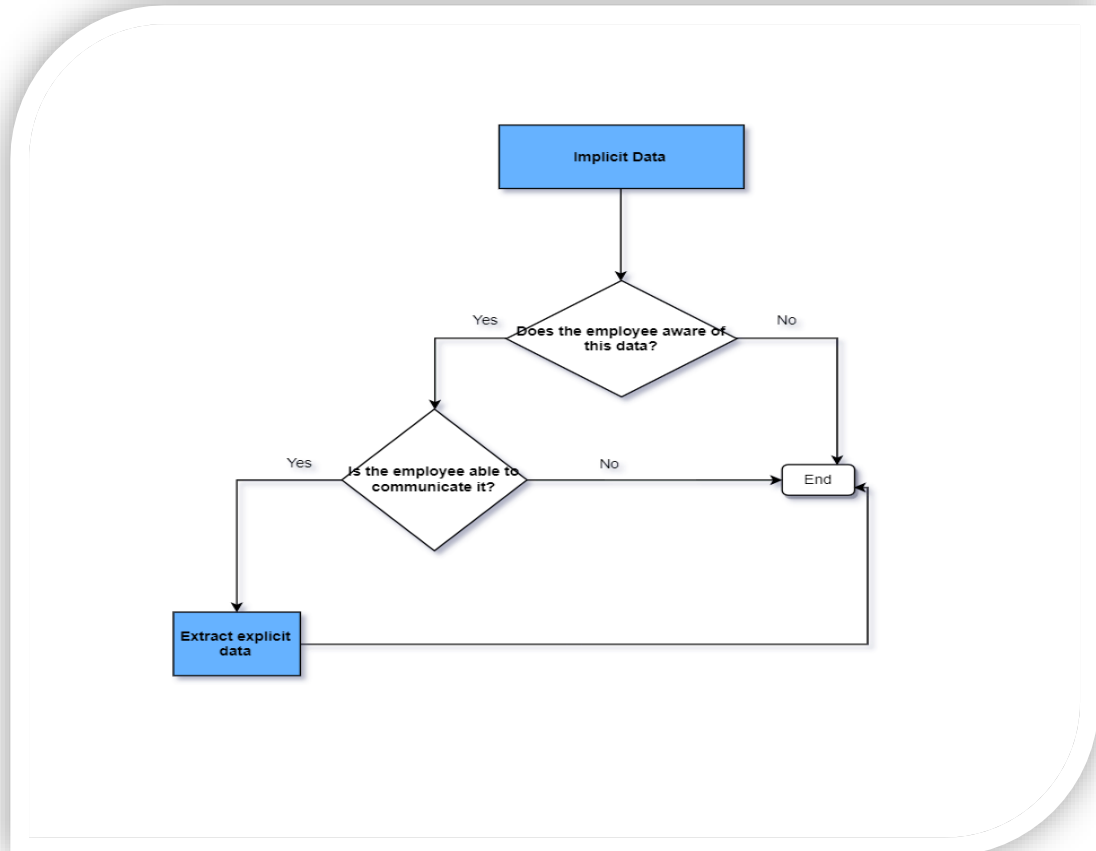
Figure 11: Conceptual equation for explicit data based on findings.

Figure 11 illustrates that the employee should be aware of the implicit data and at the same be able to communicate these implicit data. For example: Imagine a certain problem arises and the employee has the awareness of that problem and/or of what caused it. If he/she is not able to communicate that problem, this signifies that these implicit data are worth nothing in the whole process. Actually it is as if the awareness doesn't exist at all. If both awareness and communication would exist, then it will help to go from implicit to explicit data. Through a well-organized KM mechanism and well-designed BPM model, the expected positive results will be easier to gain.

2.   Conclusion

The current study wanted to explain some ideas related to the concepts of Knowledge Management, Business Process Management and Business Process Improvement. At the beginning of this thesis, five research questions were put forward. In this section we not only try to highlight what we have learned so far about those concepts and to formulate the answers we were able to

find for those research questions. This will help us in understanding the relationship between the variables (concepts) in more detail.

