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Robotic process automation or Chatbots? A Framework to evaluate the impact of new IT systems on organizational business processes

Prof. dr. ir. M.F.W.H.A. (Marijn) Janssen
Dr. rer. pol. C. (Claudia) Werker

Student Name: Aditya Kolari

Student Number: 4837118

Faculty: Technology, Policy and Management at TU Delft

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Aditya Kolari

Student number: 4837118

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GRADUATION COMMITTEE

Chairperson : Prof.dr.ir. M.F.W.H.A. Janssen, Section ICT

First Supervisor : Prof.dr.ir. M.F.W.H.A. Janssen, Section ICT

Second Supervisor : Dr. rer. pol. Caudia Werker, Section Economics of Technology and Innovation

SUMMARY

Today market success and competitive advantage depends on information, and the proper flow of information using information technologies is critical to maintain competitive advantage. To improve their business processes and networks, organizations need to leverage new information systems/information technologies (IS/IT).

These new IT systems, which see a constant flux of innovations in software, computational and automation capabilities, include technologies such as robotic process automation (RPA), chatbots, analytics using machine learning and artificial intelligence to name a few. These technologies are currently gaining a lot of traction and popularity as solutions to bolstering an organization's competitiveness. Organizations are struggling with managing these technologies to maintain competitive advantage. A challenge for organizations is to judge the effectiveness and the impact the new technology would have on their respective business processes before implementing the IT system. Organizations lack a framework that encompasses both the short-term and the long-term view of implementing these technologies as well as the challenges they would face because of these technologies. Through this research, we hope to allay this issue by asking and answering:

How can an organization effectively evaluate the impact of new IT systems to improve its business processes?

There exist various frameworks and measures in management literature that help organizations choose between multiple IT investments and there exists frameworks such as the balanced scorecard that help organization as performance measuring tools. The IT scorecard, a subset of the balance scorecard, was developed to measure performance of existing IT products and services in use.

However the use of existing frameworks to evaluate new IT systems has not been empirically recorded. Existing frameworks also do not take into consideration the uniqueness of individual IT systems and the challenges that are associated with these systems. Other challenges include a greater focus on short-term monetary gains rather than long-term benefits, a lack of standardised parameters for accurate measurements of performance and the ethical challenges that come with using these new controversial technologies.

The proposed evaluation framework aims to accommodate the weaknesses of the earlier frameworks. This is why an integrated approach has been taken in the framework. The framework consists of three levels with the evaluation of the IT system conducted at the final level.

The top most strategic level offers the organization a perspective on the needs and goals of the business. This allows them to see if the IT system truly aligns with the organization's strategic objectives. The next level is the business process level. The reason IT systems are introduced into organizational business processes is to improve efficiency of the business process by automating certain activities or reducing certain steps in the process, improve performance of employees or enhance customer experience thereby boosting overall productivity. However, if the IT systems are introduced into the

existing business process without correcting for inefficiencies, these inefficiencies are carried into the new business process (the existing business process with the IT system introduced) which is detrimental to the organization in the long run. Therefore analysing the business process helps us identify these gaps existing in the process, solve for them and redesign the business process with the implementation of the IT system. This is achieved at the business process level of the framework. Finally the level of the IT system where its impact on the business process is evaluated. The IT system is evaluated from different perspectives which include the customer, the business value the system provides, the internal processes that are affected by the IT system and the future readiness of the organization to the IT system. This integrated approach, similar to the Balanced and IT scorecards, is augmented and made more dynamic and robust enough to evaluate new IT systems by using KPIs derived by the system developers and engineers as metrics of measurement. The framework also brings to light the ethical values and challenges that come with using new IT systems. To the initial four perspectives, the two new perspectives will provide a more complete view of the impact the IT system has on the business process. The better the evaluation, the better the decision making of the organization.

To demonstrate the utility of the evaluation framework, it is applied to the incident management process which is a common business process of the service based enterprises. This business process is analysed and the common challenges found in this process are discussed. In order to improve the business process, two new IT systems are introduced separately; the robotic process automation (RPA) and the chatbot. The proposed evaluation framework is applied to both the situations and the results are compared to see which IT system better improves the business process.

This work has shown that including the distinctive nature of the new IT systems such as RPA and chatbots improves the results of the impact evaluation. In case of RPA, aside from the obvious benefits of the technology organizations might not be aware of the improvement in compliance the system provides or the increased quality of data being processed due to fewer errors or the heightened security risks that increased automation can cause. Organizations must also be wary of any underlying biases and stereotyping when implementing chatbots into their business processes. The idiosyncratic properties of each technology can influence the evaluation results and hence the decision on whether the IT system will be implemented. Therefore, by including the indicators specific to these systems, organizations can be aware of the potential impact these systems have on a particular business process. In this way undesired effects such as the inherent challenges of the IT system as well as the consequences of ethical issues are captured. Besides the impact evaluation of the IT system itself, the analysis at the strategic level ensures that there is a strategic alignment with the objectives of the business and the IT system and the modelling of the business process ensures that a detailed analysis can be done to find the inefficiencies and challenges in the business process.

Through the proposed framework, this study focuses largely on the IT system and the impact it has on a business process of an organization. Once these IT systems are more prolific in their applications and use, higher levels of evaluation such as at the strategic level will be possible. This will also be very useful for organizations interested in choosing the right IT system for their organizational structure, culture and business processes and therefore be an interesting field for future research. A limitation of this research is that while this paper explains the working of the evaluation framework, a detailed

analysis of the application of the framework has not been made. This can be captured by future research through in depth empirical studies with organizations implementing these new IT systems and using this framework to conduct the impact evaluation on the business process. Comparative studies can also be conducted such as comparing this framework with other integrative evaluation approaches such as the multi-attribute utility theory, the voting analytic hierarchy process and information economics.

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Finally, I would also like to thank my family for being the constant pillars of support and patience that has helped me weather the pandemic and complete my thesis work.

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LIST OF ABBREVIATIONS

AHP	Analytical Hierarchy Process
AI	Artificial Intelligence
BPM	Business Process Management
BPMN	Business Process Model and Notation
BWM	Best Worst Method
CA	Competitive Advantage
CSAT	Customer Satisfaction Score
CSM	Customer Satisfaction Measurement
DU	Definitional Uncertainty risk
DEA	Data Envelopment Analysis
FTE	Full time employee
IT	Information Technology
IS/IT	Information Systems and Information Technology
IR	Technological Infrastructure Risk
IVR	Interactive Voice Response
KPI	Key Performance Indicator
MCDM	Multi Criteria Decision Making
MCUT	Multi Criteria Utility Theory
ML	Machine Learning

NLG	Natural Language Generation
NLP	Natural Language Processing
OR	Organizational Risk
ROI	Return on Investment
RPA	Robotic Process Automation
SM	Strategic Match
SME	Subject Matter Expert
TU	Technical Uncertainty risk
VAHP	Voting Analytical Hierarchy Process

CHAPTER 1 : INTRODUCTION

Today, information technologies (IT) that include computers, software applications and innovations in telecommunications, are a key component to organizations delivering the right products and services to their customers, expanding their reach, surviving and growing in the market. Information systems and information technologies (IS/IT) has been recognised to be closely linked to business strategy by impacting the organizational profit mechanisms (Drenvich & Croson, 2013). IT systems are also functionally linked to business processes in order to overcome constraints to growth and due to competitors (T. Davenport & Sbort, 1990). With newer IT systems comes greater flexibility and growth opportunities; however, a method to comprehensively evaluate the harmonious integration of the new IT systems with organizational business processes and study its consequent impacts on the organization has yet to be developed.

1.1 OVERARCHING CONCEPTS

Before we go further, defining the main concepts will allow for better understanding through the report. IT systems is the confluence of computing, communications and content technologies that organizations leverage to enhance various value chains such as product development, supply chain management, data warehousing and customer development (Sambamurthy et al., 2003). From an organizational perspective, IT resources are the transferrable assets that produce profits and are part of the organization. These include (a) the physical IT infrastructure components or the tangible resources, (b) the technical and managerial skills which constitute the human resources, and (c) knowledge assets that are IT enabled intangible resources (A. S. Bharadwaj, 2000; Drenvich & Croson, 2013). IT capabilities are assets of an organization that are non-transferrable and produce profits (Amit & Schoemaker, 1993). These include (a) the ability of the organization to mobilise and use its IT resources in combination with its other resources and capabilities to create value (A. S. Bharadwaj, 2000; Drenvich & Croson, 2013), and (b) the IT enabled knowledge, routines and practices that improve the value of non-IT resources and are specific to the organization (Drenvich & Croson, 2013; Feeny & Willcocks, 1998). Investments in IT can include either tangible resources or intangible capabilities. These IT investments can influence both the efficiency and effectiveness of an organization, and provide information that is critical in improving the value of investments to be made on other resources or improves the decision making of the management (Drenvich & Croson, 2013). Therefore, IT systems have an integral relationship with the organization's strategy.

Strategy can be viewed as a series of decisions made by the management in order to achieve its objectives (Drenvich & Croson, 2013). This mainly includes decisions that balance trade-offs between efficiency and effectiveness. An organization aims to be efficient by reducing costs and be effective by trying to create and capture value through its products or services (Drenvich & Croson, 2013). This decision making balance is affected largely by the variability of the environment the organization has chosen to operate in. In low variability environments, organizations may choose to improve performance by focusing on efficiency rather than effectiveness. Such investments could include IT systems that capitalise on economies of scale and focus on operating on lowest costs by replicating and

routinizing central activities, even if the organization is vulnerable to disruptions from competitors due to path dependency (Drenvich & Croson, 2013). In high variability environments, organizations may choose to maximise performance by concentrating on higher effectiveness over efficiency and such investments would include IT systems that is flexible and can respond to a dynamic environment even if the organization accrues significant costs in the short run (Drenvich & Croson, 2013).

An organizational business process can be defined as "a set of logically related tasks performed to achieve a defined business outcome" or more specifically as "the logical organization of people, materials, energy, equipment, and procedures into work activities designed to produce a specific end result (work product)" (T. Davenport & Sbort, 1990, p. 12). These processes have two important characteristics, first, the business outcomes for these processes are defined and the customers which may be external or internal to the firm, are its recipients and the second, that these business processes cross organizational boundaries and are not encumbered by a formal structure (T. Davenport & Sbort, 1990).

Business processes continued to evolve and become more complex and this resulted in a new form management system being born, the business process management (BPM) whose goal is to develop a comprehensive system to better manage and improve if necessary the operations of an organization. In the drive to achieve ever increasing performance metrics and reduced turnaround times, management techniques such as Six Sigma and more recently Lean and Agile methods of working developed. These methods showed that in order to improve business process performance organizations must take careful precaution to reduce variations and fluctuations at every point in the value chain by carefully measuring the outcomes of business processes and statistically separating out the root causes of inefficiencies.

1.2 UNDERSTANDING THE ROLE OF IT SYSTEMS IN ORGANIZATIONAL BUSINESS PROCESSES

Organizations soon realised that to reduce variation they would have to remove any fluctuations that arose in the repetitive tasks that human labour undertook. During the same time, simple IT and automation system began appearing that were soon seen to undertake these same tasks with reduced vacillation and increased efficiency. IT systems were still, however, seen to be providing only peripheral benefits to the improvement of organizational business processes. As time progressed, there was an increase in the value of information (this included the information collected from consumers, suppliers, product or service usage information etc.) and the processing of information through the organization's value chain. With digitization becoming more prevalent within the boundaries of the organization as well as interorganizational networks, IT systems had a clear influence on the competitive actions undertaken by an organization (Sambamurthy et al., 2003). In this way, IT systems became a core component of organizational business processes.

This is also evident in the direction management literature had also taken. Management research details the close knit relationship between IT systems, business processes and the strategic importance of investing in IT for both medium and large organizations. Davenport (1990) in his paper states that IT and business processes face a recursive relationship as shown in figure 1 and influence one another.

The type of business process in the organization will influence the type of design and architecture of the information system used in the business process, while new technologies and innovations can open up new opportunities for organizations and can induce the design of new business processes (Giaglis, 2001).

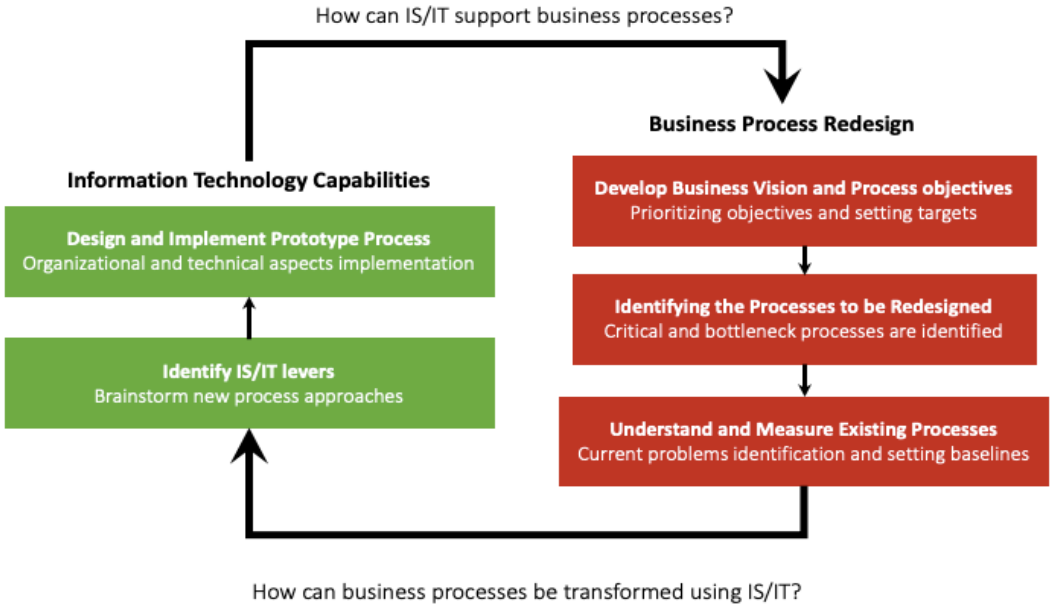

Figure 1: Relationship between Business process and IT (adapted from (T. Davenport & Sbort, 1990, pp. 12, 14))

1.3 EVALUATING IT SYSTEMS IN AN ORGANIZATIONAL CONTEXT AND ITS ACCOMPANYING CHALLENGES

The benefits of aligning and integrating IT systems with organizational business practices are apparent theoretically but these benefits are very often not seen when putting this into practice (Giaglis, 2001).

The dichotomy between organizational-level performance and IT systems is first observed inside an organization where there are clear delineated roles for business managers and IT professionals with their respective tools, skills and terminology (Giaglis, 2001). The dichotomy can be further observed in the way IT investments are framed as functional level (operational level/project level) investments instead as investments that have an impact at the organizational level (A. Bharadwaj et al., 2013). This is why there is a gap between the IT investments and the ability to evaluate the business value of these investments (A. Bharadwaj et al., 2013; Carr, 2003; Drenvich & Croson, 2013).

Evaluation of the IT systems is crucial for any organization because IT systems absorb considerable amounts of organizational funding (Irani & Love, 2001). Business unit managers of the organization must also be aware of the impact IT systems will have on a particular business process as this will allow them to better use other organizational resources and capabilities to improve the organization's position with respect to their competitors (Drenvich & Croson, 2013; Irani & Love, 2001). Failure to comprehend this can result in improper allocation of resources and misuse of organizational capabilities, detrimental to the organization in the long run. From a systems perspective, evaluation

provides a feedback mechanism for the management to make better decisions and is a crucial component of an organization's learning process (Smithson & Hirschheim, 1998). Evaluation also provides benchmarks of what an IT system proposes to achieve and this can later be used to measure the success of the actual implementation of the IT system (Irani & Love, 2001).

Evaluation of the impact of IT systems has always been a challenge for organizations. Traditionally evaluation includes identifying, quantifying and doing a cost benefit analysis of the IT systems. However, this method has turned out to be quite narrow and one dimensional and caused problems both at a conceptual and an operational level (Symons, 1991). Conceptually, it was not always clear what criteria are required to be included in the evaluation. Certain criteria may be preferred by parts of an organization for the use as metrics of measurement in the evaluation but those criteria may not be agreed upon by other parts of the organization (Symons, 1991). The evaluation methods also had trouble dealing with intangible benefits as well as found it difficult to incorporate the time value of benefits provided by the IT systems. Furthermore, objective and value free evaluation parameters may be decided at the upper level management, however when the evaluation itself is carried out by other people at different times, the same parameters may be used with implicit assumptions made by them thereby preventing the process from truly ever being a value-free evaluation (Symons, 1991). The actual process of conducting the evaluation was at the operational level. As the initial purpose of IT systems was to reduce costs and turnaround times and increase production processes in order to achieve competitive advantage in the market, a cost benefit analysis of the IT systems was satisfactory. At the operational level it is also observed that the identification and management of benefits has largely been given cursory attention during the feasibility studies and later forgotten about. Much care needs to be taken to ensure the achievement of these benefits through regular and recurring evaluation. Furthermore, when the timescale of IT investments is long, analysing the costs and benefits accurately is quite a challenge. The trouble lies in the fact that finance-based evaluation techniques favour short-term investments rather than long term projects that aim to improve the company's infrastructure and that has long lasting impacts. To improve the operational capability of IT systems over the costs and benefits, they must also be evaluated over the constraints and opportunities that the organization faces (Symons, 1991).

Nowadays, the changing role of IT systems in the organizations has made it increasingly difficult to conduct its evaluation (Irani & Love, 2001). To make matters more complicated, there exists a significant number of tools and techniques that help organizations appraise IT investments. There is also a lack of standardization of definitions of key performance indicators and metrics of measurement for the IT systems (Gunasekaran et al., 2006; Irani & Love, 2002; Renkema & Berghout, 1997). Furthermore, there is insufficient clarity on the distinctions between metrics that measure strategic, tactical and operational dimensions as well as intangible and non-financial performance metrics, and a lack of proven models that manage and measure risk and optimization of IT investments, their implementation and evaluation (Gunasekaran et al., 2006). Evaluation becomes a further challenge as the life cycle of information systems becomes blurred as time progresses, as additional systems are built on top of one another and integrated for smoother and improved performance (Irani & Love, 2001;

Themistocleous & Irani, 2001). Figure 2 looks at the challenges faced at the different stages of evaluation.

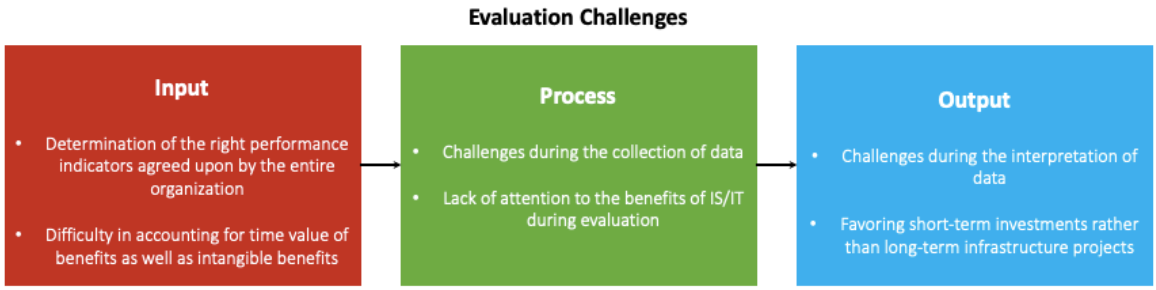

Figure 2: Evaluation Challenges

This does not mean that evaluation is not possible or unnecessary. IT systems increasingly provide strategic and qualitative benefits such as a new brand image or an improved customer experience. The increasing expenditure on IT systems, the influence of IT systems penetrating the core of the functioning of organizations along with the disproportionate and sometimes disappointing results of the impact IT systems on organizational business processes has furthered the need for the proper evaluation of IT systems (Irani & Love, 2001). Aside from the feedback of the IT systems provided to the management, the evaluation also provides an important learning process for an organization to diagnose problems and inefficiencies and develop plans to reduce any uncertainty (Smithson & Hirschheim, 1998). The chapter 4 on the literature review further expounds on some of the existing frameworks developed to evaluate IT systems and how they address some of the challenges.

1.4 MAIN AND SUB-RESEARCH QUESTIONS

Among the IT systems that organizations consider implementing in order to improve their business processes, the focus is on the new technologies like robotic process automation (RPA), chatbots and analytics using machine learning and artificial intelligence. Aside from the challenges mentioned above, existing framework have also not been used to evaluate any of these new technologies. This is a gap identified in the management literature.

So in order to make sound IT investments, organizations must be able to evaluate IT systems its effectiveness and impact on the business process before the IT system is even implemented. The evaluation must consider all the short-term and long-term benefits of the IT system and the values of the stakeholders involved in the use of the IT system. The new technologies being considered here all possess their individual quirks and idiosyncrasies. The evaluation must also account for this and the challenges an organization is likely to face during the implementation and the use of the IT system. Therefore by answering the following research question, organizations will be able to evaluate IT systems in a more robust and holistic way and the results of the evaluation will lead to better decision making by the organization's management.

How can an organization effectively evaluate the impact of new IT systems to improve its business processes?

To answer our research question, we approach in a stepwise manner and answer the sub-research questions which will lead us to our final answer.

THE TECHNOLOGY

To select the IT system that is the right fit for a particular business process, the existing business process of the organization is mapped and analysed. Through this process we identify the problem gaps and inefficiencies in the business process and then choose the IT system that will best alleviate the business process. The new IT system will be analysed as well to better understand its working, the advantages it provides as well as the disadvantages the organization has to be aware of. The existing business process will then be mapped with the introduction of the new IT system to create a modified version of the business process. The modified business process will then be compared to the original business process to observe the value the IT system will actually provide and the measurements will be taken into consideration in the evaluation process. These steps will be achieved by answering the following sub-questions.

