Action Research to Evaluate and Improve IT Incident Management in the Case Company through Business Process Management Methods

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Abstract:

This action research using mixed research methods aims to establish understanding of the case company's current incident management monitoring and to improve it and related processes in the IT department. First the research focuses on a problem that was identified by the case company expert panel. The researcher questions are designed to answer the case company's needs through practical and academic iterative inquiry: 1. What is the present performance of IT Incident Management ticketing system? 2. In what ways can the incidents be identified and acted upon more efficiently? 3. In what ways can the system be improved to ensure improved customer experience? To address the aim of this study, it uses action research logic and literature from action research, business process management and information technology service management. The research was conducted as mixed research, which includes participant observations, an action research reflection journal, and raw data reports. The results indicate that monitoring of processes should be kept as a systematic continuous process and that there is a need to intertwine business process management methods with information technology service management methods to attain transparency in processes and to establish a systematic approach to monitoring.

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1 INTRODUCTION

Agguter (2020) defines digital transformation as a term to highlight how information technology (IT) forms the basis for all business activity areas and how the reliance on technology simultaneously increases the risks related to it. With digital transformation the borders between IT and business processes or practices are blurred, as all parts of an organization need to work together to deliver the organization's intended outcome. Already in 2018 Tilastokeskus (2019) had identified that digitalization has made 90% of workforce to use digital software in their work in Finland. Digitalization has received a boost through the pandemic as operational digitalization, creation of digital business models and revenue streams, digital customer experience and creation of new workforce models accompanied with automation and artificial intelligence, have increased. The boost received also means that new technologies must be introduced, and digital transformation has become a strategic move for organizations. With the speed of novel changes being introduces, a new set of challenges to decision making emerges. To tackle decision-making there is a need to incorporate management competences with technical understanding. (KPMG 2020). IBM (2022) identifies that IT forms the foundation to all organization activities and is not possible to separate it from business operations. Increased threats come when systems fail or do not perform in intended ways, whether it is due to network crashing, data vanishing from the systems or malware that has crept into the system. It is the IT management who ensure that the technologies remain available and perform at their best regardless of the situation. (IBM 2022). IT incident management and change management secure functionality of the systems on day-to-day basis. Incident Management ticketing systems collect data on the incidents and the benefit of it can be realized when the data is used transparently and is understandable for managers to take actions on. (Mahalle et. al. 2020). Utilizing the advantages of digital transformation opportunities can result in cost reductions, organizational efficiency, and competitive advantage (Gackowiec et al., 2020).

While business processes are the focus of improvements, it is the IT tools that enable the improvements (Chang, 2016). IT is a supportive business process that provides required services to a business (Hoerbst et al., 2011). With digital transformation IT departments' agile approaches are expanding into more business-oriented departments and adopting

the best practices from business departments. The adoption of Agile methods in business departments and Information Technology Infrastructure Library (ITIL) general management practices impact IT departments but has also a business relevance as it creaks an efficient approach to working across cross-departments. While IT Service Management (ITSM) is used to focus solely on technological aspect, the current day implementation assumes a business-centric approach (Agguter, 2020.) Business and technology must be aligned to reap the benefits of data within the company and without a common language between these departments, this will not happen (Nanda, 2021). Both the customers and the employees of a company expect improved experiences and to achieve that, data should be used for efficient and better decision-making. Data issues should be tackled so that the experiences can be improved. (Nanda, 2021.)

For companies to remain competitive, the need to improve their processes, and for an organization to achieve their goal and processes, process management is essential. Organizations use technologies to further develop organizational performance, which ideally leads to a wider access to information within the organization. (Gackowiec et al., 2020). In the end, information enables a holistic understanding of the organizational processes, and a better understanding leads to improved management of the organization. Britt (2016) illustrates a case for using Business Process Management (BPM) methods to clarify workflows to reduce cost and retain information in a more accessible form for staff members to use. Establishing clarity over information and data through Key Performance Indicators (KPI's) helps decision-making and reduces reactive reactions to proactive actions (Werner, et al., 2021; Jebraeily, et al., 2019). Quality standards have become so important to organizations that International Standardization Organization (ISO) provides internationally recognized certifications of quality (ISO 2022; Hoerbst, et al., 2011). For BPM process information is essential and real-time measuring is not possible without appropriate monitoring mechanisms (Chang, 2016). Detailed information and process understanding are fundamental for efficient monitoring of processes (Gackowiec, et al., 2020).