This section will be structured by stating each of the research questions and the answers we can formulate on the basis of our case study one by one. As such the answers reflect the reality (based on the case study) and could be an indication of what could be the impact of the integration between KM and BPM in real business life. Since we only studies one case in depth, we cannot determine with certainty what tangible impacts of KM on BPI are. We will thus rather proposing some ideas concerned with the effects of this integration and what potential effects would occur if business managers (project managers in this case) would decide to use the effects of the integration of KM on BPI.

Research Question 1: Is there an effect of KM on BPM in business terms?

According to our case study, there is either a positive or a negative effect depending on how well the KM process is managed. If the KM uses a well-organized mechanism there might be a positive effect when using BPM to create a business model (in our case the UML help in establishing that). Communication and awareness should also work along-side with the KM mechanism. Knowledge identification and knowledge sharing (the role of the different stakeholders is crucial in our case) will help to insure the positive effect of KM on BPM. On the other hand if the KM mechanism would not be well-organized or/and the knowledge identification and sharing wouldn't be managed and monitored accordingly a negative impact will probably occur.

Business Process Management can thus only be modeled as expected if the KM process is well-managed.KM can thus be the basis of good BPM.

Research Question 2: Is there a link between KM and BPI?

KM has the role of an enabler to Business Process Improvement. Investigating any business problem/case and extracting the needed data to implement a new project would both help in improving internal business processes. There is a direct link between them that could be positive if all the needed data helping in decision making are extracted (the indication that different data were lacking and were later collected is an indication of this in our case). This knowledge will constitute the basis for the building or extraction of best business practices to deal with certain problems and situations. Overcoming some challenges in the future can be the result of the continuous feedback the business can gain by implementing new project/services processes.

Sometimes this is also achieved by intelligently investigating the efforts a business performs while fixing certain gaps.

Research Question 3: Dose the BPM as a moderator variable have a positive effect on BPI?

BPM is all about the good execution of business models. Executing the intended processes after several tests can lead to a positive result (see the tests on technical errors mentioned in our case). Since texts (of processes and procedures) however can be sometimes ambiguous, BPM can also help in creating models and executing them after conducting some tests in order to reach a better decisions making process (see the UML). If we can allocate each decision to the right process/stage/problem then the process will work better than before. In other words, BPM as a moderator variable can translate those texts that sometimes could for instance be ambiguous to IT people or finance people (who are responsible for funding the project) into charts, graphs or maybe use cases (like what they have used in this case) before the final model will make it absolutely clear to all parties. This translation/transformation in the key to link KM to BPI

BPM as a moderator variable would boost and be considered as an added value to the written texts (in our case study procedures). Developing models makes it easier for several parties to understand, communicate about and start executing a certain project within a given environment and taking all circumstances into consideration.

Research Question 4: Can tangible business effects be achieved through the integration between BPM and KM? Which are they?

The answer to the question is yes and can be validated by a number of examples we mentioned in our case study.

We mentioned some tangible examples within the analysis chapter. Table 6 was named "cancellation procedures". This clarified and clearly made the integration beneficial in terms of avoiding errors in the future. This was one way of how the system of the MOH was improved.

Another example that indicates how the integration between BPM and KM increases the reliability of the whole system is by making it more obvious if errors occur and thus limit their frequency of occurrence. Both table 7 and 8 showed an example of clarifying the tasks and

authorities of several entities/individuals linked to the system, so that they better understand their role/authority and can execute the authorities invested in them more correctly.

Moreover the second example mentioned in the section on the link with BPI named "deduction as a payment method" is an example of how again through refining the information after the integration the Business Process was improved and the employees got additional valuable information on customers. The screen developed before the actual testing phase was actually refined.

Also the first example in the same chapter proves that in different stages and through communication with the different stakeholders the system gradually was refined (Business Process Improvement) and extra information turned into knowledge. This knowledge is about who is temporarily not included in the system (non-Jordanian residents) and why. It can be used later to eventually amend the system in a way that would make this possible anyway and which information has to be gathered to do so (eventual future Business Process Improvement).