1. *What are the advantages and the disadvantages of the IT system to be introduced into the business process?*
2. *Notwithstanding the challenges the system carries, will the IT system improve the business process?*

THE PROPOSED EVALUATION FRAMEWORK

Once the modified business process with the new IT system has been mapped out, the impact the IT system has on the business process and the organization will be studied. The IT system will be evaluated for the impact it will have on the organizational business process through the evaluation framework proposed in this paper. The basic question to answer here are:

3. *What are the components of the evaluation framework?*
4. *How does the evaluation framework evaluate the IT system for its impact on the organizational business process?*
5. *What are metrics of measurement or the key performance indicators (KPIs) used in the evaluation framework?*

The usability of the framework will be demonstrated on an organizational business process commonly found in enterprises in the service sector – the incident management process. The incident management process will be introduced with two new IT systems thereby creating two scenarios. The framework will be applied to both the cases and resulting conclusions will be derived.

In the end, this will provide organizations with an evaluation framework that is capable of providing a holistic view of the impact an IT system would have on its business process before the implementation

of the IT system while including the unique aspects of the new IT systems. The evaluation framework will also be robust and dynamic enough for the organization to use it on IT systems that are yet to come.

1.5 OUTLINE OF THE THESIS REPORT

Here I would like to outline the chapters the thesis report will contain initially by describing each chapter to be included.

Chapter 1: Introduction

The first chapter introduces the concepts of organizational strategy, organizational business process, the link between IT systems and business processes and the challenges an organization faces when evaluating IT systems. This is followed by the context and motivation of this research.

Chapter 2: Research Approach

This will be used to describe the scope, objective of the research and the methodology of conducting the research.

Chapter 3: New Technologies in Information technologies (IT)

This chapter looks into some of the latest IT systems available to organizations that are looking to improve their business processes. These IT systems are observed closely and the advantages and disadvantages of these systems are described.

Chapter 4: Literature review

This chapter on literature review describes the existing models and frameworks available in the literature for the evaluation of IT systems. It also looks into the advantages and disadvantages of individual frameworks.

Chapter 5: Proposed Evaluation Framework

After observing the literature for existing frameworks, a new evaluation framework is proposed that aims to accommodate the weaknesses of earlier frameworks. The elements of the framework and the various metrics of measurements used are described here.

Chapter 6: Testing the Evaluation Framework in practice

The utility of the framework is demonstrated by applying it to the incident management business process. For this we need to understand what the incident management process is, its individual components, its stakeholders and the common challenges found in the incident management process. Then the proposed evaluation framework is used to analyse the incident management process with the new IT system in place. Two new IT systems are used to improve the incident management process. The framework will be applied on both the scenarios. The derived results will then be compared to

finally select the IT system that has a bigger overall impact on the incident management process's improvement.

Chapter 7: Conclusions, Limitations and Future recommendations

Finally, we will conclude with a discussion on the results drawn out from the demonstration as well as the entire research. We will look at how the proposed research questions are answered and what some of the limitations of the research are. This is followed by future recommendations for research in this direction. Aspects of the MOT program that were useful and that influenced this research will also be discussed here.

CHAPTER 2: RESEARCH APPROACH

IT systems are introduced into organizations in order to improve efficiency and effectiveness and increase productivity of that organization. The success of an IT system, when its purpose is achieved, is dependent on multiple factors working together such as the potential of the IT system, organizational characteristics, its business processes, the employees and their capabilities and how the IT system is developed and implemented in the organization (Peffers et al., 2007; Silver et al., 1995). Towards this end, research into the productive application of IT systems in organizations is beneficial and helps to advance and convey knowledge about the management of IT systems as well as the use of IT systems for managerial and organizational functions (Peffers et al., 2007). This research is a discipline of applied research where theories from various disciplines are computer science, economics, the social sciences are applied to the crossroad junction of information technology and organizational management (Peffers et al., 2007).

2.1 DESIGN SCIENCE RESEARCH METHODOLOGY (DSRM)

The large amount of interest IT systems research garners is due to the pervasiveness of the IT systems in the information based society we live in today (March & Smith, 1995). This interest can be divided into two types of research – descriptive and prescriptive. Descriptive research involves understanding the nature of IT system and therefore is a knowledge producing process, similar to natural science. Prescriptive research involves improving the performance of IT systems and therefore is a knowledge using activity, similar to design science (Hempel, 1966; March & Smith, 1995; Michalos & Simon, 1970).

Unlike natural science that focuses more on understanding and generating claims on the nature of reality, design science aims to create things that serve our purposes. Design science produces and applies knowledge of tasks and situations to create effective artifacts (March & Smith, 1995) which is also the purpose of this research. In the case of IT systems research, the central object of study is referred to as an IT artifact in an organizational context (Hevner et al., 2004; Orlikowski, Wanda J.; Lacono, 2001). The IT artifacts considered commonly in IT systems research can be defined by four broad categories – constructs, models, methods and instantiations (Hevner et al., 2004). *Constructs* provide the vocabulary and symbolism in which problems and solutions are developed and communicated (Hevner et al., 2004; March & Smith, 1995). *Models* represent real world scenarios, the design problems associated with it and its corresponding solutions using constructs. Through abstraction, models also allow researchers to study the effects of the decisions made on the designs and resulting changes in the real world (Hevner et al., 2004; March & Smith, 1995; Michalos & Simon, 1970). *Methods* are the processes that guide the researchers through the solving of the problems either through explicit algorithms dictating the steps or the best practices rather informal approach. *Instantiations* use all of the above and implement it in an existing system. This allows the researchers to study the suitability of the IT artifact in the real world scenario, conduct feasibility studies which enables the final assessment of the IT artifact (Hevner et al., 2004; March & Smith, 1995).

As we will be conducting a design science based research on IT systems, we will follow the steps that the design science research methodology (DSRM) ensues (Peffers et al., 2007). A methodology is a system of principles, practices and procedures that are applied to a particular branch of knowledge, which in the case of design science research includes concepts and principles that defines the research being conducted, rules of practice and the process of conducting and presenting the research (Peffers et al., 2007).

The principles of design science research broadly state the process of designing artifacts that solve problems that have been observed, make appropriate research contributions and convey the results in a clear manner. The rules of practice cover overarching guidelines to conduct research as well as possible (Hevner et al., 2004; Peffers et al., 2007). The guidelines are stated in the following table. The most important of these rules is that the research conducted must create an artifact that indeed solves a problem (Hevner et al., 2004; Peffers et al., 2007). Finally, the methodology includes a procedure that describes the commonly accepted process of conducting the research. At the final stages of the DSRM researchers also often provide mental models that have the characteristics of the outputs of the research. Such a model of reality provides reviewers, and consumers of the research with some direction towards the expectations of the design science research (Hevner et al., 2004; Peffers et al., 2007).

Table 1: Guidelines to the rules of practice in DSRM (Hevner et al., 2004, p. 83)

Guideline	Description
1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.

7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

The process of DSRM consists of six elements conducted in a nominal sequence which will also be followed in this research. The elements involved in this process are hereby explained descriptively and graphically.

Problem identification and motivation: This involves defining the exact research problem, specifying the associated challenges and rationalizing the need for a solution. This enables reviewers to understand the reasoning behind the research problem and ensuing solution as well as motivate further research to be conducted in this field (Peffers et al., 2007). All identified problems do not necessarily have to solved for as the process of design research is one of partial and cumulative solutions (Peffers et al., 2007). Once the problem has been identified, by stating the objectives for the solution, the research scope will be set and it becomes clear what is to be expected of the research.

Define the objectives for a solution: The objectives of the solution are deduced after the identification of the problem and the feasibility of the solution becomes more clear. These can either be quantitative or qualitative in nature. Quantitative objectives can include conditions necessary for a new solution to be a better fit than the status quo while qualitative objectives can include a characterization of how the solution (artifact) will alleviate the problem in a manner not previously addressed. These objectives can be reached through an understanding of the nature of the problem and through literature reviews providing knowledge on current solutions and their effectiveness (Eekels & Roozenburg, 1991; Peffers et al., 2007).

Design and development: This stage involves the design and development of the artifact which could potentially be constructs, models, methods or instantiations. The functionality and architecture of the artifact is determined here through the use of all the resources and knowledge accrued so far (Hevner et al., 2004; Peffers et al., 2007).

Demonstration: The utility of the artifact is demonstrated by solving for one or more problems. The demonstration can be done through experimentation, case studies, simulations or other similar activities (Peffers et al., 2007).

Evaluation: The artifact is evaluated at this stage to see how well it assists in solving the problem by comparing the predefined objectives with the observed results from the demonstration. The evaluation can either be suitable empirical results or logically reasoned proofs. After the evaluation, researchers choose to either go to the design and development stage to improve the efficacy of the artifact or move on to the communication stage to convey the results of the research. Any subsequent development will be done in future projects (Eekels & Roozenburg, 1991; Hevner et al., 2004; Peffers et al., 2007).

Communication: The problem, the subsequent artifact and solution, its usefulness and its novelty in literature must be conveyed in a clear, rational and concise manner. This is important as it allows reviewers to understand the importance of the problem, follow the rationale behind the solution and

improves the replicability of the research which is essential for any future research in the same field (Hevner et al., 2004; Peffers et al., 2007).

Although in this DSRM methodology a nominal sequence of steps have been stated, researchers are not expected to follow the steps in the exact same order. Depending on the problem they are attending and the amount of knowledge and information they already possess at the start of the research, researchers can begin at any point in the sequence (Peffers et al., 2007). In research publications, researchers might use this sequence to structure their report as well due to its rationally consistent sequence (Peffers et al., 2007).

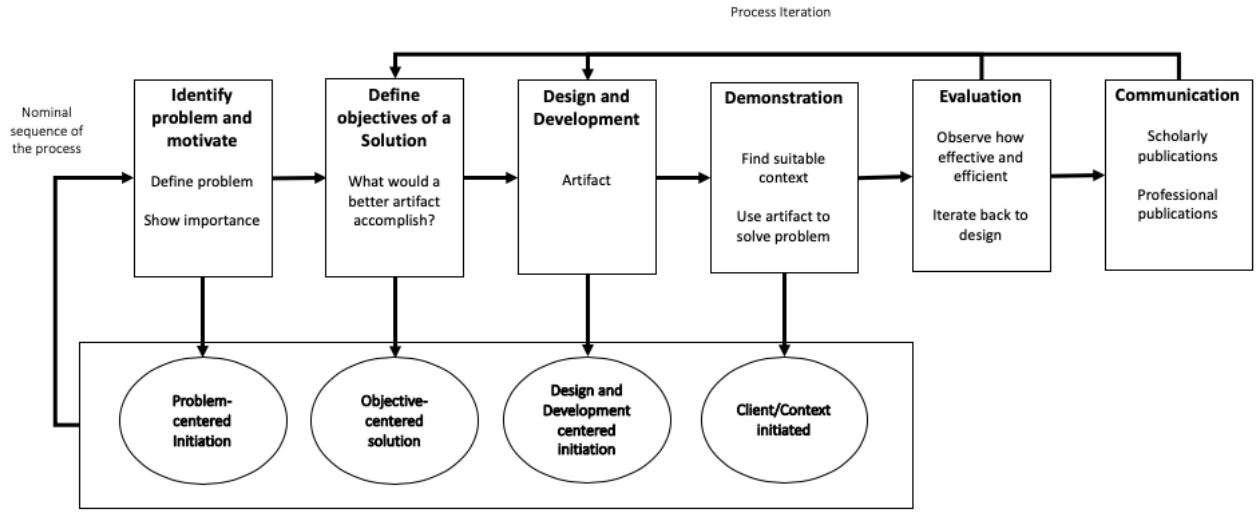

Figure 3: DSRM process model (Peffers et al., 2007, p. 54)

2.2 SYSTEMATIC LITERATURE REVIEW (SLR)

A systematic literature review is conducted to get an overview of the available knowledge associated with the research problem and all the existing solutions in the literature. Jesson (2011, pg: 104) defines it as: *"Systematic reviews provide a systematic, transparent means for gathering, synthesising and appraising the findings of studies on a particular topic or question. The aim is to minimise the bias associated with single studies and non-systematic reviews."* The SLR is generally conducted to gain a deeper understanding of a particular field of study and the existing theories and developments in that field. This allows interested researchers to be aware of the knowledge gaps in the field of study. SLRs are also conducted after a research problem has been identified and information about the existing solutions needs to be garnered. The method of conducting a systematic literature review can be summarized in the following steps (Kitchenham et al., 2009):

- The research intention and the intentions of the SLR are first described and detailed. This can include the research questions being addressed, the limitations of existing research and the year from when the SLR is being conducted.

- The search for the necessary information then begins. Databases both online and offline can be chosen to find the requisite reports, research papers and journals.
- Next inclusion and exclusion criteria are set in order to sieve through the collected material.
- The remaining papers are then evaluated and assessed for their quality. This can be done by scoring them based on factors such as the impact factor, number of citations etc.
- The final set of papers are systematically scrutinized and the required data is collected to be analysed later.
- Any deviations from this protocol need to be reported for the benefit of future researchers.

The methodology of an SLR, however, requires long durations of time, resources and more number of researchers than what is in the scope of this thesis research (Jesson, 2011). For this reason, a version of systematic review known as rapid review, will be conducted. A rapid systematic review collects descriptive outlines of evidence available on a subject, followed by a critical appraisal of selected works and finally a brief overview of what these selected papers tell us about the subject so far and what are the gaps in the knowledge where further research can be conducted (Jesson, 2011). A rapid review is mostly based on a comprehensive search of all available electronic databases and some selected journals, but this does not mean it is an exhaustive inspection.

2.3 CASE STUDY BASED RESEARCH

Using a case study to build and strength the theory formulated is a strategy of research used to create theoretical propositions from empirical evidence based on different cases. Here the idea is to use each case as an experimental device that serves to validate the theory proposed (Eisenhardt & Graebner, 2007). The advantage that single cases have over multiple case is that more complicated and nuanced theories can be developed as the theory can be made to fit multiple details of a particular case instead of the fewer common details that multiple cases have between them.

For the purposes of demonstration, one of the steps of DSRM, a case study approach was taken where the IT artifact is tested on an organizational business process to evaluate its utility. The organizational business process in question is the incident management process of Exact (Delft). The business process as well as the common challenges associated with it are described in detail in subsequent chapters.

The four tests common in social research were kept in mind during the study to increase its quality. These are construct validity, internal validity, external validity and reliability (Yin, 1994). *Construct validity* ensures that accurate operational measures are established for what is being studied. The main tactic used in this study to increase its construct validity is using multiple sources of evidence and research literature to strengthen the line of enquiry taken throughout the study (Yin, 1994). These resources were mainly collected during the literature review phase. *Internal validity* assures the causal relationship between the concepts that have been observed and stated in the study (Yin, 1994). Explanation building, an analytical tactic using the same resources collected during the review has been used to this end in the study. *External validity* is a test to see if the findings of the research are generalizable beyond the immediate study (Yin, 1994). To assure the external validity of the study, the IT artifact of this study has been demonstrated on an organization business process that is very common

in the service sector. Future research can be conducted where the IT artifact is used on other business processes and IT systems thereby improving the overall generalizability of the artifact. *Reliability* is the test to demonstrate the repeatability of the operations conducted in the study thereby reducing biases and minimising errors (Yin, 1994). All the findings and conclusions have therefore been documented in such a manner throughout the report so as to improve its reliability and repeatability for future researchers.

However, the depth of case study analysis has been greatly affected by the global coronavirus pandemic. A number of metrics of measurement that are part of the IT artifact have not been used as lockdowns of business workplaces and enterprises resulted in a lack of information for a detailed study. For this reason, the incident management process has been chosen as it is a very common organizational business process in the service sector with sufficient available literature. Information and claims stated during the process of research subsequently can therefore be strengthened by existing literature as well. The possibility of experimenter's bias (influencing the research and results to describe certain outcomes) and reporting bias (reporting results favourable to the initial hypothesis) needs to also be stated (Yin, 1994), although much care is taken by the researcher to ensure the study remains unbiased.

CHAPTER 3: NEW TECHNOLOGIES IN INFORMATION TECHNOLOGIES (IT)

Today organizations and business enterprises have embraced the potential of information and IT systems and this is visible in the shift of focus in entire industries to the importance of information and data. This has resulted in corresponding shifts in business strategies that organizations undertake to incorporate the latest IT systems that collect data and control the flow of information that largely benefits many of their business processes and daily transactions.

Out of the myriad IT systems available to organizations, they may find some that have completely different functionalities but when added to an existing business process can drastically improve its performance. There are other which achieve similar functionalities as the older systems but differ in design and implementation methods and can shave of variations and time as compared to the older systems. The plethora of IT tools accessible to organizations largely focus on the management of data and information, information processing and communication (Sidorova et al., 2015). The goal of implementing such systems in the end is to lower production and maintenance costs in order to achieve a competitive advantage over other businesses in the same market. The latest technologies that strive to improve business processes are the use of robotic process automation for workflow and process optimization, chatbots that have multiple capabilities most popular of which is in the customer interaction process and machine learning and artificial intelligence that are capable of bringing long term infrastructural improvements in an organization (T. H. Davenport, 2018; Radziwill & Benton, 2017; van der Aalst et al., 2018). These are discussed in detail below.

3.1 ROBOTIC PROCESS AUTOMATION

In the recent years robotic process automation has garnered quite a lot of attention with regards to initiatives that relate to process automation. 54% of all European companies are planning to have at least 10 of their processes automated with RPA by 2020, says the Information Services Group (2018).

For a more detailed definition of RPA, IEEE Corporate Advisory Group (2017, p.11) states that RPA is a “preconfigured software instance that uses business rules and predefined activity choreography to complete the autonomous execution of a combination of processes, activities, transactions, and tasks in one or more unrelated software systems to deliver a result or service with human exception management.” Figure 4 describes the basic nature of RPA. RPA improves automation and workflow performance in an “outside-in” manner rather than an “inside-out” manner like the traditional IT systems (van der Aalst et al., 2018). This means that RPA can be implemented without having to change the existing IT systems in the organization.

The ability to accomplish non-value adding activities in a scalable and cost effective manner all while decreasing turnaround times, is what attracts organizations to automate their business processes using RPA, pursue a strategy for operational excellence and gain the competitive advantage. In cases where

obtaining the manpower with desired specific skills or developing or integrating a new business process system are too complicated or expensive and the costs do not justify the needs, robotic process automation can function as an element of transition between manual human labour and an intricate system of business process automation. RPA and the other software robots basically access systems to either perform automated individual tasks or perform tasks that are similar to the ones performed by humans or just imitate them. An example of a RPA activity is the automatic opening of a new instance on Microsoft Excel on a specific command or trigger, navigating to a preselected spreadsheet, changing data in specific cells and finally saving the changes made and closing the sheet (Hofmann et al., 2020). To enable the RPA software, organizations can use the services of RPA vendors such as AutomationEdge, BluePrism etc. which focus solely on RPA or they can use services that provide additional tools combined with RPA such as Cognizant and Pegasystems (van der Aalst et al., 2018). These services offer BPM (Business process management) and CRM (Customer relationship management) on top of RPA (van der Aalst et al., 2018).

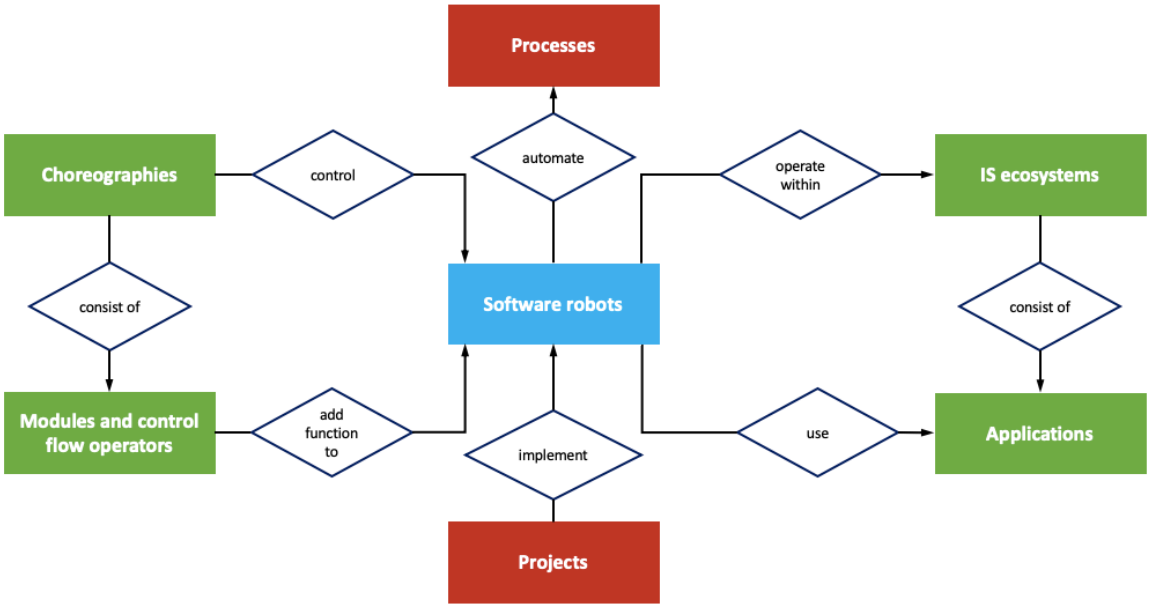

Figure 4: Nature of Robotic Process Automation (adapted from (Hofmann et al., 2020, p. 100))

When deciding the right processes to be converted and taken over by RPA, aspects such as financial strength of the organization, organizational structure and capability and time must be considered. A process is suitable for automation if :

- it follows a rule-based structure that is standardized without the need for judgement or any cognitive effort (Uskenbayeva et al., 2019),
- accesses multiple systems to complete the process and
- is performed manually and often by human labour.

Examples of processes ripe for RPA are basic forms of data analysis such as data formatting and graphic conversions, data entry, archiving data and emails, generating mass mails and providing regular notifications and updates (Hofmann et al., 2020).