1.1 Research Aim

This thesis aims to evaluate an established continuous monitoring process of incident management through business process methodology in the case company IT department. The purpose is to understand how monitoring is established in the current monitoring process, what information the monitoring process offers and what actions can be taken to improve the monitoring. This thesis applies an iterative research process from start to end to better understand the pain points of the current system and what solutions or recommendations of improvements to the management could be presented. To understand the impact of continuous monitoring process in incident management, there is a need to understand the used practices in IT department and practices used in BMP. There are three research questions for this thesis:

1. What is the present performance of IT Incident Management ticketing system?
2. In what ways can the incidents be identified and acted upon more efficiently?
3. In what ways can the system be improved to ensure improved customer experience?

1.2 Delimitations and scope

The purpose of the research is to understand how incident management ticketing system is being managed in a specified area with one service provider in the case company. While the end results have the potential to be utilized beyond the selected area within the case company, there is a need for adapting methods for different cases depending on the processes and management methods in use. This research focuses solely on the IM monitoring area and only considers impacting the processes based on suggestion of the literature of BPM and Service Management to reach the intended aim.

1.3 The Structure of the Thesis

Chapter one presents the research topic with the intended research questions. Chapter two presents the relevant literature research on Business Process Management, how processes are set up, monitored, and evaluated. The chapter is dividend in two parts, Service Management, and Incident Management, to introduce the setting of the research in a logical

manner from theoretical point of view. Chapter three introduces the used methodology, and chapter four presents the findings of the research. In the last chapter the findings and their implications of the findings to the case company are discussed. Limitations of the research and recommendations for future research are included in the last chapter.

2 THEORETHICAL FRAMEWORK

This chapter starts by presenting Business Process Management (BPM) and IT Management from a higher level. First the BPM is introduced to establish how processes are defined, evaluated, and narrowing down on process monitoring. Second, Service Management is presented from the point of view of the case company, then the focus is moved onto incident management.

2.1 Business Process Management

This chapter focuses on establishing an understanding over BMP methodology in general level before focusing on the following sub-chapters to definitions of process and process evaluation.

Doniku (2019) defines BPM as a system used in organizations with business transactions and improvement processes. While Chang (2016) specifies that BPM is a systematic and a structured way to analyze, improve, control, and manage processes with the aim to improve quality. The importance of understanding processes is essential to an organization. To gain greater value of processes, there needs to be an accurate established manner to monitor them. (Gackowiec et al., 2020). BPM is a management approach to ensure process quality and performance to meet the end customers' expectations (Gudelj, et al., 2021; Chang, 2016). With BPM methods the key is to use technologies with the existing processes to enable more efficient approaches. As the process management methods change over time there is an understanding that focusing on one specific management strategy comes with risks. While there is no specific established BPM approach, there are approved principles. BPM should not be taken as a technological implementation, but as one that includes technical, organizational, and functional areas. (Chang, 2016.) De Pourcq et al. (2019) further defines that process-orientated organizations lead to improved process flows, quality, cost, financial performance, and customer satisfaction.

Chang (2016) states that processes are to be managed continuously to ensure consistency of value to the customers and establishing a basis for process improvement. Process management includes measuring, monitoring, controlling, and analyzing the process. The aim

of monitoring is to provide information on the processes, enabling analysis of information to define improvement areas. Monitoring of processes is a statistical process control (SCP), and active monitoring allows to understand the variance within the process results. When variance is high there is an issue within the process and BPM enables to set a mechanism for controlling that variance. Analyzing the identified issue is the key to understanding how a process should be improved to gain better results. Continuous improvement of processes is enabled by accessibility to process information, and to ensure it is continuous it should be continuously monitored. (Chang, 2016.) Gudelj, et al. (2021) point out that one purpose of BPM is to remove activities that do not generate value for the process flow. The processes an organization conducts are part of the value creation of the organization and to leave the processes conducted unmonitored creates risks (Chang, 2016).

Chang (2016) suggests that to create a functional BPM approach there is a need to understand its stages. When starting the implementation, the established way of work should be clarified, including the processes, mapping the processes to the applications that support them and documenting the unique requirements that need to be addressed. As understanding is built, opportunities for improvements should be identified. In the second stage, there is a need to design an IT-focused solution for the future applications. If necessary, a custom solution should be designed to fill the gap observed. It is customary that at some point new idea inclusion is closed, to ensure that the scope of the project does not grow beyond the intended purpose. This often leads to follow-up projects to implement new ideas or solutions later. When reaching the end of the second stage, there should be documented specifications of the project, what is needed and how they are intended to be done. After the designing stage comes the third stage of development. In the third stage the system is established in the designed format. However, there might emerge a need for customizing solutions and especially for enforcing organizational changes. Once the development has been completed, a project moves to deploying the solution. Figure 1 illustrates typical approach to implementing the BPM in an organization. (Chang, 2016.)