A last example is a list of all the planned outputs needed for insuring the performance of quality management in the future. They are: quality control management plans, the test plan, the project quality policies and standards, including quality assurance, the quality control roles and responsibilities, the test cases and procedures and the document test results and quality reports.

These examples all prove that through integration in a full BPM we can achieve many tangible positive impacts in business.

Research Question 5: Does the integration between KM and BPM have a positive or negative impact on BPI?

After answering the previous questions we can say that through a well-organized KM mechanism and a well-modeled business process (through BPM) a lot of tangible positive benefits can be gained. Consequently a positive impact on BPI is clearly possible, if the necessity of collaboration and communication among the project/business parties is cared after. On the other hand if project developers/managers fail to perform a suitable KM mechanism and can't get the models operating as expected or desired and/or if a lack of collaboration and communication occurs, this may lead to a negative impact on BPI.

Appendix

Two interviews with the Head of IT department were conducted. She asked for a brief explanations of this study and what we are examined. Then we provided a list of questions that is related to the deployment of KM cycle first. Afterwards, we asked some other questions related to the tests and the quality control management as well as questions on some tables that is related to the link with BPI. In this section the list of questions and the brief explanation I provided will be provided. The following are the questions asked for her:

1.   Questions about the on-hand project

1. How would you describe the organizational structure for the current center/building/branch?
2. What are the main tasks of health insurance department according to the Ministry of health?
3. Is there a knowledge sharing culture in general within the current center/building/branch?
4. What are the services to be enabled online to the customers? What were the automation processes conducted/enabled already currently?
5. What is the average cost for issuing/canceling/amending/renewing a health insurance card?
6. Knowledge sources used to collect data from (about the tasks to be done to accomplish the new project)?
7. What are the reliable data or best practices selected to deal with those data? Is there any implicit data that need to be transformed into figures, texts or diagrams?
8. What was the Knowledge sharing style between developers and management used to propose the selected data and best practices?
9. How was the use cases and schemas for the project deployed and validated (tested)?
10. Can you please tell me who are your business partners that are directly associated with the implementation and lunch of the project on hand?
11. Can I get some of the excel sheet (or maybe some rows) before the actual testing and after?
12. What is the modeling style/program you used to translate the written needed processes and processes procedures?
13. Are there any expected outputs on the long run? What about the short run? Any indicators or any changes have to be done so far?

2.   Brief explanation

The following is the explanation I provided before the interview:

My variables:

Knowledge Management: a process that contains practices and techniques used by an organization to create, capture and use knowledge to enhance performance.

Business process Management: using models to design and execute business processes.

Business Process Improvement: is an effort that can be launched in order to improve the ability of the organization to meet its customers' needs, eliminate errors, identify opportunities to yield more effective and efficient processes, assist in learning and even to end processes that are inefficient.

I want to adopt the KM cycle in order to investigate the relationship among those three variables.

KM Cycle:

1. Identify which are the optimized knowledge sources, situated either inside or outside the organization.
2. Strategize what is the valuable knowledge and/or what are the best practices in which implicit knowledge has to be extracted, codified or transformed to explicit knowledge, in a format most needed in the future.
3. Facilitate the dissemination of the knowledge and/or best practices available to the business areas/units that need them.
4. Accelerate the deployment of the best possible knowledge to business processes to start solving problems and making decisions.
5. Validate and test the outcomes from the previous step.
6. Articulate the know-how for those best practices or knowledge that should result in two parts: most useful and least useful. The least useful practices/knowledge should be disposed of while the most useful should be transferred to the organizational knowledge repository.

Note: I defined two main types of knowledge (Explicit and Implicit); the difference is based on the fact of whether people in a company or organization are aware or not of the knowledge the organization possesses, one fundamental property when distinguishing between explicit and implicit knowledge is to consider explicit knowledge as implicit knowledge plus awareness. This means that when we as humans reach an ideal state in what we are doing (which is the "awareness" about the process or operation currently in hand), then we should be capable of seeing and expressing implicit knowledge explicitly. And this is exactly what we need to extract knowledge within any organization

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