With the flawless, traceable (for accountability and security) and uninterrupted flow of the business process, RPA aims to improve organizational and process performance, be more efficient, scalable, secure and more compliant all while maintaining low costs. Once the repetitive, laborious and banal tasks requiring little cognitive effort are reduced, the employees are now free to use their time and resources in more challenging tasks that cannot be automated, required critical and creative thinking, social skills or intellectual judgement.

However, there are certain pitfalls organizations must be wary of when considering automation of processes. If processes containing errors, gaps and inefficiencies are converted as is for automation, the robots will execute all the steps to the letter including the inefficient ones which will mean increased costs and redundant and excessive use of organizational resources. Therefore, organizations must ensure that processes primed for automation has been redesigned to mitigate errors and inefficiencies as much as possible. Furthermore, the organizational strategy must also take into consideration both the direct and indirect effects of automation on the organization. Organizations must be wary when RPA takes incorrect decisions based on inherent biases and contextual changes. If gone unnoticed, these decisions can lead to adverse situations with considerable security and ethical risks (van der Aalst et al., 2018). Other concerns include the implications on manpower in the organization, the landscape of business processes and IS/IT systems, the organizational structure, governance, management and leadership strategies (Hofmann et al., 2020).

3.2 CHATBOTS

Advancements in natural language processing have helped develop this next technology. Chatbots are computer systems that allow users to interact with computers using natural language (Radziwill & Benton, 2017). This is widely used in businesses (for example when providing customer services), healthcare and education (Ahmad et al., 2018). The input for these chatbots is usually the natural language mainly received physically such as typing requests by the user or using speech recognition systems and then in an outcome oriented manner one or more instructions are executed. These chatbots aim to be intelligent, autonomous, social and proactive in nature (Radziwill & Benton, 2017).

Dialog systems as a technology to improve communications have been studied for a long time. Dialog systems can be of two types. Interactive Voice Response (IVR) systems and Conversational Agents. The IVR systems interact with humans making them dialog systems, however their interaction mainly follows the implementation of decision trees such as payment or service systems that ask users to “Press a number” for a particular action. Conversational agents are more intricate systems and can further be divided into two categories. The embodied conversational agents which conduct conversation typically

in the form of avatars, animals or robots (humanoid or otherwise) are one category. The other, are the chatbots which mimic human interaction in the form of texts or email (Radziwill & Benton, 2017). The figure 5 shows this relationship.

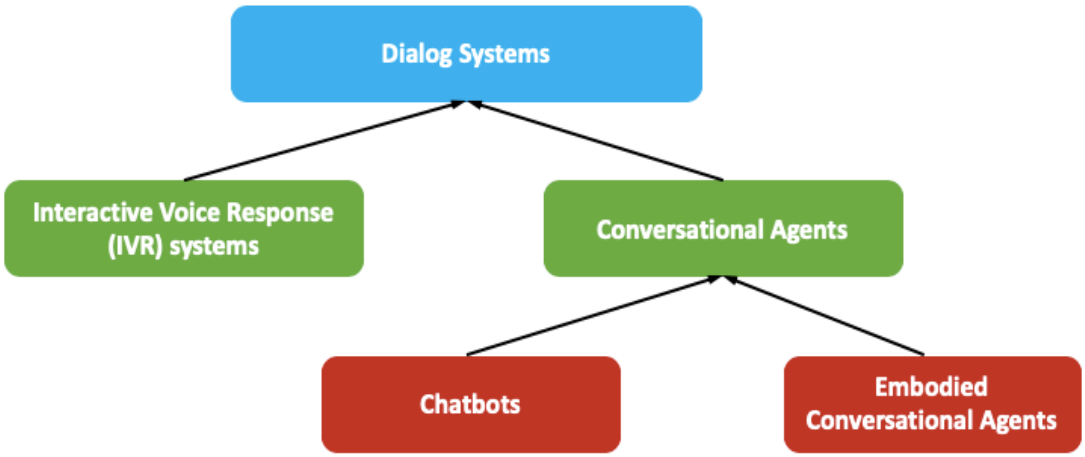

Figure 5: Dialog System of classification (adapted from (Radziwill & Benton, 2017, p. 43))

Chatbots are advantageous as they can assist the inquiry of humans with personalized messages and replies and improve efficiency by staying operational twenty-four hours a day. Multiple design techniques exist that allow chatbots to respond to humans in a natural way, of which the most common one is the technique of pattern matching where the computer matches phrases to a predetermined set of keywords in its database (Ahmad et al., 2018) while other more advanced systems use machine learning to adapt to new information and different requests. Chatbots are of various types depending on the dimension and can be divided into type, direction, guidance, predictability, interaction style and communication channel. The type of chatbots in each of these dimensions is shown in table 2.

Table 2: Types of Chatbots (Adapted from (Paikari & Van Der Hoek, 2018, p. 15))

Dimension	Chatbots
Type	Information
	Collaboration
	Automation
Direction	Input
	Output
	Both

Guidance	Human-mediated
	Autonomous
Predictability	Deterministic
	Evolving
Interaction style	Dull/Banal
	Alternate vocabulary
	Relationship builder
	Human like
Communication channel	Text
	Voice
	Both

Implementation and integration of chatbots is also becoming easier with the advent of social media and productivity tools for developers such as GitHub and Slack. By splitting testing responsibilities between the service provider who regulates the inputs for the tests, action execution and obtaining desired outputs; and the client who assesses the efficiency, effectiveness and ease of use of the chatbot, development platforms exist today who offer the implementation of chatbots as a Software as a Service (SaaS) product (Radziwill & Benton, 2017).

Using machine learning, chatbots are developed to increasingly adapt to new and different inputs and requests. The common methods of currently being used in its development include unsupervised learning using models based on Markov- chain, supervised learning which require enormous training sets and hybrid intelligence which involves the participation of humans in the training process. Although the latter two take longer to develop and are more expensive to undertake, the resulting systems are better at facing new problems and require less time to reach their goals compared to other systems (Radziwill & Benton, 2017; Wilson et al., 2017).

One of the main challenges of chatbots is of natural language processing (NLP). Chatbots must be able to use NLP to figure out the syntaxes and contexts of everyday conversation in order to better understand the questions it will be asked. Machine learning, the second challenge, is then necessary for the chatbot to learn accurate responses to the posed questions (Rahman et al., 2017). There is also the ethical concern of responses being derogatory, racist or contain other biases in their responses (Schlesinger et al., 2018) which will not be well received by people at the other end. In an organizational environment, this could result in loss of clients and any future business. Therefore this will be a concern for any businesses looking to implement chatbots.

3.3 ANALYTICS USING ARTIFICIAL INTELLIGENCE (AI)

With swift growth and development of the capabilities of artificial intelligence (AI) throughout the last few decades especially in its ability to study statistics and large quantities of data and through various quantitative methods generate useful and actionable insights, organizations and businesses all over the world are increasingly looking to AI to help them strategically in their decision making. The most popular and powerful systems of the lot of AI technologies are the statistics based AI systems which use machine learning or deep learning approaches. Machine learning (ML) is the use of algorithms to enable computers to learn patterns and behaviours through data generalization (Bravo et al., 2014). This is most often achieved through unsupervised reinforcement which means that the system is not told what the discovered pattern should be or do. ML also overlaps with data mining. However, while in data mining the system focuses on find patterns in the data, ML is used to generate new and desirable patterns (Bravo et al., 2014).

To understand the journey of AI development so far, Davenport (2013, 2018) delineates four eras of analytics which show an increase of data usage, mathematical and statistical methods and finally the development of complex and specialized platforms that are today's AI technologies. The figure below summarizes the four phases.

Analytics 1.0 – *era of artisanal descriptive analytics (business intelligence)* – This phase lasted for a long time where organizations that collected and worked with data analytics largely focused on data management and the analytics results were largely used to support internal business decisions rather than use it as a tool to make predictions and gain competitive advantage.

Analytics 2.0 – *era of big data analytics* – With increased development seen in both hardware and software technologies, this phase saw a shift in focus from organization in-house decision making to development of complex data-based products for the masses. Recommendations and search engines are a result of this phase.

Analytics 3.0 – *era of data economy analytics* – Here organizations have begun to realize the potential of big data and data analytics and the organizational benefit of its predictive capabilities. This became clear when large scale organizations and multinational corporations with conventional cultures and business models began adapting and incorporating into their culture and business models data analytics and other data based industrial tools which used multiple machine-learning algorithms developed either in-house or by third party developers.

Analytics 4.0 – *era of artificial intelligence* – This phase is step where organizations embrace cognitive technologies with advanced analytical capabilities based on artificial intelligence.

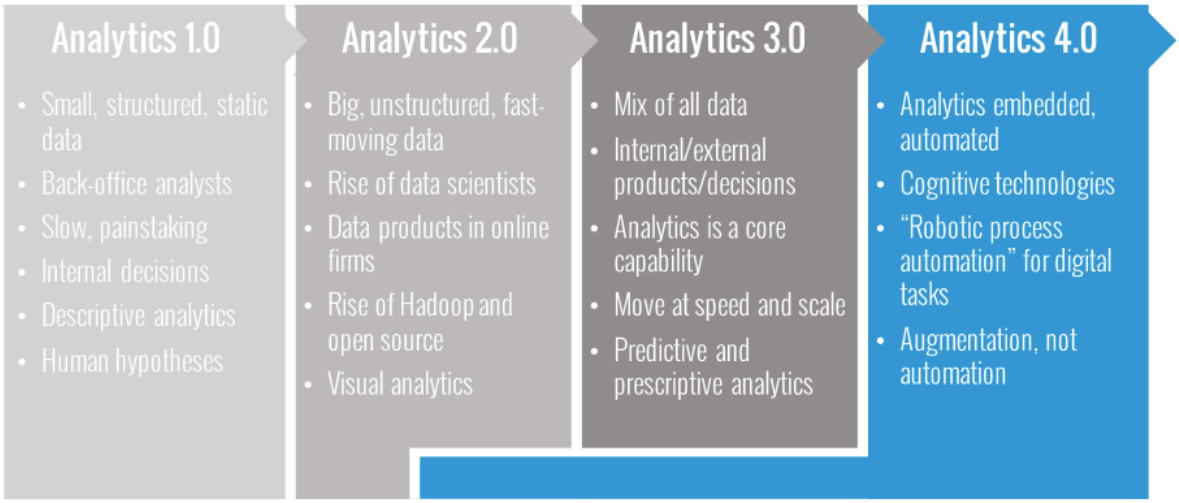

Figure 6: The four phases of Analytics (T. H. Davenport, 2018, p. 2 fig. 1)

The essence of many approaches to artificial intelligence lies in machine learning which is basically analytics of various statistical models. Some of the types of analytical AI are:

Predictive analytics: Predictive analytics largely bases itself on *machine learning*. Predictive analytics models are first trained using *supervised learning* which is the training of models or neural networks using previously collected data with the outputs and results already known to us. Each neural net consists of nodes to which weights and thresholds are assigned. When an input signal reaches a node, it is first multiplied with the assigned weight and then compared with the threshold value. If the calculated value is greater than the threshold value, then the signal is allowed to pass through the node, otherwise it is blocked. During the training of the neural net, initially all the values of the weights and thresholds are randomly set and whilst the training continues the values are constantly monitored and adjusted until expected values at the output are received (Hardesty, 2017). Once the model is trained, it can then be given new and previously unknown inputs to generate new outputs that can be studied.

Deep learning: Deep learning models are a more complex version of the models and neural networks used above. Here each of these neural networks consist of not only millions or billions of nodes but each node also consists of hundreds or thousands of attributes. Such models are currently being used to process and recognise images and voice data (T. H. Davenport, 2018).

Statistical natural language processing (NLP): Natural language processing is when AI systems are used to understand our natural language. Currently computers and machines do not understand the human language as-is, so in order for us to communicate with them, we have an established set of codified languages. The goal of NLP is to allow computers and humans to interact without any hinderance by developing a system that can understand and interpret human language without any difficulty. Statistical NLP is the use of statistical models on the collected texts and speech patterns to decipher useful meaning and information (T. H. Davenport, 2018).

There are other types of AI systems that do not use statistical models but nevertheless are under the umbrella of artificial intelligent systems. These are largely rule-based systems which were dominant

until very recently. These AI systems require human experts to construct and code in the set of rules in each particular domain they wish to use the system in (T. H. Davenport, 2018).

Semantic natural language processing: Based on the semantic and ontological analysis of phrases and words, this was the main form of NLP being pursued before statistical NLP became popular. Semantic NLP is a very labour intensive and time taking endeavour where the system has to be extensively and effectively trained to understand the relationships between the words and phrases, the various syntaxes and the underlying concepts (T. H. Davenport, 2018).

Natural Language generation (NLG): NLG is the method used when systems generate meaningful words, phrases and sentences that can be easily understood by humans. Here, however, the output is largely based on the set of rules coded and sentence and phrase templates provided to the system (T. H. Davenport, 2018).

Robotic process automation (RPA): RPA is a subset of the non-analytical AI systems. It performs all the complex tasks based on a predetermined set of rules and workflows with additional layers attached it which include the user interfaces that we interact with as well as the interface used to connect with existing systems already in place. No statistical analysis is being done in RPA systems (T. H. Davenport, 2018).

The Applications of an analytical AI system

Enhancing the development of products and services: Most of the existing products and services both physical and digital that invariably use data can benefit by adding and incorporating AI systems into it. These systems can assist and improve all points of a value chain. Leveraging AI allows for deeper and more accurate analytics, more automation, faster development of test cases, models and prototypes which can all aid organizations in the creation of new products and services, enhancing existing products and services while also accelerating product development (T. H. Davenport, 2018).

Optimization of internal and external business processes: An organization's success depends largely on its ability to adapt to the fluidity of a competitive marketplace. Machine learning and AI systems can thus benefits businesses by improving and optimizing internal business processes to increase the quality and the speed in which decisions are made thereby giving them an edge over their competitors. AI tools can further add value by enhancing external business processes such as customer engagement and studying social media to assess the effectiveness of sales and marketing campaigns. Chatbots have been successfully used to connect with customers of businesses thereby collecting valuable market information that can be useful during customer base expansion as well as improving their brand image and relation with the consumers (T. H. Davenport, 2018).

Advancing the existing analytical capabilities: Businesses that currently employ analytics largely use conventional analysts and data scientists. With the ever growing amount information and increasing data sets and to overcome the gap between the information available and the number of analysts employed, businesses can incorporate AI systems that can take in the vast amounts of raw data and

prepare it for further analysis by human analysts thereby increasing productivity (T. H. Davenport, 2018).

Ethical concerns of using AI systems

Now with a constantly developing innovation such as artificial intelligence technologies which has far reaching consequences and impacts in almost every field in the industry, certain ethical issues crop up which businesses and enterprises will do well to keep in mind so as to be prepared in case of any backlash due to their investment in this technology. Some of the ethical concerns that crop up with AI systems are:

Privacy and security: AI systems depend on voluminous amounts of data to ensure they generate useful results. With better technologies such as sensors and cameras being developed every day that collect data of both increasing quality and quantity as well as digital nature of internal and external business processes of organizations makes it crucial for businesses to think about information privacy and information security. Keeping their customers information secure is often a value proposition offered by companies and has even given them the edge over their competitors.

Transparency of AI systems: Systems that are developed as predictive analytics tools to assist in the decision making often use machine learning. This means that the patterns and relationships identified by the systems are often not transparent to the experts such as the engineers and programmers working on the system. To enhance the speed and quality of the decisions making, these systems are constantly being programmed to make quicker decisions with a reduced need for human participation (Danaher, 2016).This would mean that it would be often impossible for both the organization as well as the affected consumer to know why the system generated a certain output and how decisions were made. Such decisions are often referred to as “black box” decisions as the reason the system generates a particular result often remains unclear (Bravo et al., 2014). This raises the concerns about the transparency of decision making and accountability (Müller, 2020). Furthermore, the quality of the generated output largely depends on the quality of the input, so if the input data consists of anomalies and biases, these anomalies and biases will be reproduced by the system reducing the quality of the output as well as the decisions made using them. Some of these issues have been recognised by the EU and have been considered in their regulations which provide consumers with the legal right to explanation if they face some discrepancy with the decisions made based on automated AI decision making systems (Regulation (EU) 2016/679, (Müller, 2020)).

Bias in decision making systems: Biases arise when individuals make decisions based on factors and characteristics that are not necessarily relevant to the confronted issue. Although they are generally harmless and quite beneficial in our everyday lives, when the decisions made due to these biases have discriminatory and adverse consequences, being aware of these biases is crucial (Müller, 2020). Today’s decision making systems that are based on AI and use predictive analytics depend extensively on data to generate results. The data is acquired through a multitude of ways for example sensors that collect temperature data or a statistical survey conducted during market research. The concerns here are of the biases that may affect the decisions being made by the system either due to the biases being

perpetuated because they were already present in the data being collected; or, due to the biases that was coded into the system by the expert at the time of conception which has an impact on all the decisions being made. Therefore, organizations must be aware of such biases before placing excessive trust in these AI decision making systems.

Automation and employment: Businesses striving for increased productivity go for increased automation which is what these AI systems offer. However, to achieve this higher productivity through automation implies that fewer humans would be necessary to obtain the same result (Müller, 2020). So when organizations decide to invest in IS/IT technologies, when consider the cost savings and productivity gains they would do well to keep in mind the number of human jobs that would be redundant or unnecessary.

Behaviour manipulation: Although manipulating behaviour consumer or otherwise has been with us forever, we must be aware of manipulating online and offline behaviour with the use of information by AI systems. With access to better quality and increasing quantity of information of their consumers, AI systems have a deeper understanding of consumer behaviour making consumers more easily susceptible to manipulations and "nudges" (Müller, 2020). Businesses have to aware of the moral concerns this raises when confronted by any decision making process.

3.4 TABULAR OVERVIEW OF THE NEW TECHNOLOGIES

The following table summarises the three IT systems discussed in this chapter and highlights some of the individual advantages and challenges of these technologies.

Table 3: Comparing different technologies

	RPA	Chatbots	AI Analytics
Definition	Software that uses preconceived business rules to execute processes and tasks autonomously (van der Aalst et al., 2018)	Software that allows users to interact with computers using natural language (Radziwill & Benton, 2017)	This is the method of using ML and AI to analyse large amounts of data, to garner insights, make predictions, optimize processes and systems and improve automation (Bravo et al., 2014; T. H. Davenport, 2018)
Type of system	Lightweight system	Depending on the training of the system, it falls in between	Heavyweight system

		lightweight and heavyweight systems	
Focus	Frontend	Frontend	Backend
Cost of implementation	Relatively Low	Low	High
Time to implement	As this software works with any existing IT infrastructure, of the three systems, RPA is the quickest to implement (Lacity et al., 2015; van der Aalst et al., 2018)	Takes more time than the RPA	Takes the longest to implement as it requires the restructuring of the existing IT infrastructure
Advantages	Arduous tasks usually done by humans can be automated. This increases productivity: • as employees now have the time to work on more laborious and cognitively challenging tasks (Lacity et al., 2015). • due to the reduced number of errors an RPA system will make when executing repetitive tasks (Oza et al., 2020). • It offers an overall reduction in costs and operational risks (Hofmann et al., 2020) • It also does not require any additional infrastructure and will work well with the existing IT	Chatbots provide an improved experience to the customer: • Unlike bland email responses and notifications, customers can interact with businesses as if they would be talking to its employees itself (Paikari & Van Der Hoek, 2018). • Chatbots also provide around the clock service, any time of the day even when the business may be closed. • Valuable customer insights may be collected from their interactions with the end users	RPA and chatbots are both simpler subsets of AI analytics (T. H. Davenport, 2018). A more developed AI system provides organizations with: • Better insights by analysing larger pools of data, therefore will lead to better decision making. • More sensitive than humans to errors, in turn commits fewer errors of its own. • Improves customer experience • Can provide more automation, therefore can increase speed and productivity of business processes.

	infrastructure (Hofmann et al., 2020; van der Aalst et al., 2018) • It offers the opportunity to easily scale up operations of a company	• This system is cheaper than hiring employees to undertake this task, therefore it also offers cost savings in the long run (Paikari & Van Der Hoek, 2018).	
Disadvantages	• Skilled employees to work with the system may be required to be hired if such employees do not already exist in the organization (Lacity et al., 2015). • Care must be taken when replacing a particular process with RPA. The process chosen ideally be repetitive, rule based and not require human input of any form.	• As it is still a system undergoing innovation, chatbots are more prone to errors in their responses to customer queries, which might hamper the overall experience (Rahman et al., 2017). • For a well-trained system that can be more adaptable to new situations, the installation costs and time will proportionately increase.	• As these systems require changes in the company's IT infrastructure they are generally more time consuming to implement and cost a lot more than the other systems. • When these autonomous systems come to a decision or decisions are made based on the results their analysis provides, companies must be aware of any ethical infringements such decisions can cause. One must also be aware of any critical biases inherent in the system (mostly coded in during its development) that can affect any decisions it takes (Bravo et al., 2014; Müller, 2020).

CHAPTER 4: LITERATURE REVIEW

4.1 ROAD TO THE COLLECTED DATA

For this literature review, we approach with a main scoping question that we need to be answered which is - *What are the existing tools to evaluate the impact of IT systems in an organizational environment available in the research literature?* We follow this up with a set of sub-questions (Jesson, 2011):

- What is the nature of the data collected – qualitative or quantitative?
- What were main focuses of proposed solutions and what did they fail to consider?
- Are these studies organization/industry specific?
- Are these studies country specific?
- What were the research methodologies used to conduct these studies?

Now the results of the primary question have been detailed in this chapter. It includes a detailed study of the existing frameworks that currently exist in the literature that deal with the evaluation of IT systems, further explaining the strengths and weaknesses of each framework. After stating the common challenges faced by the evaluation of IT systems, we shall then move on to the proposed framework to evaluate the IT system to be used to improve organisational business processes.

Both qualitative and quantitative studies are available regarding this subject. Although these studies are not country specific, they also try to not be industry specific and provide solutions for both product based industries like manufacturing and service based industries. However as it is easier to implement IT solutions in service based industries which nowadays are largely based on IT, we can see empirical evidence for the evaluation framework studies skewed in this direction as well. The following table shows quantitatively the steps taken towards the number of papers analysed in detail for this study.