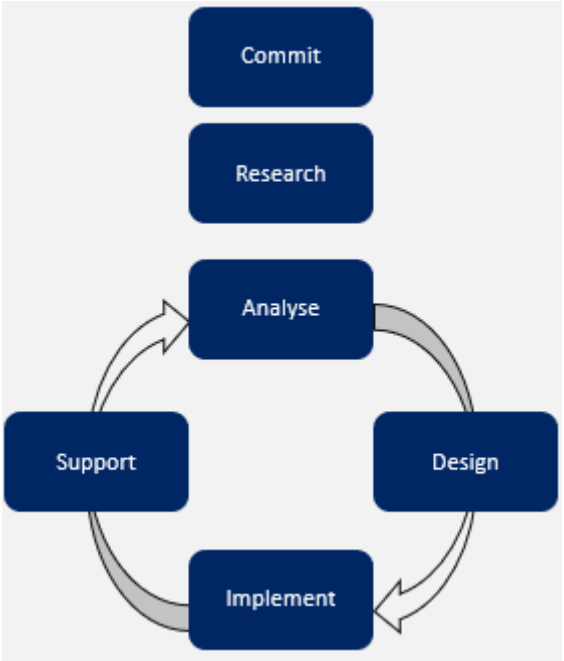

Figure 1: BPM Implementation Methodology. Adopted from Chang (2016).

The first step for the organization is to commit to the process management by aligning the organization and its strategic decisions. Once alignment has been reached the research stage starts by defining established business processes and choosing the process management product. After the initial preparations, an iterative process cycle starts by focusing on the identified need in the earlier research stage. In analysing stage, the project team, the project charter, and the performance metrics are set up. In the design stage the process is planned according to the intended purpose and optimized. There is a possibility to add new organizational changes or metrics to support the new design. In implementation stage the process solution is built, tested and the users are trained. As the implementation stage comes to its end, the product will go live entering the support stage. The support stage is continuous and is there to support the new process itself and to establish a continual monitoring and control through the BPM methods. If necessary, the cycle can start again to establish a new optimization or needed metrics to the process. (Chang, 2016.)

2.1.1 Defining the process

Kumar (2018) explains that through rearranging the business processes companies could achieve advances in productivity. Improvements could lead to a quicker delivery to the customers, shorter order-to-cash cycle times for the companies. Without having the process flow mapped down in detail, it is not possible to evaluate where the inefficiencies exist. The second issue with the organization process inefficiency is that some processes are routinely conducted, leading to unnecessary work being done or new technologies enable a more efficient way to have it done. Process is defined as: (1) A process is a routine of performed activities to achieve a set goal. (2) A business process is a set of activities which incorporate inputs creating an output for a customer that produces value. (3) A business process is a string of activities aiming to produce exact outcome the customer. (Kumar, 2018.)

Process is a chain of activities that transform inputs into outputs, it is conducted to attain a set objective. A process that is defined in detail can improve productivity and the details include steps, instructions, and the participants of the process. (Agguter, 2020.) The main differences between a process focused and a function focused organizational structures are that in the former the information tends to flow between functional areas rather than going through a manager first. The level of complexity of processes may vary depending on the process, while some processes have few activities, others can have several steps. The more steps a process has, the more work is associated the activities, increasing duration needed to complete the work. (Kumar, 2018.)

Role of monitoring in BPM is one of the five important aspects of BPM lifecycle shown in Figure 2. At the start of a BPM lifecycle, a process is started by informal design which over time is formalized into a process model through a modelling tool or language. In the execution stage the process is implemented in use. After the execution stage comes monitoring stage, which is used to measure the performance of the process through key performance indicators (KPIs). Without monitoring and understanding the data of the process, the BPM lifecycle cannot move to optimization stage to reduce the waste within the processes. The BPM lifecycle does not end at the optimization stage but is considered as a continual improvement process in which the process goes from the initial stage to the next during a lifecycle. (Kumar, 2018.)