Table 4: Evidence report table

Google Scholar	• (1) & (2) search strings – over 3.000.000 • (3)-(8) - 22879
Other electronic databases	Over 36600
Papers that fall under the inclusion criteria	~90
Papers still relevant after first reading	15-20
Papers that the evidence in this paper are based on	10+

For the purposes for this literature review mostly online resources and digital libraries were used. The libraries and online resources used were Google Scholar, Web of Science, Scopus, Wiley online library, Science Direct, JSTOR, Emerald Insight, Taylor & Francis online, and Sci-Hub when papers were unavailable in the above libraries.

For the online search, a significant set of keywords were used as search strings (with rearranged orders in situations where it made sense). These search strings included (but were not restricted to):

- 'new technologies in business process management' – 3.630.000 results
- 'organizational framework information technology' – 3.220.000 results
- 'business process management information technology' – 2.950.000 results
- 'information systems integration "framework for analysis"' – 59.600 results
- 'methodologies for information systems investment evaluation' – 1.840.000 results
- 'information technology and business "modelling aspects"' – 2.590 results
- 'business process modelling "information systems architecture"' – 8.490 results
- 'process innovation information technology' – 4.050.000 results
- 'robotic process automation in business processes' – 115.000 results
- 'chatbots in business processes' – 11.400 results
- 'AI analytics in business processes' – 57.800 results

Following this a set of inclusion and exclusion criteria were exercised to eliminate papers that would not add substantial value to the purposes of this study (Jesson, 2011). These chosen criteria are as stated below.

Inclusion: Frameworks proposed were for only IS/IT technologies, the technologies were used on an organizational context (also includes business processes), language used was English, globally held studies, time scale was post 1990, additional research papers found through the references of the papers first considered

Exclusion: Papers that suggested organizational change without the use of IT technologies, grey literature such as non-academic research, papers published before 1990.

The papers that finally selected for detailed reading were all from peer-reviewed journals. These included journals like Strategy & Leadership, Research Policy, Business Process Management Journal, Management Information Systems Quarterly, European Journal of Operational Research, European Journal of Information Systems, Strategic Information Management, Logistics Information Management, Journal of Business Strategy, Journal of Business Analytics, The Institute of Electrical and Electronics Engineers Standards Association, IEEE Engineering Management Review, Academy of Management Journal, Journal of Management Information Systems, report by the Royal Society.

4.2 RESULTS OF THE LITERATURE REVIEW

- *The balanced scorecard approach:*
  Kaplan and Norton first proposed the balanced scorecard at the enterprise level to evaluate firms not just on their financial statements but to also include metrics that measure internal processes, customer satisfaction and learning and growth inside the organization (W. V. Grembergen, 2005). By balancing the factors with these four dimensions and maintaining their strategic goals, firms could better ensure their success in the long run. In a similar vein, at the application level, the balance scorecard can be adapted to evaluate the IS/IT systems and the impact they have on business processes. This would include dimensions like the contributions and perspectives of customer and corporate, excellence of operation and future orientation (W. V. Grembergen, 2001, 2005). Then by measuring the scores obtained in each dimension, IS/IT systems can be chosen such that it's the right strategic fit for the business process under consideration as well as measure its impact on its improvement. This is visualized in figure 7.

USER ORIENTATION	**BUSINESS CONTRIBUTION**
Perspective question How do users view the IT department? **Mission** To be the preferred supplier of information systems. **Objectives** • Preferred supplier of applications • Preferred supplier of operations • Partnership with users • User satisfaction	**Perspective question** How does management view the IT department? **Mission** To obtain a reasonable business contribution from IT. **Objectives** • Control of IT expenses • Business value of IT projects • Provision of new business capabilities
OPERATIONAL EXCELLENCE	**FUTURE ORIENTATION**
Perspective question How effective and efficient are the IT processes? **Mission** To deliver effective and efficient IT systems and services. **Objectives** • Efficient and effective development efforts • Efficient and effective operations	**Perspective question** How well is IT positioned to meet future needs? **Mission** To develop opportunities to answer future challenges. **Objectives** • Training and education of IT staff • Expertise of IT staff • Research into emerging technologies • Age of application portfolio

Figure 7: Aspects of the Balanced Scorecard adapted for IT (Van Grembergen & Saull, 2001, p. 2 fig. 1)

- Another challenge that arose was the selection of the type of IT investment companies should look into in order to improve their business processes. Smithson (1998) in his paper explained the multiple levels at which an organization can evaluate the implementation of an IS/IT system. These are at the Macro, Sector, Firm, Application and Stakeholder levels. Macro level is a large scale view of the technology's impact nationally and globally. The level of a Sector is the impact a technology as on a particular industry. Firm level is the impact of the technology inside the organization on certain metrics like performance, productivity and efficiency as compared to competing organizations. The level of Application is its impact on a specific application or a particular organizational business process. Finally the Stakeholder level looks at the concerns raised by different stakeholders involved in the business process and with the technology under evaluation.

The IS/IT systems can also be evaluated using the three-tier framework as proposed by Smithson (1998) and adapting it to be able to measure new IS/IT systems. The framework takes into consideration both the origin of the IS/IT systems when they are imported to the business process as well as the assumptions that underly during the evaluation of the information systems. This can be categorized mainly into three sections which are efficiency (objective and rational assumptions made in the evaluation), effectiveness (focuses more on doing the right things rather than doing things right) and understanding (where the evaluation is analysed within the context of the organization).

- Clemons and Weber (1990) observed that in spite of the attention received by IS/IT initiatives for their success in improving business processes, managers had difficulty in evaluating these initiatives for their strategic importance to the firm. The challenges faced by the managers which they observed were replicability and competitor response to a new initiative, incorrect application of financial models used to evaluate these investments, the restructuring of the industry and the resulting shifts it causes in the markets, long lead times in the implementation of IT projects and various other organizational barriers. They also observed the advantages which were often overlooked by the managers of firms responsible for the investments such as divisibility and expandability of the services an organization could offer, commercializing the improved in-house systems that would be transformed by the IS/IT infrastructures, reduced times to respond to customer requirements, improved flexibility and a larger set of overall often profitable options to work from. Based off of these advantages and professional experience of the authors, they proposed guidelines organizations could follow during the evaluation of IS/IT investments. Their suggestions included being able to make rational choices through scenario planning even when some quantifiable data would be unavailable, boundaries found during systemic analyses could be used as fine-tuning triggers once the project began, the gains an organization can enjoy through the information and knowledge swap between the implementing firm and the client, understanding all the risks that undertaking an IT project entails and that there are times when cooperation between two firms is a better alternative than an outright purchase on an IT system. The challenge with this paper chiefly is the lack of empirical studies backing this framework which is primarily where its credibility hinges. Furthermore, empirical studies of this nature usually involve long periods of time and resources which organizations may not always be open to thereby reducing the sample size used in these studies (Clemons & Weber, 1990).

- Merani and Lederer (1998) provided a framework that measured the organizational benefits mainly in three dimensions: strategic, informational and transactional. Each dimension further consisted of three other divisions. Strategic benefits included competitive advantage, organizational alignment and customer relations benefits. Informational benefits included information access, information quality and flexibility of information. Lastly, transactional benefits included efficiency in communications, systems developmental efficiency and efficiency in conducting businesses.

- Irani and Love (2001, 2002) provided another method to evaluate IS/IT investments. Similar to Merani and Lederer's three dimensions, they have divided the evaluation factors into three broad sections – strategic, tactical and operational benefits. Through this classification they were one of the first to incorporate evaluating for both tangible and intangible benefits of IT projects where the intangible benefits are included in the strategic benefits and partially in the parameters for the tactical benefits and tangible benefits are included in the operational benefits and the remaining parameters of the tactical benefits. However, this method has not been used to evaluate IT systems used in organizational business processes. Furthermore, it does not include the opinions and considerations of the stakeholders who actually use the IT systems. Without their inclusion, the decisions taken based on the evaluation may not always be in the best interest of the organization.
- Stewart & Mohammed (2002) developed a framework that uses factors from the business and technology domains as described by Parker et al (1998) and Irani and Love (2001) and to include both tangible and intangible benefits theorised that an integrated approach would benefit organizations better. Therefore they used the multi-criteria utility theory (MCUT) which considers the entire situation as a multi-criteria decision making (MCDM) problem. Some of the business domain factors include return on investment (ROI), strategic match (SM), competitive advantage (CA), and organizational risk (OR) while the technology domain factors include strategic architecture alignment (SA), definitional uncertainty risk (DU), technical uncertainty risk (TU), and technology infrastructure risk (IR). The paper further describes multiple criteria and sub-criteria within these factors which are used in the evaluation process and explain that these criteria are developed individually by the organizations to account for their specific strategies and objectives (Stewart & Mohamed, 2002).

- In Rau and Bye's (2003) paper, they indicate four main areas where IT systems add value. Those are *expense containment, process improvement, customer advantage* and *talent leverage*. They further subdivide IT value into hard assets (tangible assets), people (semi-tangible assets) and innovation (intangible assets). The goal here being to be able to quantify all aspects of an evaluation. The difficulty however, is that due to its strict focus on quantification, aspects such as value attached to or generated by the use of these IT systems as well as the attitudes and opinions of the stakeholders who come in contact with the system may not always be included in the evaluation. A lack of empirical evidence on the success of this framework with respect to operations in business processes is also an issue (Rau & Bye, 2003).

- Lee's (2004) framework observes an integrated approach to the evaluation of IT systems. It includes four aspects – strategic analysis, business process redesign, IT configuration and performance evaluation – which allows managers of the organizations a broad and flexible measuring mechanism. The result arrived through the mathematical model then goes through a sensitivity analysis to understand the relationship between the parameters. A major takeaway of this framework was that measuring cycle times' impact on customer's decision to repurchase was a critical factor in the evaluation. Although it is an expansive and useful framework, it has not been used in the context of the new technologies and innovations that have been developed to improve

organizational business processes. This means that it also lacks an ethical component that is important to include when dealing with these new technologies and due to its non-quantifiable nature it is excluded just like strategic parameters like development of the product or capacity to improve (Lee, 2004).

- Following Irani and Love (2001) to include both tangible and intangible benefits and Stewart and Mohammed (2002) to consider IT systems evaluation as an MCDM problem, Chou et al. (2006) developed a framework using a fuzzy multi-criteria decision-making approach. One of the first frameworks to involve tangible and intangible benefits, risks and influence of stakeholders, they use only four consideration criteria (external, internal, risk and cost) and one benefit criteria to evaluate IT systems (Chou et al., 2006). As this evaluation mechanism has not been used to evaluate new IT systems nor has it been used to improve business processes, certain factors endemic to these new technologies might therefore be missing from the existing mechanism.

- Schuurman et al. (2008) in their paper modified the Bedell's method used for portfolio management and analysis in order to use it for the evaluation of IT systems. They have abstracted the level of importance by asking three questions; in a hierarchical manner with the organization at the top (level 1), followed by the business processes (level 2) and finally the activities (level 3) to which the IT systems are closely related to. Following this a portfolio is created for each level where the effectiveness of the IT system is compared to the strategic importance of the IT system. The benefit of this method is mainly the drawing of a reasonable picture of the IT system's importance based on limited amount of data. Furthermore, it works well when dealing with one IT system conducting a singular activity or is part of a singular business process. It cannot effectively evaluate systems that execute multiple tasks and/or involved in multiple business processes (Schuurman et al., 2008).

- Azadeh et al (2009) in their evaluation take a similar approach as Chou et al. (2006). They use another MCDM method, the voting analytic hierarchy process (VAHP) instead. The criteria they used are strategic, tactical, intangible and technical aspects. They also include the opinions of the stakeholders' involved and integrate them into the evaluation process as managers, IT professionals and users may differ in the way they perceive the benefits of the IS/IT investments. They suggest to first use the Delphi method to collect the required data, then use VAHP to determine the weights to be assigned to each criteria and finally the data envelopment analysis (DEA) to evaluate between the effective and ineffective IT investments (Azadeh et al., 2009). The goal of the these two frameworks Chou et al. (2006) and Azadeh et al. (2009) however, is to be able to distinguish between two IT projects and say which is a better investment but they do not tell us the impact an individual IT system would have on a particular business process in an organization.

Table 5: Strengths and weaknesses of the existing evaluation frameworks found during the literature study

Evaluation Frameworks	Strengths	Weaknesses
Balanced Scorecard Approach (W. V. Grembergen, 2005)	• A supportive mechanism to align IT/businesses and IT governance • Multiple scorecards are available such as business balanced scorecard, IT operations scorecard, that take into consideration the various factors involved in the evaluation of the IT framework in a business.	• Can only be successful if IT and businesses act on the measures stated by the scorecard and the business contains mechanisms such as a Board and IT steering committees that are function properly. • The best results are obtained when these scorecards are developed simultaneously, however it is always a challenge to do so as multiple stakeholders involved in the development of the scorecards have to be on the same page.
Clemons and Weber (1990)	The guidelines proposed in this paper aim to make it easier for organizational managers to find the trigger points that can be used to evaluate and improve their IT systems and projects.	The lack of empirical data supporting the claims of the authors reduces its credibility. Furthermore, a clear method of conducting the evaluation has not been proposed.
S Smithson, 1998	On top of the effectiveness and the efficiency of an IS/IT system, it also takes into consideration personal and organizational contexts, matters of cognitive psychology and social constructs and behaviours in its evaluation.	This framework is quite an old framework and a lot of activity and changes have been seen especially in the efficiency and effectiveness zones.
Merani and Lederer (1998)	Their framework is divided into three dimensions: strategic, informational and transactional benefits of IT investments to be used for evaluation.	The framework takes into consideration the tangible benefits and strategic alignment of the investment with the organization but does not include intangible benefits and the stakeholders'

		opinions and influence on the investment before, during and after implementation.
Irani and Love (2001, 2002)	The framework considers the strategic, tactical and operational aspects of the IT projects for the organization while considering the tangible and intangible benefits for the first time.	It fails to include stakeholders' opinions who actually use these IT systems. This framework has also not been used to evaluate IT systems crucial in various business processes.
Stewart & Mohammed (2002)	Using Parker et al 's (1998) and Irani and Love's (2001) criteria, they developed a mathematical model using the multi-criteria utilization theory considering the evaluation as an MCDM problem.	Lack of empirical evidence to show its success in evaluating the impact of IT investments is the main concern.
Rau and Bye (2003)	Their framework suggests four main areas where IT systems must add value: expense containment, process improvement, customer advantage and talent leverage. A further subdivision of IT value into hard assets, people and innovation is also seen. By quantifying all the metrics, they wish to achieve a numeric result on which organizations can take their decisions.	Their focus on quantification can often bypass certain other parameters that might otherwise be important in an evaluation such as the values attached IT investments and stakeholder opinion and influence as they may not always be able to quantify them.
Lee (2004)	This provides an integrated approach through an evaluation matrix that includes: strategic analysis, business process redesign, IT configuration and performance evaluation.	Due to its focus on quantification, certain strategic parameters and values (like ethical issues) associated with the IT systems are excluded. Furthermore, this framework has not been used in the context of new innovations in IT systems.
Chou et al. (2006)	Their method involves an MCDM tool to include tangible and intangible benefits, risks and influence of stakeholders.	As it has not been used to evaluate the new technologies that have been developed to improve organizational business processes, certain factors

		endemic to these technologies will therefore be missing from the evaluation tool.
Schuurman et al. (2008) using Bedell's method	Bedell's portfolio management method (1985) is reapplied here in the context of IT systems evaluation and the impact it has on organizational business processes.	It fails to evaluate effectively IT systems that execute multiple tasks or are involved in multiple business processes.
Azadeh et al (2009)	Their method measures both tangible and intangible costs and benefits as well as the risks involved in IT systems which means they use both quantitative and qualitative data in their analysis. They also incorporate multiple stakeholders in their analysis which drives their consensus and therefore validation.	This method like the previous method is ideal when it comes to choosing the best alternative from multiple IS/IT investment choices, however it does not evaluate the impact of an individual IT system used to improve a particular business process.

When it comes to IT investment evaluations, the above are a few of more than sixty methods available for an evaluation (Koi-Akrofi, 2017). Hamaker (2009) divided them into four broad categories. Financial methods which include tools like the net present value (NPV), the internal rate of return (IRR) and cost benefit ratio. Management science and operation methods like the MCDM tools (Analytical Hierarchy process (AHP), Best-Worst Method (BWM)) and Bayesian analysis of decisions. IT systems specific methods like cost benefit analysis, benefit/risk analysis and information economics. And other integrated methods like the balanced scorecard (and its derivative, the IT scorecard) and value chain analysis. Although they have the same goal of evaluating the value of an IT system to an organization, each method has its flaws and this has to be considered carefully when using them to evaluate the new technologies in IT systems.

After Azadeh et al.'s (2009) framework, no substantial framework has been proposed in order to evaluate the impact of IT systems on organizational business processes. Furthermore, many of the existing frameworks have also not been applied to the new technologies such as robotic process automation, chatbots, analytics using artificial intelligence all available to organizations looking to gain an edge over their competition. This shows the lack of focus of management literature on this space. Additionally, with these new technologies we are observing certain controversies that were not part of the previous innovations. One example is the ethical concerns that come with the use systems that require artificial intelligence. Although it is at a nascent stage, a framework that incorporates these values and that can evolve with these technologies is lacking.

4.3 CHALLENGES FACED

One of the challenges latter frameworks have tried to address is to shift focus from only the short term benefits of IT systems and try to incorporate the long term intangible benefits. The reason for the focus on short term tangible benefits most likely stems from the over reliance on quantitative measures by the literature and therefore in turn by the organizations. Due to the lack of quantitative metrics to measure intangible and long term benefits such as an organization's innovativeness or customer perceptions of the brand image, these benefits were left out.

Now however with a shift in the preferences of the customers as well as need to grow in the industry organizations need IT systems to improve productivity and their business processes. But as these investments can be expensive, risky and payback period and return on the investment may take more time than they are accustomed to, metrics to effectively measure these long term benefits must also be included in the evaluation process to get a complete picture.

Existing frameworks have not been used to evaluate these new IT systems that organizations are looking at to improve their business processes. This is why they have not been able to include the idiosyncrasies of these new systems that play a crucial role when it comes to evaluating their performance or the impact they will have on a business process.

Furthermore, the latest IT systems as well as upcoming innovations in this sector will carry with them controversies and ethical concerns due to the far reaching impact they have and what the consequences of those impacts could be. If this is not included in the evaluation process, organizations would be choosing to ignore a significant part of the impact a particular IT system would have and this could cost the organization later.

4.4 CONCLUSION

The literature study shows that there exists a lot of methods whose end goal are the same – to best evaluate the performance of a business process or the impact a particular technology would have. However, each approach has its individuals merits and flaws. Through the previous chapter, the new IT systems such as RPA and chatbots are better understood. Due to increasing popularity of these new systems that boast superior performance while remaining cost effective, it is crucial that there exists a way to evaluate these technologies for the impact they will have on a particular business process to prevent organizations from investing in the technologies that could be detrimental to their organization. As more is known about the technologies themselves and not enough about the right strategies, this study focuses more deeply on the IT systems and the effect it has on the organizational business processes. Once experiences of these technologies in use is documented, future research and literature will also bring to light a higher strategic level evaluation which will be beneficial to organizations. The next chapter discusses the proposed new framework for the evaluation of the impact IT systems will have on an organizational business process.

CHAPTER 5: PROPOSED EVALUATION FRAMEWORK

Investments in IT systems are generally focused on making an organizational change therefore a long-term view is associated with it. IT systems also boast of increasing productivity, improved efficiency and reduced turnaround times in various business processes they are applied to. So these investments are also undertaken in order to gain an edge over their competitors. As these investments are complex and expensive, organizations require tools that accurately evaluate the returns of the IT system and show that any investment made would be justifiable. The ideal evaluation tool would be an expansive and flexible framework that organizational managers can use easily and incorporates the key performance indicators of the IT system under consideration, the financial metrics, the strategic impact such an investment could have, the opinions and values held by all the stakeholders involved with the IT system, the challenges using such a system brings and the ethical perspective of making such an investment. The result of this framework should tell the organization how such an IT system would impact the business process both in the short-term as well as in the long-term.

In the sequence of steps of the DSRM methodology, we are now at the design and development stage after passing through the prior stages (Peffers et al., 2007). The proposed evaluation framework will be the IT artifact of this study. Our focus here is to improve organizational business processes using IT systems while staying aligned with the overall organizational strategy. Therefore, the design of the artifact is based off of Lee (2004), Adesola et al. (2005) and Bedell's method (Schuurman et al., 2008) while the evaluation of the IT system is adapted from the Balanced scorecard (Kaplan & Norton, 1996) and IT scorecard (Keyes, 2005).

5.1 THREE LEVELS OF THE EVALUATION FRAMEWORK

This evaluation framework aims to help organizations estimate the impact IT systems and the redesigning of business processes have on the organizational performance (Lee, 2004; Schuurman et al., 2008). Therefore it helps to ascertain the most appropriate business processes that can be improved and the IT systems that need to be implemented in order to achieve business strategies. The evaluation framework hence consists of three levels – the strategic level, the business process level and the IT systems level. The different elements of the framework are discussed below.

The Strategic level:

IT systems have a direct effect on the mechanisms by which organizations create and capture value in order to earn profits and gain market success (Drenvich & Croson, 2013). IT systems are therefore an integral part of organizational strategy. Organizational strategy gives structure to the aims of the organization and direction to selection of business units that make up the organization and the business processes that ensure the smooth functioning of the organization (Versteeg & Bouwman, 2006). An explicit organizational strategy also results in an explicit organizational structure. This is essential as it helps distribute responsibilities with the organization evenly, influences organizational behaviour with

external stakeholders and impacts the type of IT systems used by the organization (Versteeg & Bouwman, 2006). As organizations today are becoming more digital and lean heavily on information, connectivity and communication, IT enabled business processes are becoming more important (A. Bharadwaj et al., 2013). So strategy involving digital systems has become part of the overall organizational strategy. Any change in the IT systems that an organization uses therefore requires a look at the strategic level. A look at competitors use of IT systems in their business processes would also be useful at this stage. Implementing IT systems when their competitors have not used it yet is even more beneficial for the organization to gain a strategic advantage (Lee, 2004). In order to gain market share and technical competency in the long run, timing of implementing the IT system is also an important factor to consider (Lee, 2004). An organization also consists of various levels of management who are stakeholders in the business process. At the strategic level, the concerns of the top level management which include - *Are the business objectives achieved through this IT system?*; *What are the returns on investing in an IT system?*; *How are the costs for the IT systems being managed?*; *What are the risks involved and how are they managed?*; *Would the IT system improve the workplace environment? –* are addressed (Keyes, 2005).

Therefore at the strategic level, stakeholder analysis, SWOT analysis, process prioritization matrix, process performance table, root cause analysis and value chain analysis are some of the tools organizations can use to obtain the requisite information (Adesola & Baines, 2005; Lee, 2004).

The business process level:

Organizational business processes consist of a sequence of interrelated activities that convert different organizational inputs into value-added products or services as outputs (Lee, 2004). To maximise efficiency, effectiveness and productivity, business processes need to be designed in order to achieve the strategies set by the organization. A standard business process involves flow of two kinds. Physical flow which is the movement of products and services in a physical capacity and Information flow which involves the creation, transformation, dissemination and storage of information throughout the business process (Lee, 2004). Organizations invest in IT systems because these systems directly influence information flow in business processes by reducing or removing barriers in both space and time and also lower the cost of processing information (Lee, 2004).

To ensure the IT system's effectiveness, the system must be the right strategic fit for the business process (Schuurman et al., 2008). To this end, the business processes that require improvement must first be identified and analysed in order to find its vulnerabilities and inefficiencies. The business process can be mapped using BPMN and tools such as cause and effect analysis, value added analysis (Adesola & Baines, 2005) can be used to measure the performance of the business process. This is key for the next step which involves modifying or redesigning if necessary, the business process with the IT system in place to provide the necessary improvements. Performance criteria can then be set for the new business process which can later be used to compare the performance of the new business process with the old process after the evaluation is conducted (Adesola & Baines, 2005). After the IT system has been selected and modelled into the business process, it can then be evaluated for its impact on the business process.

The IT systems level:

For most organizations in the contemporary business environment, in order to stay innovative and perform competitively, agility is of crucial importance (Sambamurthy et al., 2003). When dealing with IT systems, organizations look to build more capacity and capability for IT systems, for additional business opportunities once the IT system is implemented and create knowledge assets within the organization by further developing the IT system (Pemberton & Stonehouse, 2000; Sambamurthy et al., 2003; Stewart & Mohamed, 2002). This is also the case for IT enabled business processes. Therefore when evaluating IT enabled business process, having a complete picture is more advantageous in order to make the right decisions about any investments in new IT systems. This is why an integrated approach such as the one used in the Balanced and IT scorecards is beneficial.

The scorecards allow its users to examine how individual activities impact the achievement of the overall business strategy and business unit objectives (Kaplan & Norton, 1996; Keyes, 2005). It builds in the cause-and-effect relationships, includes adequate performance drives and also links the activities to relevant financial instruments (Keyes, 2005). This also results in an effective learning process for the organization as it provides the most holistic model to study the impact of individual systems or business processes (Kaplan & Norton, 1996). These scorecards have also not been used in the context of the new IT systems discussed in this report. This is why these scorecards have been used as bases for this evaluation framework.

At the level of the IT system, the effectiveness of the IT system itself is analysed by observing how well it supports the business process (Schuurman et al., 2008). The first four dimensions that constitute this integrated approach are the customer, the business value of the IT system, the internal processes and the future readiness of the organization.

Customer: The customer's perspective focuses on the customer's response to the IT system as well as how an organization wants it to be viewed by the customer (Giannopoulos et al., 2013; Nørreklit, 2000). Based on the appropriate measures, this perspective allows one to learn if the IT system has met the goals and expectations that were intended for it (Rosemman & Wiese, 1999). This perspective also requires the organization to differentiate between the internal and external customers in order to better understand the impact the IT system has on them. Depending on the system, it could be internal users who are the customers or external partners like suppliers and contractors who use the system (Rosemman & Wiese, 1999). Customers have four main considerations about a product or service offered by a business – time, quality, performance and cost of service (Giannopoulos et al., 2013; Kaplan & Norton, 1992). Depending on the system some measures are more important than the others. Customer satisfaction, customer retention, number of customer complaints, service/product quality and image or reputation (Olson & Slater, 2002) are some of the metrics available to measure the customer's perspective.

Business value of the IT system: This dimension is comparable to the financial perspective of the Balanced scorecard. It connects the financial objectives of the organization with the financial value an IT system carries with it. The two main components of a financial evaluation are cost and revenue (Lee,

2004). The cost for IT systems can be estimated relatively accurately by using the current market rates for the IT systems or through requests for quotes and tenders from IT system vendors (Lee, 2004). Cost savings can be estimated by observing efficiency of operations and using metrics that measure reduced workforce, diminished costs for flow of information and communication and decreasing size of workspaces (Lee, 2004). Revenue that the IT system generates can be estimated using measures like return on investment (ROI) (which includes ROI, cash flow return on investment (CFROI), return on assets (ROA), and return on net assets (RONA)), return on sales and payback period (Keyes, 2005; Olson & Slater, 2002). Investing in an IT system is a considerable risk for most organizations. Therefore, by including the risks that are involved with implementing an IT system the business value perspective is considerably improved. It offers organizations with the opportunity to implement the IT system by minimizing risk in order to maximise the return on the investment (Stewart & Mohamed, 2002, 2000). There are different risks associated with implementing an IT system into an organizational business process. Organizational risk (OR) determines the degree to which implementing a new IT system depends on untested corporate skill, capabilities of the management and their experience (Stewart & Mohamed, 2002). The risks associated with the IT system itself include definitional uncertainty risk (DU), technical uncertainty risk (TU) and technology infrastructure risk (IR). DU assesses the extent to which the specifications and user requirements of the IT system are known prior to the implementation. TU assess the preparedness of the technical team of the organization to the new IT system. IR considers the amount of additional investment needed to initiate the project excluding the investment in the IT system itself (Stewart & Mohamed, 2002). Organizations can also measure their competitive advantage in the market by assessing the extent to which the IT systems create new business opportunities and facilitate organizational transformation (Stewart & Mohamed, 2002). Metrics to measure these risks are specified in table 6.

Internal processes: The internal processes perspective focuses on the processes and activities that the IT system enables directly and indirectly within the organization. To this end, the internal processes can be divided into three sub-dimensions – planning, development and operations. Planning measures the seriousness of the organization about implementing a new IT system and can be measured by the percent of resources allocated to planning and IT activities. Development measures the amount of time and resources the organization would spend on getting the IT system up and running. It can be measured by the percent of resources allocated for applications development and time spent on fixing bugs and fine-tuning new applications. Operations measures the effectiveness of the organization when using the IT system and can be measured with metrics like number of end user queries handled and average time required to handle end-user problems (Keyes, 2005). As the function of IT systems vary depending on the type of IT system being implementing, evaluators are free to choose the metrics that best suit the system.

In this perspective, the engagement of the stakeholders with the business process and the IT system is also observed (Burlton, 2014). One of the hallmarks of good stakeholder engagement is communication. Communication between the various stakeholders and between the different levels of management leads to effective implementation of projects (Cooke-Davies, 2002). Therefore, it can act as an effective indicator of the extent to which stakeholders were engaged during the implementation of the IT system

(Davis, 2016). Satisfaction is another measure that can be used to this end. When the stakeholders involved are satisfied with the IT project, there is a higher consensus among them and can therefore be a useful indicator (Davis, 2016; Keyes, 2005).

Finally, the type of business processes employed by an organization is heavily influenced by the organization structure (Armistead et al., 1999). Similarly, the type of IT system used by an organization is also influenced by the structure of the organization. Therefore, when a new IT system is introduced more often than not, it results in changes in the core attributes of an organization like the structure, culture and performance (Jackson et al., 2002; Madlock, 2018; Sabath et al., 2001). The extent to which an organization must change its structure in order to utilise the IT system properly depends on the type of IT system being introduced. Being aware of this allows an organization to choose an IT system most conducive to its structure and culture or if the introduction of the IT system requires a change in structure they can decide how and where those structural and cultural changes need to be made. All the measures above collectively allow for a comprehensive measurement of the internal business process which is the mechanism used by organizations to meet performance expectations and organizational objectives (Keyes, 2005).

Future readiness: This dimension is comparable to the innovation and learning perspective of the Balanced scorecard. IT-enabled business processes will succeed in the long run only with an adequate number of motivated and sufficiently skilled employees who are provided with timely appropriate and accurate information (Keyes, 2005). A look at the capabilities of the IT specialists in the organization gives an idea of its current accumulated technical expertise. Another measure in this area is the organization's dependence on external consultants. More often than not, new IT systems are implemented with the help of external consultants. Organizations looking to improve their technical capabilities however must reduce their dependence on these consultants and strengthen their abilities to deal with the problems that crop up on their own (Rosemman & Wiese, 1999). The usefulness of an IT system and the extent to which an organization is optimistic about its IT system is also measured by the portfolio of applications developed for the system (Keyes, 2005). The individual metrics of measurement organizations can use for this perspective is detail in table 6.

The framework so far still lacks the ability to evaluate new IT systems such as RPA, chatbots and AI analytics. Each of these new technologies (as well as IT systems yet to come) have (or will have) unique characteristics and flaws about them which have not been addressed by any of the perspectives thus far. Organizations interested in implementing these new IT systems may not be aware of all these characteristics of such technologies. Hence by accounting for them in the framework, organizations can be made aware of these distinct attributes and this can in turn influence the results of the evaluation. These new technologies also carry with them serious ethical concerns which have also not been addressed by any of the perspectives so far. Therefore, it is recommended to add two new perspectives to the framework which account for both these gaps – *the 'new technology' perspective* and *the ethics and responsibility perspective*.

The 'new technology' perspective: This perspective is to account for the unique attributes of the new IT systems that organizations may have missed out on during their initial survey of the technology landscape. When disruptive technologies emerge in the market that change the way things are normally done, organizations rush to adopt these technologies for a variety of reasons such as gaining a competitive edge, improving the company's image or increasing the organization's technical capabilities (Anagnoste, 2017). RPA, chatbots and AI are some of those disruptive technologies (Stahl et al., 2013). In the case of RPA, organizations may be aware of the obvious advantages such as increased automation, reduced costs, fewer errors etc. However there are other advantages and disadvantages that might be overlooked in the frenzy to adopt this system. One such missed out advantage is improved compliance. Violations against compliance regulations is quite detrimental for any organization but the RPA agents can be configured to meet all such standards and regulations thereby reducing a large cause of worry for organizations (Taulli, 2020). Some of the other things that organizations miss out on when dealing with RPA include considering RPA as a standalone IT system rather than the system that can interact and influence multiple processes within the organization, not selecting the right processes for automation, wanting to automate too much of a process, underestimating the requisite skills required for the implementation of the RPA system and overestimating the ROI of the IT system (Anagnoste, 2018). Similarly, chatbots and AI analytics have their individual characteristics and attributes that may be overlooked during the initial survey. Therefore, to this end depending on the IT system to be evaluated KPIs specific to the system may be chosen by the evaluators which incorporates these characteristics and include them in this perspective. The chosen KPIs must have certain characteristics in order to be well formed indicators. They must be *relevant* (to a particular purpose, vision or goal), *comparable* (have a unit of measurement), *time-bound* (correlate with a period of time or a point in time), *measurable* (reliable data must be available without bias and not too excessive time and cost) and *trustworthy* (its accuracy should instil a sense of confidence with the users) (Burlton, 2014). It is also best practice to use a suitable mix of KPI types as focusing on only one indicator can often lead to a skewed performance of the IT system (Burlton, 2014). Some of the indicators evaluators can use for the three systems discussed in this report are stated in table 6. In this way the uniqueness of these IT systems will be accounted for in this dimension and will influence the entire evaluation picture.

The ethics and responsibility perspective: The rise in popularity of emerging technologies has raised the awareness of the ethical conundrums these technologies can potentially create among the public, corporate business entities and the governmental bodies who decide policies and regulations. There are plenty of reasons why corporate organizations need to take a more active approach in this regard. Companies all over the globe are shifting perspectives from maximising shareholder value to improving and increasing societal value (Roundtable, 2019). Organizations must therefore be motivated to use their IT systems for the benefit of the society as well (Sutcliffe, 2011). They can avoid missing out on potential technological advancements and other business opportunities. The potential for unintended and irreversible consequences that could be negative are also strong drivers for organizations to maintain this perspective (Sutcliffe, 2011). The most common ethical issues associated with new IT systems include privacy, security, trust, liabilities and digital divide (inequality in the amount of information that is accessible) (Stahl et al., 2013; Yu, 2006). Responsibility is the other aspect of this

perspective and this constitutes different types. *Individual responsibility* where an employee of the organization has a *professional responsibility* to provide his service to the customer on time and of an acceptable quality. Each of these employees are part of teams where they execute specific roles and therefore have *role responsibility*. *Collective responsibility* which is seen taken by various teams inside an organization as well as by the organization as a whole to meet jointly approved goals. *Legal responsibility* where the organization has to ensure that it has complied with all existing rules and regulations such as data protection and privacy laws. *Moral responsibility* where the organization tries to ensure that it treats all its employees and customers equally and fairly. These are just some of the responsibilities organizations face every day and most of these responsibilities are interconnected and integral to each other (Stahl et al., 2013).

In order to best account for all these different aspects, the parameters offered by the responsible research and innovation model can be used (Stilgoe et al., 2013; van de Poel et al., 2017). The four parameters are anticipation, reflexivity, inclusion and responsiveness. Anticipation is the idea that an organization can anticipate the risks, benefits and the future consequences of implementing a particular IT system and therefore be ready when a particular scenario does occur. Some tools to undertake this exercise would be scenario building and foresight studies (Sutcliffe, 2011) and some metrics of measurement could include the preparedness of an organization to the consequences of breaches in information security, breaches in information privacy and to any future legal risks caused due to a particular IT system. Backcasting is also another technique that can be used where a desirable future scenario is first defined, then looking back strategies and follow up activities that lead to the desirable future are developed (Quist et al., 2006). Being aware of the legal implications of emerging and disruptive IT systems also constitutes as a form of anticipation (Stahl et al., 2013). Reflexivity at the organizational level means looking at their own inner activities, goals, obligations and assumptions, being cognizant of the extent of available knowledge and being aware of the consequences of implementing a particular IT system (Stilgoe et al., 2013). It is important to realise that ethics of emerging IT systems are not resolute and inflexible constructs. Ethical issues are dependent on context and need to be interpreted according to the situation at hand. Providing this flexibility is beneficial not only to the stakeholders involved in the discussion on the ethical issues but also to review these issues on a regular basis and adapt them based on the values and perceptions of the stakeholders (Stahl et al., 2013). By looking at the IT system through the ethics and responsibility perspective, the organization will be taking a step in this direction. The reflection within the evaluation acts as a learning process and the findings of the reflection can be adapted during the implementation of the IT system (Goujon & Flick, 2010). Inclusion and inclusivity looks at the organization's capability to involve relevant stakeholders in dialogues about IT systems and if this is used as a learning process and useful findings are incorporated if necessary (van de Poel et al., 2017). When undergoing stakeholder analyses and engagements in a corporate environment, organizations must not only include the usual suspects such as customers, different levels of management, the IT teams, human resource department etc. but also those who may not usually be involved. Depending on the type of IT system being implemented, gender implications, ramifications on the disabled, implications on the society as a whole and any influence on local or national government can also be looked at (Stahl et al., 2013). Responsiveness looks at an organization's capacity to adjust shape or direction in response to changing stakeholder values and altering

circumstances (Stilgoe et al., 2013). To better score higher in this perspective, organizations must shape their internal systems and processes to be as responsive as possible. To this end, organizations can use this framework as a tool to reflect and respond to the findings of the evaluation.

Emerging and disruptive IT systems require a broader outlook by organizations interested in implementing them (Baskerville, 2011; Stahl, 2012). By introducing them into their business processes, organizations have the unique opportunity to help shape how they can be used in the corporate landscape. By increasing their technical capabilities and expertise with these IT systems and making them accessible to all the relevant stakeholders, organizations can achieve their own strategic goals, improve the lives of their customers and provide net social benefit by making the best use of these IT systems (Stahl, 2012; Sutcliffe, 2011).

Figure 8: The proposed evaluation framework

Strategic	
Understand the needs and goals of the business	• Develop vision and strategic objectives • Evaluate current practices • Establish measurable targets • Look at organizational structure • Assess problem through root cause analysis

Business process	
Understand the business process	• Identify and define the business process architecture • Collect the as is business process information • Model the business process • Measure and analyze the existing process performance
Conceptualization and redesign of the innovation in the business process	• Identify performance criteria for redesigned process • Model and validate new to be process • Identify IS/IT requirements • Estimate performance of new process

IT systems		
Impact evaluation		
Customer • User orientation	**Business Value** • Cost control • Business value of an IT project • Risk management	**Internal Process** • Planning • Development • Operations
Future readiness • IT specialist capabilities • Satisfaction of IT staff • Applications portfolio • Research into emerging technologies	**'New technology'** • RPA • Chatbots • AI analytics	**Ethics and Responsibility** • Anticipation • Reflexivity • Inclusion • Responsiveness

Table 6: Metrics for measuring individual components of the evaluation framework

IT system Impact evaluation

Perspective	Metrics for measurement
Customer (Keyes, 2005, p. 99) User orientation	• *Customer satisfaction* • *Net Promoter score*
Business value (Keyes, 2005, p. 99) Cost control	• *Percent over/under budget* • *Allocation to different budget items* • *IT budget as a percent of revenue* • *IT expenses per volume*
Business value of an IT project	• *Return on Investment* • *Payback period*
Risk management (Stewart & Mohamed, 2002, 2000)	• *IT strategy risk* • *Strategy Alignment risk* • *Organizational risk (OR)* • *Definitional uncertainty risk (DU)* • *Technical uncertainty risk (TU)*

	• *Technology infrastructure risk (IR)*
Internal Processes (Keyes, 2005, p. 99)	
Planning	• *Percent resources allocated to planning and review of IT activities*
Development	• *Percent resources allocated to applications development* • *Time spent on fixing bugs and fine-tuning new application*
Operations	• *Number of end user queries handled* • *Average time required to handle end-user problem*
Future readiness/Long-term view (Keyes, 2005, p. 100)	
IT specialist capabilities	• *IT training and development budget as a percent of overall IT budget* • *Expertise with specific technologies* • *Expertise with emerging technologies* • *Age distribution of IT staff*
Satisfaction of IT staff	• *Turnover/retention of IT staff* • *Productivity of IT employees*
Applications portfolio	• *Age distribution of applications* • *Platform distribution* • *Technical performance of applications portfolio* • *User satisfaction of applications portfolio*
Research into emerging technologies	• *IT research budget as a percentage of IT budget* • *Perceived satisfaction of top management with reporting on how specific emerging technologies may or may not be applicable to the company*
	• *Open/Closed structure*

Organizational structure	• *Mechanistic/Organic structure* • *Functional/Divisional/Matrix structure*
'New Technology'	
Robotic process automation (RPA)	• *Employee productivity enhancement* • *Job satisfaction* • *Process acceleration* • *Cost savings* • *Number of false positives (Type 1 errors)* • *Number of false negatives (Type 2 errors)*
Chatbots	• *Activity volume* • *Retention rate* • *Bounce rate* • *Customer session volume* • *Response volume* • *Usage distribution by hour* • *Questions per conversation* • *Interaction rate* • *Goal completion rate* • *Non-response rate* • *Frequently asked questions* • *Comprehension level* • *Self-service rate* • *User feedback*
AI analytics	• *Classification speed* • *Data security* • *Quality of analytics* • *Activity volume* • *Number of errors in incident classification* • *Number of errors in assigning severity levels* • *Number of false positives (Type 1 errors)* • *Number of false negatives (Type 2 errors)*
Ethics and Responsibility	
Anticipation	• *Consequences of breaches in information security* • *Consequences of breaches in information privacy* • *Anticipation of legal risks involved with using these technologies*

Inclusiveness	• *Implications on replacing human labour with IT systems*
Reflexivity	• *Transparency of information and decision making to the organization* • *Transparency of information and decision making to customers* • *Accounting for the biases in the decisions made by autonomous systems* • *Impact of false positives (Type 1 errors) and false negatives (Type 2 errors)*
Responsiveness	• *Creation of backup and failsafe plans to deal with errors and unintended consequences*

5.2 CONCLUSION

The goal of the framework is to provide organizations with an integrated tool that is flexible to accommodate new technologies that have not been discussed here and can crop up in the future. It also aims to solve for the challenges of earlier frameworks such as those that focused more on the short term tangible benefits rather than taking the long-term view when it comes to IT investments, using industry standard KPIs as metrics of measurements for individual dimensions so as to not arouse confusion during the evaluation process and include the benefits of the IT systems they aim to provide; and also bring into focus the ethical challenges implementing these new technologies in IT may carry with them which was not a focus in earlier frameworks. By giving the organization a look at its strategic goals and alignment, the business process and the gaps for improvement, a redesigned business process with the new IT system and observing the IT system from the perspectives of the customers, its business value, the internal processes, the future readiness of the organization and the ethical context, the organization can get a holistic perspective on the impact of implementing a particular IT system can have on the organization's productivity and profitability and therefore make better decisions.

CHAPTER 6: TESTING THE EVALUATION FRAMEWORK IN PRACTICE

In the DSRM methodology after the design and development phase is the demonstration and evaluation phases (Peffers et al., 2007). Now that the proposed evaluation framework has been sufficiently described in the previous chapters, it will now be demonstrated on the organizational business process that needs improvement. For this purpose the incident management process has been chosen. The framework will then be evaluated for its usefulness and the utility it will provide organizations looking to evaluate the IT systems they wish to introduce into their business processes.

6.1 UNDERSTANDING THE INCIDENT MANAGEMENT PROCESS

Most enterprises that are service oriented have in place an incident management process. An incident refers to any failure or error in any part of the service or product which a customer might face and report. The main goal of the incident management process is to resolve the incidents customers face during their use of the organization's IT services efficiently and effectively (Bartolini et al., 2010; Gupta et al., 2008). Organizations that aim to do well in the market want to ensure their customers are not confronted with any such issues. When a substantial part of organizational resources are set aside to ensure this, the timely resolution of any incidents that crop up is crucial. When faced with an incident, customers usually come in contact with the first responders or level 0 personnel (usually the help desk) at the business end, who try to resolve the issue as best as they can by providing any relevant information or perfunctory solutions to their problems (Bartolini et al., 2010; Kidd & Hertvik, 2019). In case they are unable to resolve the issue, based on the selected keywords from the issue in question an incident ticket is created and then referred to employees (either level 1 or level 2 employees) who are subject matter experts (SMEs) with respect to that incident who then proceed to resolve the incident (Bartolini et al., 2010; Gupta et al., 2008). The incident management process has chiefly remained a manual process while also remaining prone to inaccuracies and increased consumption of time.

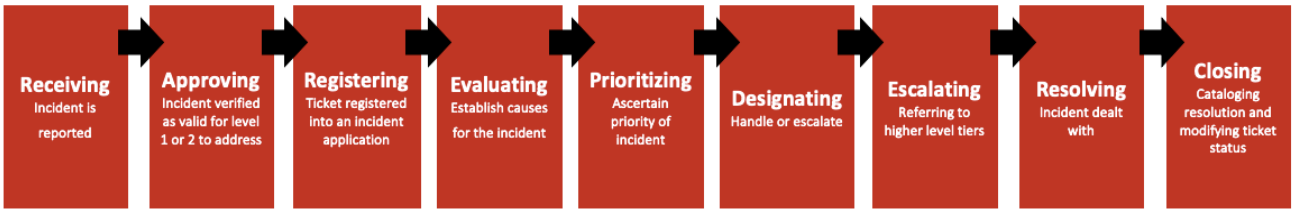

Figure 9: : Incident management process

The above figure encapsulates the general steps in an incident management process. Different organizations follow different forms of the incident management process, but these are the steps that are most common among them (Gibson, 2014).

Receiving

Customers report their issues through various channels such as telephone, email, a web-based platform or even in person. They come in contact with the level 0 personnel here. When customers have difficulty in expressing exactly the issue they are facing, it is the responsibility of the level 0 employees to get the relevant information about the incident (Bartolini et al., 2010; Kidd & Hertvik, 2019). They also help in answering any queries customers may have about the service or product and can often also provide perfunctory solutions to many of the incidents that customers report (Gibson, 2014).

Approving

In the next phase, level 0 personnel go over the queries and request and deem its validity as an incident and approve its push to the next level for further scrutiny.

Registering

Once the incident has been validated, the level 0 personnel must log in the details of the customer and the incident that would be essential for the resolving of the incident by the respective technicians. The registered incident is often referred to as a ticket. The incident ticket contains relevant information regarding the customer and the problem being reported (Gupta et al., 2008). The information about the incident is registered in the organization database reserved for such incidents and this allows for the smooth tracking of the incident throughout its lifetime (Gibson, 2014).

Evaluating

Once a ticket is registered, it is taken up by respective technicians (level 1 personnel) who evaluate the incident and establish the symptoms and the causes of the incident (Bartolini et al., 2010). Often they are in contact with the customer to glean further information about the incident through an effective system of questioning. This gives them a clear understanding of what they are working with and how they should go about resolving it (Gibson, 2014; Kidd & Hertvik, 2019).

Prioritizing

Next step is to prioritise the severity of the incident. These priorities to assign severity levels to incident are often stated by the organization and are service specific. The severity levels often assigned to incidents are: low, medium, high and urgent. Urgently severe and high severity incidents are assigned to those that affect a considerable number of customers and it is critical for the organization that the incident be resolved within a day or two as it affects their core processes. Medium severity incidents are those that affect perhaps a single user using a critical service or a system/network that continues to work due to redundant measures but the organization must ensure it is resolved in the meantime. For customers' benefit organizations usually refuse to assign incidents a low severity if they can help it, but in case of a pileup of incidents needing to be resolved then the incidents that affect the least number of people and customers can wait for more than a week for it to be resolved it is usually assigned the a low severity level (Gibson, 2014; Wright, 2020).

Designating and Escalating

Usually the level 1 technician who has undertaken the ticket, follows through until that incident is resolved and the customer is notified. However, if the incident requires expertise or clearances that the technician currently does not possess, they escalate it to level 2 personnel (engineers with specific expertise or departmental managers) who then resolves the incident (Bartolini et al., 2010; Kidd & Hertvik, 2019; Wright, 2020).

Resolving

As soon as the ticket is addressed, the incident is treated as to have been resolved by the organization. Once an incident has been resolved, the level 1 or level 2 personnel then notify the customer about the status of their issue and its solution (Bartolini et al., 2010; Gibson, 2014; Wright, 2020).

Closing

Once the incident has been resolved, the personnel responsible close the incident report in the organization database. Closed incidents are stored in the database so that they may be consulted at a later stage in case similar incidents crop up. Depending on the severity levels of incidents, root cause analyses may be conducted whose results are also later stored in the database for later consultation (Gibson, 2014; Wright, 2020).

To judge the efficiency and effectiveness of an incident management process, organizations use a few common key performance indicators that they can use for this purpose (Alaska.edu, n.d.; Bartolini et al., 2010).

- Number of new incidents: This measure indicates the amount of work that is demanded of the incident management team.
- Number of resolved incidents: If the number of resolved incidents is equal to or more than the number of new incidents received, it signifies a healthy incident management process.
- Amount of backlog: The incidents in the backlog are the incidents that remain once you subtract the number of resolved incidents from the number of new incidents. A steadily increasing backlog could signify issues in the incident management process which the organization may have to look into.
- Percentage of incidents reopened: This is the percentage of incidents that were reported as resolved but had to be reopened as they did not meet the customer's requirements and had to re-resolved.
- Number of incidents repeated: As it suggests, this refers to the number of similar incidents that get reported and have to be resolved. Obviously, organizations strive to ensure this measure does not increase.
- Time taken to reply: This refers to the time taken for a customer to hear a response from the organization through any medium (online or offline methods). A quicker response time implies a more satisfied customer.
- Time till first resolution: This measures the time whence the incident was first reported until the resolution was achieved.

- Time till final resolution: When customers are notified of the resolutions, it may happen that an incident had actually been concluded too soon. In such cases when incidents have to be reopened, technicians are notified, then ensure that the incident has been positively solved and then reclose the incident after notifying the customer. Large differences between final resolution time and time until first resolution can signify lapses in the management process.
- End-user satisfaction: The end goal being the satisfaction of the customer, this is an essential matric that can be derived through questionnaires and customer surveys conducted after the resolution of their incidents.
- Performance of technician involved: Individual technicians performance can also be evaluated from the number of incidents they resolve and those they need to reopen, the time taken to resolve incidents and customer feedback about their service. Additional training can be provided for the personnel at various levels to improve their performance in case it is necessary.

6.2 COMMON CHALLENGES FACED IN THE INCIDENT MANAGEMENT PROCESS

When studying the incident management process as a business process from the perspective of Exact as well as other service based organizations, we come across a few common challenges that can be improved upon with the introduction of some form of automation and IT systems. The following although not an exhaustive list, are some of the challenges this business process faces (Lahtela & Jäntti, 2010; Wright, 2020):

- Incidents that are lost or left open: Incidents may be left open for various reasons such as they may be prioritised lower than other more urgent incidents. In such cases, other than a simple message that conveys that the organization is working on a solution, more concrete details are not conveyed to the customer. This keeps them at a loss wondering when the incident will get resolved.
- Prioritization of incidents: Although incidents are prioritised based on a priority matrix specified by the organization, personnel of levels 2 or higher may sometimes not agree with the priority levels assigned to a particular incident especially in cases of escalation of severity levels.
- Lack of clarity on the rules for incident escalation: Sometimes the rules specified by the organization for the incidents that require their severity levels to be escalated are not clear. This can result in confusion and slow down the flow of the incident management process.
- Lack of transparency between personnel of different levels as well as between the customer and the organization: When there isn't proper flow of communication between the various levels of personnel responsible for the incident management process, understandably this can cause problems for the resolution of incidents. Additionally, a lack of information sharing between personnel of levels 2 and higher and the customer can also be visible often.
- Lack of understanding of the resolution: A feeling of unease as well as dissatisfaction can prevail when the resolutions reached are reported unclearly or with too much emphasis on the technicalities of the problem when it is not needed, thereby reducing the quality of the report.

- The rejection of incidents: There are often multiple instances when the incidents reported by the customers are not in fact incidents and therefore are rejected due to invalidity. Valuable company resources gets consumed in ensuring the validity of incidents and a higher rejection rate implies a fault in the process.
- Time required for solution – not specified: Following the point of lack of information sharing with the customers, the time required to resolve the incident is also not conveyed to the customer.
- Lack of standardised problem descriptions: The description of the incidents reported are not standardised at a broader level which can lead to confusion, difficulty and loss of time for those who wish to find past incidents either for information or clarification. A more organised description categories with the details mentioned later would be much more beneficial.

6.3 MAPPING THE INCIDENT MANAGEMENT PROCESS

To evaluate the impact of specific IT systems, the business process in question must first be mapped. For this case, we have chosen the incident management process.

The incident management process is a typical business process seen very often in the software industry. It involves the process of establishing an incident (ticket) or a problem by an end user to the organization and the subsequent process that leads to its resolution. A typical incident management business process has been mapped below.

For the testing of the evaluation framework, two new scenarios have been created in which a new IT system has been implemented and its impact will be evaluated. This can be compared to the original business process and in the end a decision can be taken on the which technology that can be chosen in case an investment is to be made.

The first scenario is the use of an automated RPA system as a level 1 support in the incident management process. When a customer approaches with an incident, they are first directed to fill in a questionnaire which will provide the preliminary data on the customer itself and the nature and type of the incident which will then be automatically stored in the database of the organization for quick and easy access to the person in charge. This can eliminate the need to have the first direct initial contact with the customer as well as the manual input of data and free the concerned to attend to more important tasks.

The second scenario is the use of chatbots as level 1 support in the incident management process. Once information has been stored in the database, it is compared to search for similar incidents that have been resolved in the past. In case such an incident is found, the needful is immediately conveyed to the customer in the form of automated replies. If not, then a new incident report is filed and the original process is then followed.

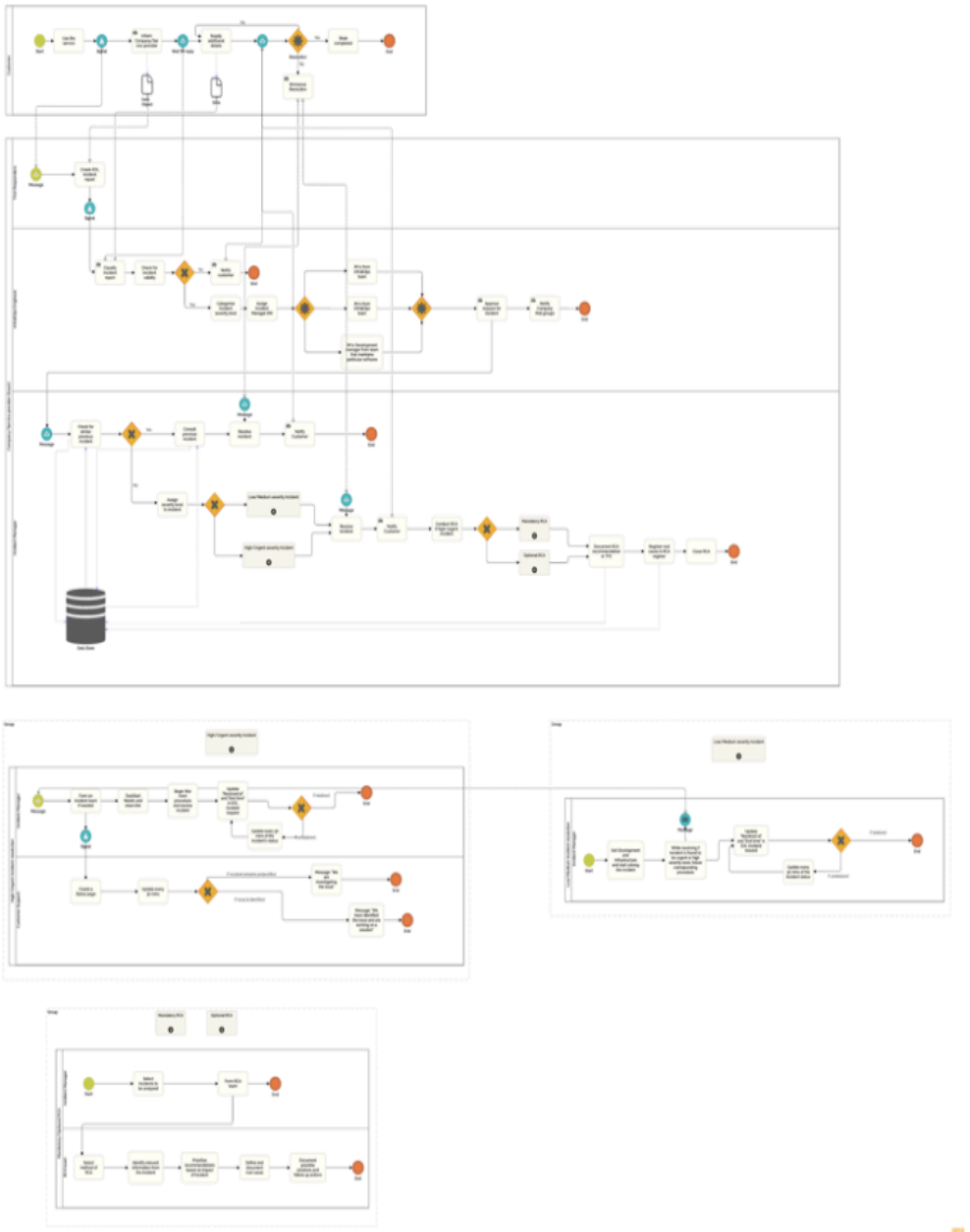

Figure 10: The original incident management process mapped

6.4 APPLYING THE EVALUATION FRAMEWORK ON THE INCIDENT MANAGEMENT PROCESS

Now due to the global coronavirus pandemic situation this demonstration will lack sufficient empirical information to truly show the evaluation in an organizational setting. The findings of this demonstration and evaluation are instead supported by past research and empirical studies done on organizations that have either implemented the RPA or chatbot systems into their internal business processes. These are therefore used to lend sufficient credibility to this study.

Let us now observe the scenario in which the RPA system is introduced to the incident management process. The BPMN model of this scenario is available in Appendix A.

At the strategic level:

As the incident management process is an IT enabled business process common in the service sector, the organization we shall assume here to of the same nature for example a company such as Exact. It can also safely be assumed that this organization also experiences the common corporate challenges such as reducing costs and increasing revenues in an increasingly competitive market (Lacity et al., 2015). The way forward for this organization would be to make substantial reductions in costs and increased savings. It could look at reducing its business operational costs which lead to reduced consumer prices on the product and service offerings provided (Lacity et al., 2015). A reduction in costs therefore becomes one of the strategic objectives for the organization. A look at the competitive landscape will let the organization know how often and how successfully the RPA system has been implemented among their competitors (Lee, 2004). This will also provide them an edge over those businesses that have not yet implemented the RPA system. Other organizational level strategic objectives can include a reduction of time full time employees (FTE) spend in the business process, improving the cycle and turnaround times of the business process and lowering the number of errors made in the resolution of incidents (Taulli, 2020). In order to prevent a wasteful investment, the organization must also ensure that the RPA investment plan aligns with the organization's own digital transformation goals (Taulli, 2020). Once the strategic objectives have been delineated and answered, next we move to the business process.

At the business process level:

One of the main reasons for RPA project failure is selecting the wrong process to be automated and not achieving the proper ROI on it (Mallik, 2020). This is why at this level the selected business process is first mapped and analysed to find the challenges present within the business process and to check its suitability for automation. This has been achieved in Chapter 6 where the incident management process has been thoroughly described, mapped and its most common challenges detailed. Next the RPA system is introduced into the incident management process, mapped and studied to see the kind of changes the IT system will bring about into the business process. In most business processes, there are tasks that are laborious, repetitive and can be characterised and codified based on a set of logical principles (Uskenbayeva et al., 2019). Such tasks are ideal for automation by RPA. In the incident management process the tasks that can be automated by RPA include customer interaction, email processing and management, database and file management which include synchronising, deleting and emptying folders and files, upload and back up, unlocking and resetting passwords, file transfer protocol (FTP) download, data migration, data validation, batch processing (programs that require minimum human interaction and are used regularly) and compliance reporting (Anagnoste, 2017; Lacity et al., 2015; Taulli, 2020).

At the IT system level:

Like the Balanced and IT scorecards, the proposed evaluation framework views the IT system from multiple dimensions while also displaying the cause-and-effect relationships between the multiple factors within these dimensions (Kaplan & Norton, 1996; Kasiri et al., 2012; Keyes, 2005). The contribution of the new framework is the addition of two new dimensions – the 'new technology' perspective and the ethics and responsibility perspective as well as applying the framework to the context of new technologies such as RPA and chatbots. Rau and Bye's framework (2003) was one of the first to use the approach of using multiple dimensions to evaluate IT systems. The dimensions included expense containment, customer advantage and process improvement (Rau & Bye, 2003). This was followed by Chou (2006) and Azadeh (2009) who added other dimensions to the evaluation process. However, these frameworks neither included the new dimensions suggested by this study nor were they applied in the context of these new and disruptive IT systems. Furthermore, the Balanced and IT scorecards ignore threats due to competitors and developments in new technologies making them static and not dynamic enough to adapt to changing circumstances (Giannopoulos et al., 2013). This has been remedied in this framework. Knowledge about competitors and their use of IT systems is made aware at the strategic level and the added 'new technology' perspective allows organizations to be more agile and adaptable to developments in the technological landscape.

After the business process level, the IT system is next evaluated from the five perspectives of the proposed evaluation framework in order to study the impact the system has on the business process.

Customer: Organizations interested in keeping humans as the first point of contact between the customers and organization can maintain their current level 0 (help desk) employees and use RPA on the back end (Lacity et al., 2015). However, if a human point of contact is unnecessary, RPA can be used to automate the customer interaction task (Anagnoste, 2017; Taulli, 2020). RPA can be used to accelerate the logging of customer reported incidents which allows level 1 and 2 employees to spend more time resolving incidents (Kidd & Hertvik, 2019; Lacity et al., 2015). RPA can also solve the problem of keeping customers more informed about the status of their incidents by issuing them notifications on the status of the service more frequently (Lacity et al., 2015; Lahtela & Jäntti, 2010). Therefore, from the perspective of the customer RPA is able to provide improved service.

Business value: Depending on the business process, when RPA systems are implemented successfully business operating costs on average reduce by 200% as compared to the original business process as well as an average reduction in run time by 76 % can be observed (Diepeveen et al., 2016; Lacity et al., 2015; Taulli, 2020). The cost estimates of RPA include costs for licensing the software, hardware costs, service costs and RPA staff costs (Lacity et al., 2015). The financial benefits included (but not restricted to) avoidance, redeployment and savings on FTEs. Work done by RPA allows the organization to reduce employing, recruiting or moving internal staff. It also releases existing employees to use their time to do other work. RPA also has the ability to work faster and longer hours than regular employees all while committing fewer errors and mistakes (Lacity et al., 2015). RPA has successfully been implemented in sectors such as banking where the compliance requirements and operational risks are extremely high (BCBS, 2011; Romao et al., 2019) . In such sectors, internal process failures, unpredictable behaviours and external developments, vulnerabilities in their technical infrastructures and lack of controls in their application systems can translate into substantial losses (Romao et al.,

2019). Therefore when RPA has succeeded there, it will also prove to be useful in sectors with less operational risks. Additional to its contribution to accelerate time to value, reduced human error and increased throughput, RPA also provides expanded value by being easily integrable with the broader digital transformation goals (like decision automation, data capturing projects) that an organization might have (Romao et al., 2019; Taulli, 2020).

Internal processes: Internally RPA's automation allows the redeployment of resources and employees to other activities. Employee satisfaction improves as they have fewer repetitive tasks and can spend their time on more challenging activities (Lacity et al., 2015). With level 1 and level 2 employees having more time to resolve incidents and due to the increased number of incidents being processed due to automation, RPA also increases the speed (reduces turnaround time) of the incident management process (Kidd & Hertvik, 2019; Lacity et al., 2015). RPA also takes considerably less time to be introduced, configured and integrated with the existing IT infrastructure as compared to training a new FTE recruit (Anagnoste, 2017).

Future readiness: The indicators for future readiness of in IT enabled business process is the available technical capabilities within the organization which also allows the organization to remain agile and adaptable to changing circumstances in the IT environment. A major cause for the failure of RPA projects is the underestimation by the organization regarding the skills required to implement and run an RPA system (Taulli, 2020). The implementation is therefore advised to be done through external consultants. The organization and its teams might be too close to the process to see the flaws, while a consultant with a deeper understanding of the technology can often provide insight into some missed opportunities (Taulli, 2020). Consultants can also assist the organization in selecting the team which will be responsible for the RPA in the future. An agile RPA team typically consists of a few key job roles. During the implementation phase, a champion or change maker usually found in the upper echelons of management to gather momentum and interest in the RPA project. RPA service support who is the first line of support for the project. RPA infrastructure engineer who aids with the installation and monitoring of servers and with the architecture of the RPA system as well (Taulli, 2020). Some other roles likely to remain with the organization after the implementation include business analyst who has a deep understanding and experience of RPA systems and can often find new uses for the system which were heretofore unknown; developer who designs, configures and develops the RPA system; and an RPA supervisor who manages the everyday workings of the RPA system (Taulli, 2020). Doing this allows the organization to stay agile and ready for the future.

The 'new technology' perspective: This newly added perspective offers the organization a deeper look at the characteristics of the IT system. KPIs that are unique to the IT system can then be selected to accurately measure these characteristics. In the case of RPA some of these unique attributes are described here. The impact of small improvements that is the RPA saving an employee 10 – 20 seconds on a task may be a small improvement but scaling it up to hundreds of employees all across a global organization will have significant impact on the operational costs (Taulli, 2020). Unlike the other infrastructure IT systems such as CRM and ERP, RPA sits atop existing infrastructure, therefore resulting in a relative ease of implementation (Taulli, 2020). As mentioned earlier RPA allows organization to remain more compliant to government regulations. The quality of data being processed

through the business process is high due to fewer errors being committed by the RPA system. Finally, the RPA system is highly scalable and suitable for both small and medium businesses and large global corporations (Taulli, 2020). There exists some limitations of RPA as well. Cost of ownership can be underestimated where depending on the business process, the type of RPA system is used. But there are also additional costs such as training the software agent and monitoring costs once the system has been implemented. Although RPA is highly scalable, when RPA is used across the entire organization managing multiple RPA agents can be highly difficult. It can also be more prone to security breaches putting the organization's proprietary data at risk. To overcome this, the organization must have a strong and capable IT team that works in tandem with the RPA team. The biggest limit of an RPA system would be its ability to automate only routine and repetitive tasks (Taulli, 2020). Therefore there is still scope for the technology to develop and grow.

The ethics and responsibility perspective: Depending on the type of IT system, the ethics and responsibility perspectives vary. One of the major concerns of implementing RPA is the loss of human jobs within the organization. However, RPA does not result in internal layoffs as seen in organizations that have already successfully implemented the RPA system. This means that the employees jobs are not threatened and they are required to do fewer repetitive jobs (Lacity et al., 2015). The implementation of RPA and inclusion of stakeholders in the process therefore results in higher employee job satisfaction and reduced turnover. A major cause of failure of RPA projects is poor security and legal planning. RPA lacks decision making abilities and therefore requires human support for access control. Therefore application credentials security, maintenance of audit logs and verification of software legal agreements must be ensured prior to the implementation of the system itself which requires proper planning and will result as part of anticipation (Mallik, 2020; Stilgoe et al., 2013). Employing this framework and adopting the resulting findings into the IT enabled business process is also part of reflection and responsiveness by the organization.

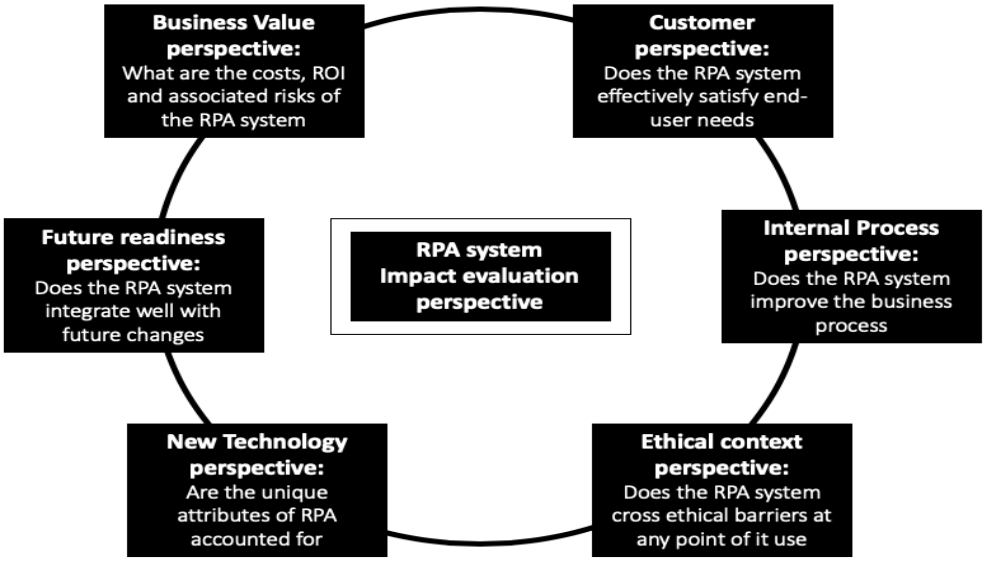

Figure 11: Perspectives of the RPA system from the five dimensions

Let us now observe the scenario in which the chatbot system is introduced to the incident management process. The BPMN model of this scenario is available in Appendix B.

At the Strategic level:

At this level, similar aspirations and strategic objectives exist for an organization to implement chatbots as the earlier scenario of implementing the RPA system.

At the Business process level:

In this case the Chatbot has been introduced on top of the RPA system. The RPA system collects the required information mainly through questionnaires and forms and interacts with the customers through standard automated email responses and is not sensitive to individual queries and nuances of the various customers. The chatbot is an AI system that mainly aims to imitate human interaction and responses (Radziwill & Benton, 2017). So the goal of implementing a chatbot is mainly to improve the interaction between the customers and the organization and give the customers an overall better experience when having to report incidents. However, existing RPA systems offer efficiencies of over 40 % depending on the business process it is being introduced into, while chatbots as they are still being developed are not as efficient (Anagnoste, 2018). Additionally, while RPA offers to automate over 60% of an organization's process activities, chatbots can currently only automate up to 15% of the processes (Anagnoste, 2018). When the two technologies are combined they offer superior performances and automation capabilities as compared to implementing them individually.

At the IT systems level:

Customer: The customer experience is improved even as compared to the RPA system as they are now able to interact with the chatbots using natural language. Chatbots offer a new communication channel and increases engagement with both internal and external customers (Anagnoste, 2018).

Business value: The costs incurred on such a system on top of the RPA system costs would include the additional cost of licensing the software for the chatbot, the expense of training the system (with the test cases specific to the incident management process), and the consultation costs for the chatbot system. The ROI and payback period calculations similarly must include the chatbot aside from the RPA system. As chatbots are still being developed to their full potential and still have certain limitations with them, chatbots carry considerable risk as compared to the already sufficiently established RPA systems.

Internal process: Aside from the benefits provided by the RPA system, chatbots offer to further reduce employee workload by taking over the customer interaction tasks. This is also advantageous to those organization that wish to maintain a human point of first contact between the customers and the organization (Lacity et al., 2015). Chatbots interact with the customers as a normal human would and is available to work 24 hours a day unlike a FTE. To further evaluate the performance improvement due to a chatbot, indicators are available to measure the performance of chatbots and the quality of conversations conducted on them. This has been detailed in Chapter 5.

Future readiness: Largely this perspective remains the same as the earlier case of the RPA system. Additionally, implementing the chatbot in the incident management process will allow an organization to study its usefulness. If it proves successful, chatbots can then be expanded into the larger customer service business process for the entire organization.

The 'new technology' perspective: Aside from the previously discussed advantages of chatbots, it also provides a layer of intelligence over the RPA system. Although RPA is an impactful system, it depends on structured data, codified rules and repetitive events. However adding on chatbots and AI functionality allows the complete system to also handle unstructured data and therefore be more dynamic (Broek, 2019). As it runs on AI it also has the additional advantage of learning from its experiences. Therefore the longer the system is used, the better its performance becomes. This combined system can also be expanded into an IT system that can derive insights from unstructured data and convey structured data to the RPA system consequently delivering the information to the stakeholders (Broek, 2019).

The ethics and responsibility perspective: Additional to the concerns raised by the RPA system, chatbots also raises the concern of biases and stereotypes in the conversations it has with customers and how it impacts overall consumer perception and satisfaction (McDonnell & Baxter, 2019). The use of anthropomorphic agents can cause projections of human attributes on the system. These biases and preconceptions such as those against gender stereotypes can cause customers to evaluate the success of the chatbot system based on the emotional connection made with the system rather than the system's actual performance (McDonnell & Baxter, 2019). The ethical question remains if customers respond positively to a particular stereotype or bias, is it right for the organization to perpetuate the bias and stereotype (McDonnell & Baxter, 2019).

For an organization that is already IT based and in the service sector, the RPA system is a low cost system that can solve most of the challenges found in the incident management process. Most common problem of not communicating with the customers about the details of the incidents, its state of resolution and the estimated time taken to resolve the incidents can all be automated. With a system that consistently alerts the engineers to provide estimates of the incidents at regular intervals and conveying them through automated notifications to the customers, end users will constantly be in the loop about the status of their incidents thereby keeping them satisfied. Furthermore, a systematic database with all the information available under standardised incident descriptions which can be created with the RPA system will be beneficial for not only the RPA system when it needs to search the database for similar previous incidents but also employees looking for information about past incidents. The RPA system can also easily assign incidents to the incident managers or level 1/2 personnel who are available to resolve the incident. RPA does not mean that the entire process needs to be automated. Certain aspects such as the actual resolution of unresolved incidents and the assignment of severity levels are still left to the humans as errors made in assigning the severity levels or resolution of incidents can be extremely detrimental to the organization and will not do the consumer any good either. The metrics of measurement endemic to each dimension tell us what the individual perspectives of the RPA are from which the overall conclusion is that it is an easy to implement low cost software

system that can improve productivity of the business process and thereby align very well with the organizational goals for digital transformation and overall cost reductions.

Now comparing this to the second scenario of the chatbot system on top of the RPA, chatbots provide an additional improved interactive experience for an organization's customers. Although chatbots are a useful IT system, there is still the issue of it only being able to automate a quarter of the tasks that RPA can undertake and the additional security and ethical risks organizations have to contend with, with the chatbots and not with the RPA system.

CHAPTER 7: CONCLUSIONS, LIMITATIONS AND FUTURE RECOMMENDATIONS

7.1 CONCLUSIONS

Automation and increased productivity have been part of organizational strategy for the past few decades for most businesses. The turn of the decade then saw the development of new technologies in IT systems that aim to improve productivity of business processes, customer experience, drastically be more efficient all while being cost effective. As the innovations are being refined to suit the consumer market, organizations are looking to use these technologies to improve their business processes to beat their competitors and gain market share. However, these IT systems can be risky investments because when they are applied to situations they are not compatible with, these systems will cause more harm than good. A framework to evaluate the impact these systems have on the business process is essential for businesses looking to innovate and invest in IT systems. To this end, there lacked an evaluation framework for these new IT systems, so this study aims to provide that evaluation framework by answering the proposed research questions.

As explained in the study, business strategy dictates the overall direction taken by an organization to traverse the market. This has a large impact on the type of investments an organization chooses to make. Therefore, aligning with the overall strategy and business interests is crucial for any successful investment especially when the organizational business process is involved. This is because the business processes of an organization are the manifestations of the organizational strategy and is what drives an organization. So this study has taken direction that earlier frameworks proposed by Lee (2004), Adesola (2005) and Schuurman's Bedell method (2008) have taken (Adesola & Baines, 2005; Lee, 2004; Schuurman et al., 2008). The study has approached the IT system evaluation by first studying the organizational strategy, followed by a thorough analysis of the business process to see if it is the right fit for the new IT system and then finally the IT system itself through multiple perspectives.

The balanced scorecard and IT scorecards are both frameworks that use multiple dimensions to evaluate performance measures and show cause and effect relationships between the multiple dimensions (Kaplan & Norton, 1996; Keyes, 2005). This has been another inspiration for the IT system evaluation framework proposed in this study. However, the earlier frameworks are not compatible and have not heretofore been used to evaluate new technologies like RPA, chatbots and AI analytics. To solve this problem, this study has added two new perspectives – the 'new technology' perspective where KPIs unique to these technologies are chosen to better represent their distinct attributes and the ethics and responsibility perspective that makes an organization aware of any ethical challenges that may arise with using a particular IT system. This also makes it dynamic and adaptable enough to evaluate IT systems like RPA and chatbots as well as those technologies that are yet to be developed.

7.2 DISCUSSION

The aim of this study was to answer the question of how to usefully evaluate the impact of IT systems on organizational business processes. In chapter 1 this question as well as five sub questions were asked to come to the final conclusion.

1. *What are the advantages and the disadvantages of the IT system to be introduced into the business process?*

In chapter 3 each new IT system is described in detail and the individual advantages and disadvantages are observed. This gives the reader an idea of the potential of this individual IT systems in an organizational context.

2. *Notwithstanding the challenges the system carries, will the IT system improve the business process?*

From the findings described in chapter 3, chapter 6 shows how each of these IT systems would improve a particular business process and what the important performance aspects of these technologies are when considering implementing them in an organizational business process.

3. *What are the components of the evaluation framework?*

Chapter five discusses the three levels of the framework – the strategy level, the business process level and the IT systems level. At the IT systems level, the framework is further divided into six perspectives the customer, the business value, the internal process, future readiness, 'new technology' and the ethics and responsibility perspectives.

4. *How does the evaluation framework evaluate the IT system for its impact on the organizational business process?*

Chapter 5 further describes how measuring the IT system from these six perspectives allows for a more complete and robust evaluation of any IT system. This can then help organizations evaluate IT systems for their impact on any business process before actually implementing the IT system.

5. *What are metrics of measurement or the key performance indicators (KPIs) used in the evaluation framework?*

Table 6 in chapter 5 lists the individual KPIs in each perspective that organizations can use to evaluate any IT system they wish to implement into their business processes.

The IT systems focused on in this study were the new technologies available to organizations as solutions to improve productivity and efficiency of their business processes such as RPA, chatbots and analytics using artificial intelligence. The course of study found that there was a lack of focus in the literature towards the evaluation of the impact these technologies have on businesses. Furthermore, frameworks that existed so far and that have been used to evaluate IT systems did not account for the unique nature of these new IT systems. Large fraction of the evaluation frameworks found in the

literature are in the periods up to 2010. These frameworks although focused on IT systems were not able to look at these new technologies such as RPA and chatbots because these technologies had not been developed to this extent by then. Post 2010, however, these systems began gaining traction and becoming popular among organizations as solutions to improving business process challenges. However, the impact of these IT systems on the business processes has not been sufficiently documented in management literature. This study aims to be a step in the direction to remedy this.

Inferences about the framework

Through the literature study, it is realised that to evaluate the impact a particular system – in this case the IT system – has on an organization, an integrated approach is best suited to provide an overall view. For this study we focus on particularly the impact IT systems have on organizational business processes. Therefore it was crucial to add dimensions to the framework that examines both the IT systems and the business processes.

The proposed evaluation framework therefore takes an overarching strategic view of the organization's goals and vision. Any impact the IT system will have is first compared to the strategic goals of the company and checked to see if they align. Once that is achieved, the business process is examined. As we have stated earlier, IT systems are implemented into business processes to eliminate the inefficiencies that exist in these processes. However, if they are implemented without optimizing the business process, the IT systems can become additional bottlenecks that have to be crossed during the execution of the process. Furthermore, redesigning the business processes might open up other opportunities of the implementation of IT systems which were previously unknown. This is why the business process dimension first examines the business process thoroughly and then allows for its redesign with the IT system as part of the business process. This also allows the designers to anticipate any problems implementing a particular IT system in a business process might cause. Finally the IT system itself is examined from the perspective of five dimensions and on the impact it has on each of these dimensions. The results are then drawn out from each of these dimensions to get an overall view of the impact the IT system has on improving the business process. The evaluation of the IT systems are usually conducted by the managers who are responsible for a particular business process in tandem with the IT department of that organization. Therefore knowing that every organization culture as well as evaluation is unique, the multiple performance indicators to select from per dimension allows managers to tailor their evaluation for their scenario making the framework adaptable and flexible. The study then shows how the framework can be used by showing how to evaluate the impact implementing the RPA system and the chatbot system into the incident management process.

As the technologies being considered here are new, more is known about the technologies themselves and not enough about the impact these technologies have on organizations and their business processes or about the ideal business strategies organizations can take depending on their individual circumstances. This is why, although the framework is divided into the three levels of strategy, business process and IT systems, the focus is largely at the levels of business process and IT systems. When the effects that these IT systems have on an organization are known in more detail in the future, a higher level evaluation at the strategy level will also be possible.

How has the Management of Technology program aided me through this study?

The goal of the program was to understand the workings of technology in a deeper way, that is to perceive the way technology interacts differently with everyday users, the corporate sector and the government. Doing so we are better prepared as well as more adaptable and should be able to take advantage of the new innovations that are to come. One of the central parts of this study was that of evaluating new technologies for an organization. This program also aided me in doing this by highlighting the important aspects that need to be focused on when looking at any new technology. The course on business process management and technology was the first that helped me really understand how products and services were actually delivered to the end user and the technologies that accompany it. Realising that no business process is perfect and there can always be space for innovation and improvement was the first step that led towards this study. Courses on responsible innovation, technology dynamics and social and scientific values introduced the ideas of how innovation has been utility driven so far while any negative ramifications are dealt with later mostly by people who had no say during the state of its development. Additional to the inputs of the supervisors, this led to the idea of including the ethical context when considering implementing the new IT systems which inadvertently have controversies boiling around them. Elements from sustainable innovations and transitions were also useful in learning how innovations happen sustainably in the public domain and I have tried to adapt some of this knowledge into the corporate sector. Finally, the course on research methods was useful in learning how to conduct a research study such as this.

What would I do differently?

The process of conducting this research landed right in the middle of the coronavirus global pandemic which led to forms of economic and social lockdown nationally and globally. This meant empirical evidence for the evaluation would not be available which impacts the quality of the results of the study. Under normal circumstances, I would wish to conduct this study in a more systematic manner. Empirically observing the business process and stakeholder interaction would be very valuable to such a study as this.

7.3 LIMITATIONS

The study does contain a few limitations. Due to the current difficulties in conducting empirical research, certain qualitative and quantitative measurements from the organization (in this case Exact) were not able to be taken. The results and conclusions reached are however strengthened by the fact that they are extrapolated from past research and empirical studies. This study also lacks a detailed application of the evaluation framework which would drive home more clearly the utility of the integrative approach this framework provides.

Another limitation of the framework is that the stated cause and effect relationships are assumed to be measured at the same time and differences in periods of time in the measurements is ignored. The organization might employ the framework at the same time thereby obtaining the measurements at the same time but the effects of each of these indicators may manifest at separate times. Suppose the chatbot

is being implemented into the incident management process, the customer satisfaction indicator may improve within 3 – 6 months however the financial returns may take lot longer. This can have a drastic effect on the evaluation results itself and therefore can affect the way an organization takes a decision on a particular IT system. Currently the evaluation framework does not account for this limitation.

7.4 FUTURE RESEARCH

By presenting the limitations, the study aims to shed light on prospective areas for future research in this field. With improved external conditions, and gaining popularity of RPA, chatbots and AI among businesses in the Europe, a detailed and a more empirical study of the application of the framework to evaluate the impact of these systems on the various business processes will be very beneficial. Studying each of these technologies individually in different organizational and business process contexts will prove very useful. The framework's larger focus is on the IT system and not a higher level strategic evaluation. Future studies in this field will also be very beneficial. Additionally, studies can also be conducted comparing this framework with older frameworks and approaches such as the multi-attribute utility theory, the voting analytic hierarchy process by Azadeh (2009) and information economics to evaluate new IT systems and how useful the insights they generate can be for the decision making by the organization. This framework can also be compared to Bedell's method (2008) to check if it overcomes Bedell's limitation of being able to study only one technology and not a technology with multiple functions or a system that is part of multiple business processes.

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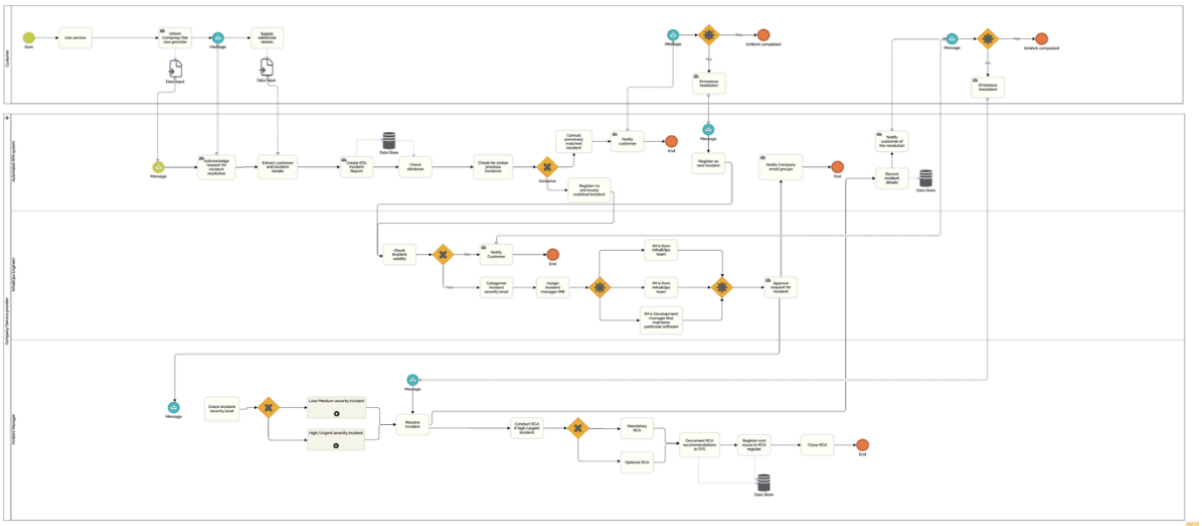
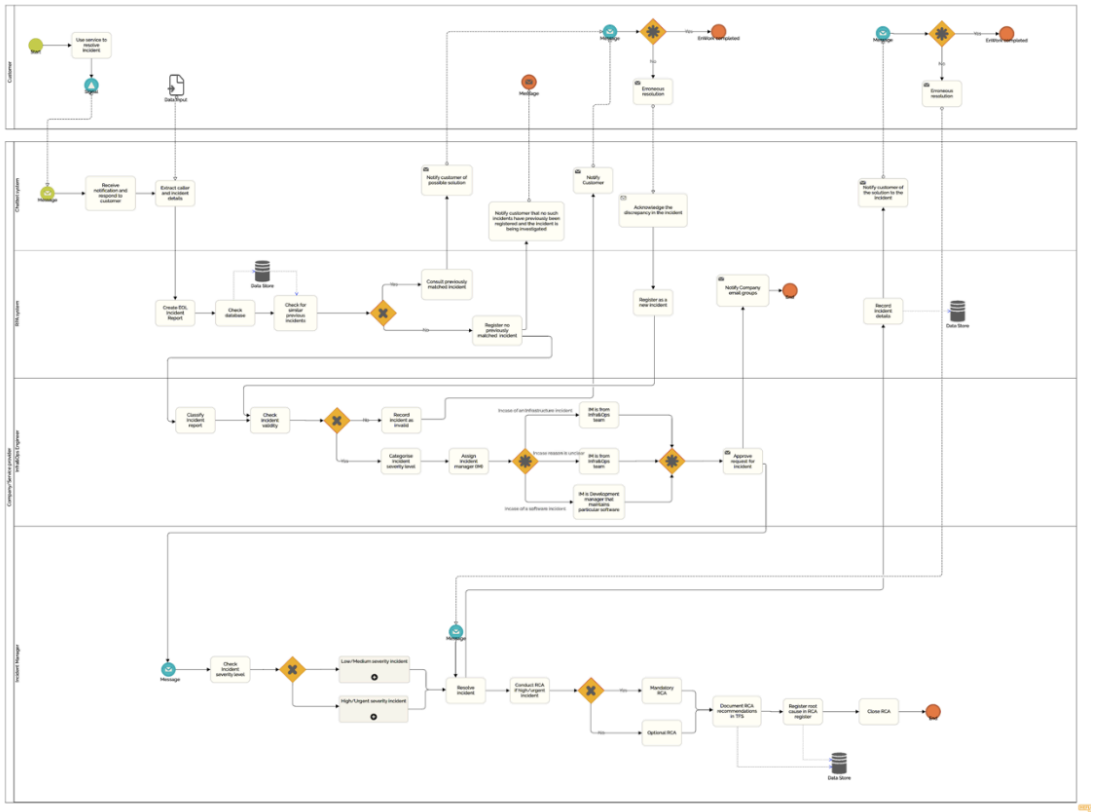
APPENDIX

APPENDIX A



APPENDIX B



APPENDIX C

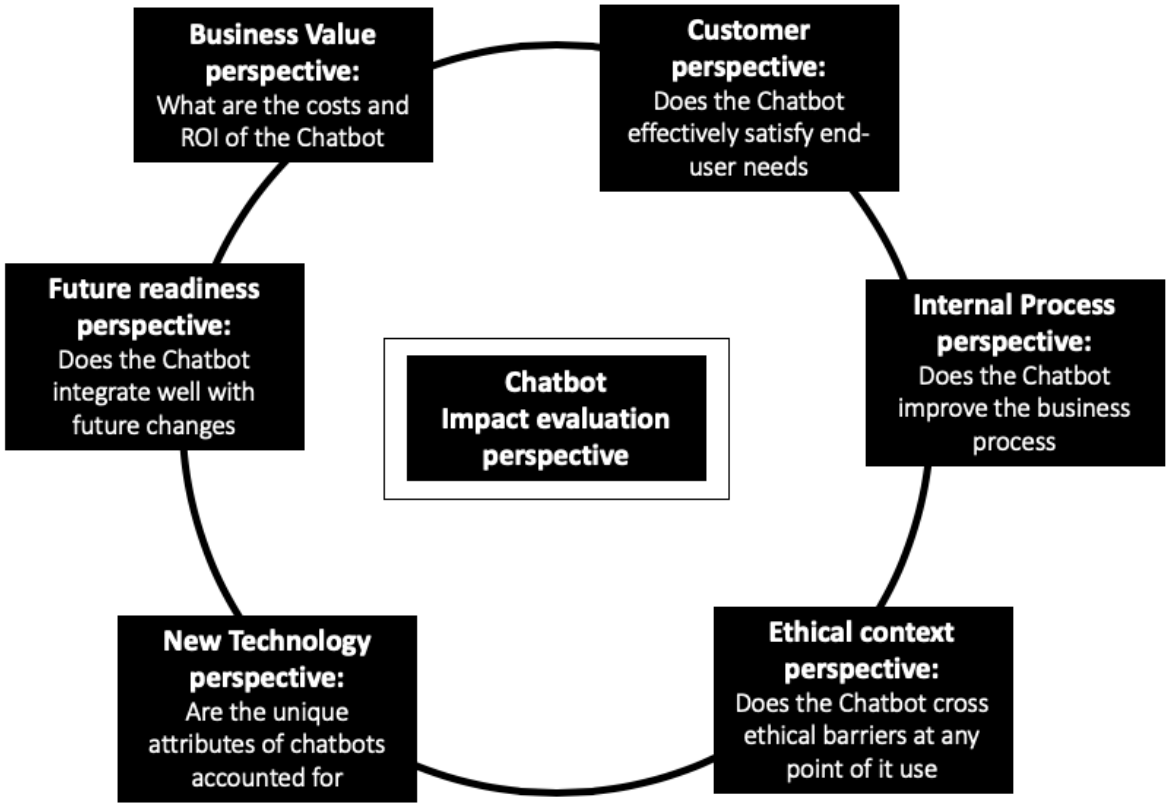


Figure 12: Perspectives of the Chatbot system from the five dimensions

APPENDIX D

RESULTS

Scenario1:

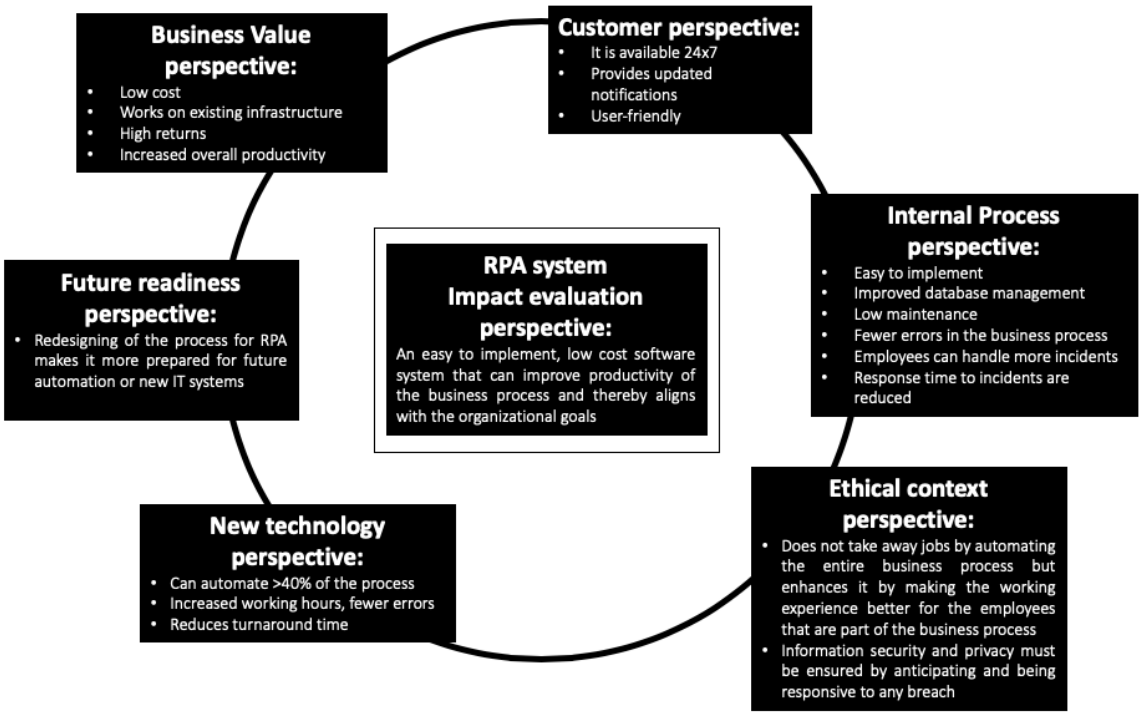


Figure 13: Perspectives of RPA after conducting the evaluation

Scenario2:

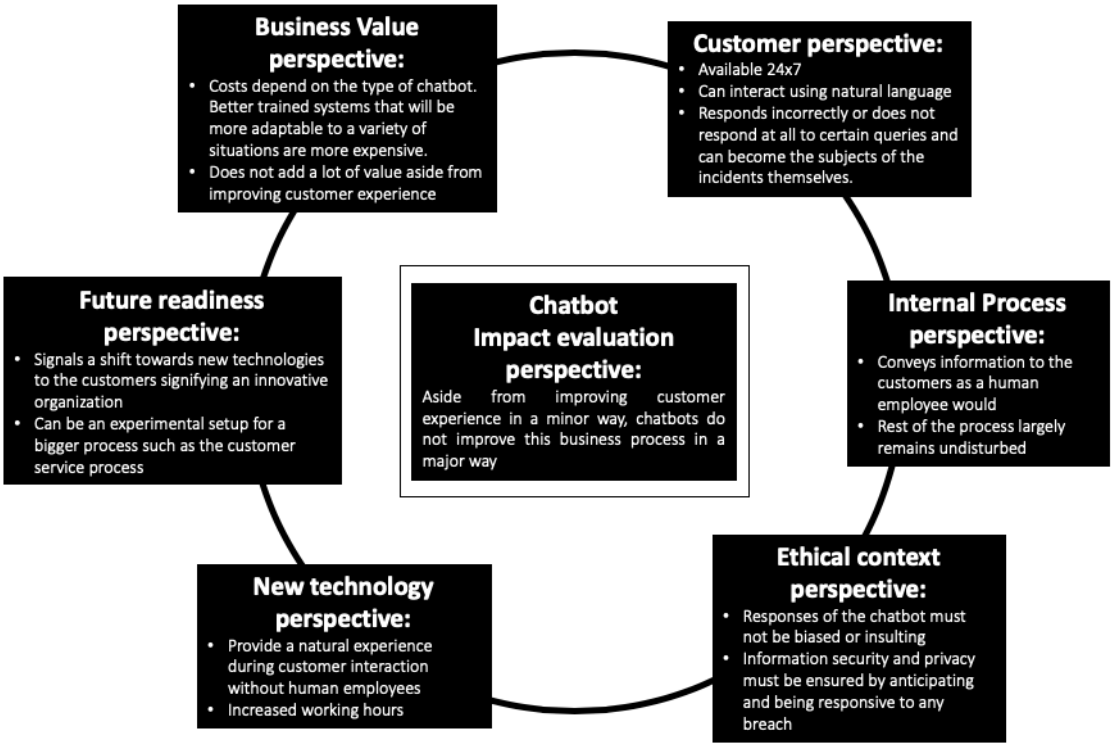
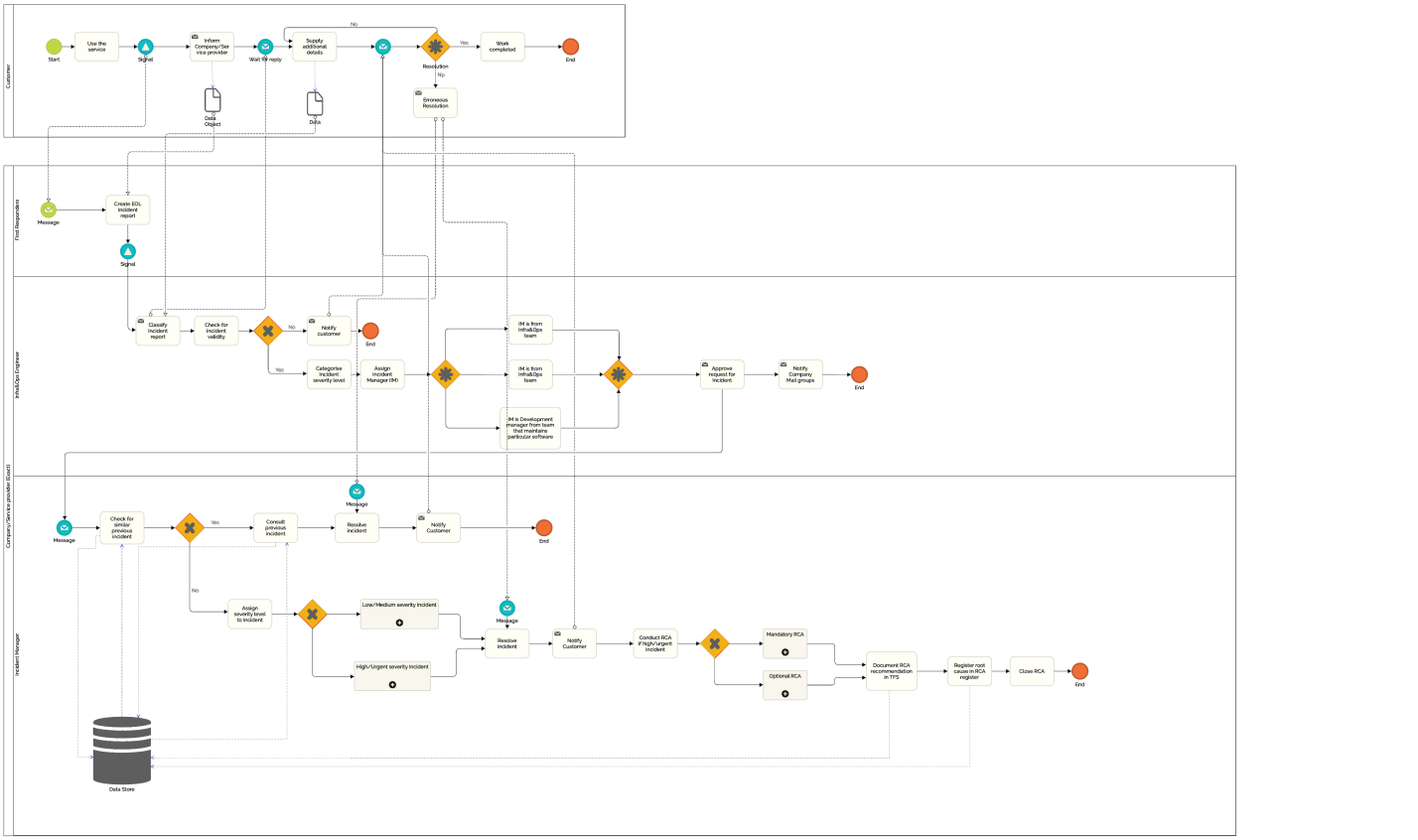
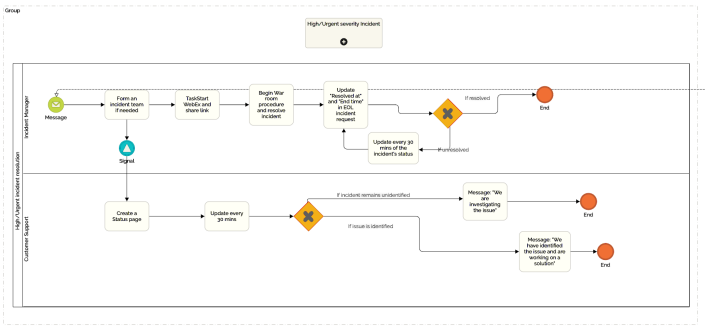
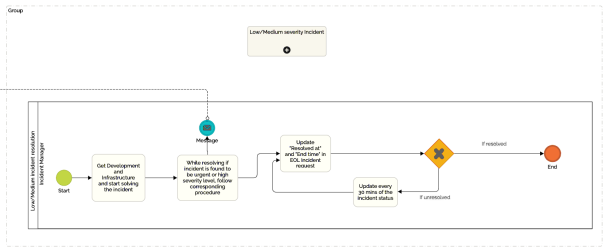
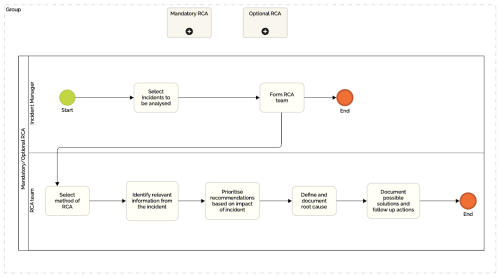


Figure 14: Perspectives of the Chatbot after conducting the evaluation

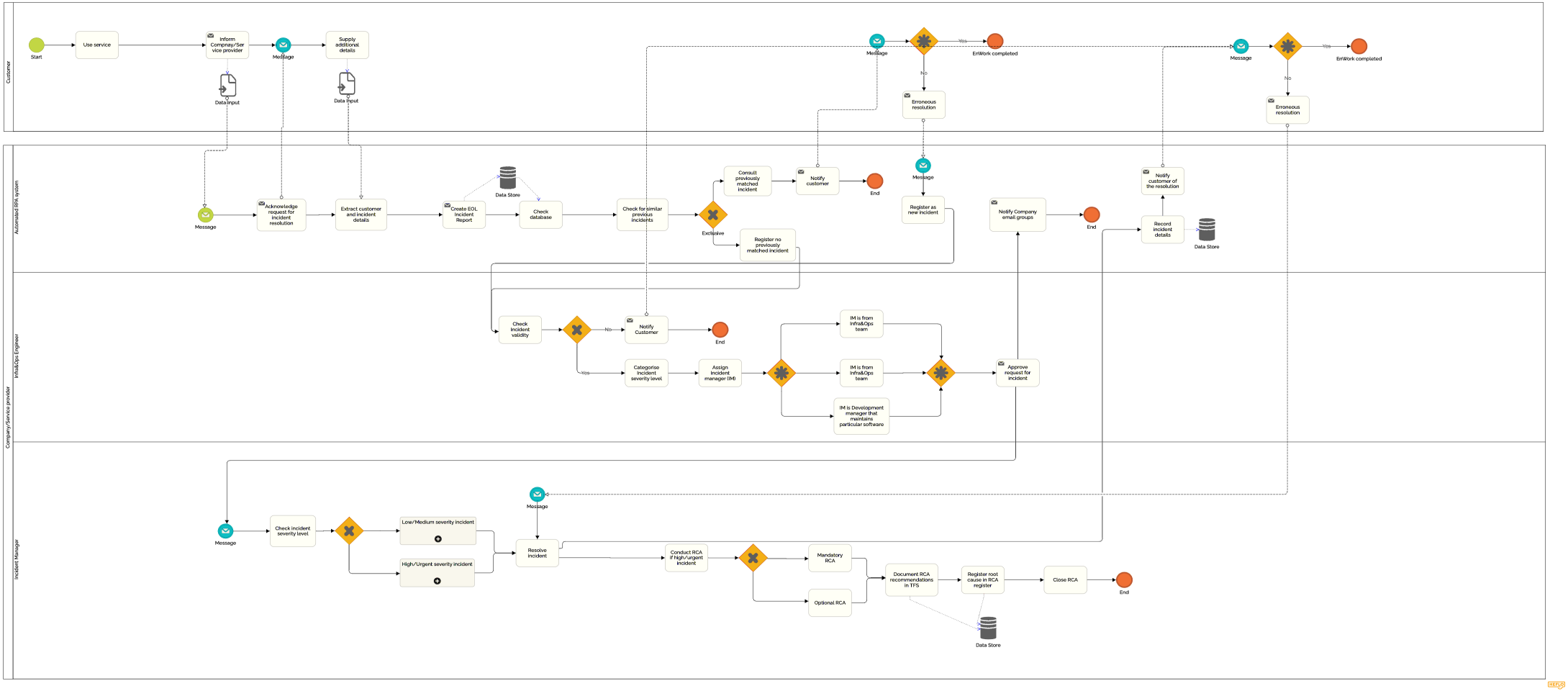

Customer
Start
Use the service
Signal
Inform Company/Service provider
Wait for reply
Supply additional details
No
Resolution
Yes
Work completed
End
No
Erroneous Resolution
Data Object
Data
First Responders
Message
Create EOL Incident report
Signal
Infra&Ops Engineer
Classify Incident report
Check for incident validity
No
Notify customer
End
Yes
Categorise Incident severity level
Assign Incident Manager (IM)
IM is from Infra&Ops team
IM is from Infra&Ops team
IM is Development manager from team that maintains particular software
Approve request for Incident
Notify Company Mail groups
End
Company/Service provider (Exact)
Message
Message
Check for similar previous incident
Yes
Consult previous incident
Resolve Incident
Notify Customer
End
No
Incident Manager
Assign severity level to Incident
Low/Medium severity Incident
High/Urgent severity Incident
Message
Resolve Incident
Notify Customer
Conduct RCA if High/Urgent Incident
Mandatory RCA
Optional RCA
Document RCA recommendation in TPS
Register root cause in RCA register
Close RCA
End
Data Store


Group
High/Urgent severity Incident
Incident Manager
Message
Form an incident team if needed
TaskStart WebEx and share link
Begin War room procedure and resolve incident
Update "Resolved at" and "End time" in EOL incident request
If resolved
End
Update every 30 mins of the incident's status
If unresolved
Signal
High/Urgent incident resolution
Customer Support
Create a Status page
Update every 30 mins
If incident remains unidentified
Message: "We are investigating the issue"
End
If issue is identified
Message: "We have identified the issue and are working on a solution"
End


Group
Low/Medium severity Incident
Low/Medium incident resolution
Incident Manager
Start
Get Development and Infrastructure and start solving the incident
Message
While resolving if incident is found to be urgent or high severity, follow the corresponding procedure
Update "Resolved at" and "End time" in EOL incident request
If resolved
End
Update every 30 mins of the incident status
If unresolved


Group
Mandatory RCA
Optional RCA
Mandatory/Optional RCA
Incident Manager
Start
Select Incidents to be analysed
Forms RCA team
End
RCA team
Select method of RCA
Identify relevant information from the incident
Prioritise recommendations based on impact of incident
Define and document root cause
Document possible solutions and follow up actions
End

Incident Management process with RPA



Incident management process with Chatbot