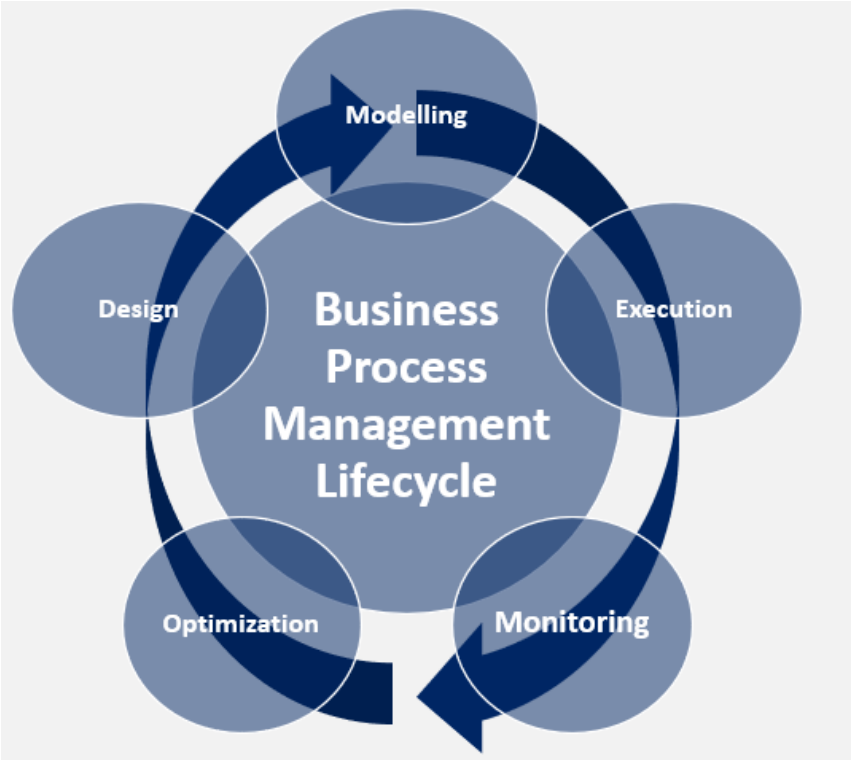

Figure 2: A process development lifecycle. Adopted from Kumar (2018).

2.1.2 Process Evaluation

To evaluate the performance of a process, the common way is to use KPI's which may include variables such as time, cost, quality, and flexibility. A focus to increase outcome quality may increase the cost and time needed to complete the process. These four variables are often at odds with one another, as focusing on one of them influences others forming a "Devil's Quadrangle" as illustrated in Figure 3. (Kumar, 2018.)

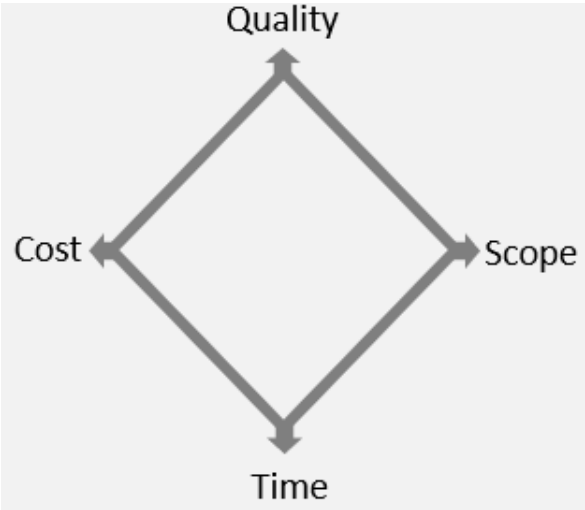

Figure 3:The Devil's Quadrangle. Adopted from Kumar (2018).

De Pourcq et al. (2019) explains that the complexity and the number of performance indicators can increase depending on the stakeholder. Selection of effective KPI's needs to be set by a multidisciplinary team (Werner et al., 2021). KPI's are among the most efficient means for an organization to align their operations and processes to reach the specified targets. The inherent complexity understanding KPI's relations to one another make them important for a manager to understand and use. (Werner et al., 2021; Jebraeily et al., 2019).

BPM should focus on a continual monitoring of processes and incremental improvements over time (Gudelj et al., 2021). Performance management includes observation, monitoring and tracking the activities within the processes and the process parts and understanding the impacts of these actions. To achieve efficient monitoring there is a need to conduct a performance evaluation, which compares the planned and achieved outcomes and provide feedback based on those findings. Information gained will enable a stronger decision-making and improved monitoring. (Gudelj et al., 2021; Werner et al., 2021). Werner et al. (2021) argues that KPI's can illustrate the situation within a company through identifying abnormalities in the data.

Any performance measurement should have a consistency of systemic approach, selection and need to be measurable (Gudelj, 2021). Data collection from the system could be established with automation in mind, thus ensuring a more functional performance management (De Pourcq et al., 2019). Werner et al. (2021) recommends using the common

international KPI's for measuring performance, as evaluating and comparing them will be easier. The common KPI's are identified by Kumar (2018) as:

- Process throughput time: minimum, average, and maximum time a process needs to be completed.
- Process throughput rate: minimum, average, maximum rate indicates the number of cases which were completed within a specified time.
- Process throughput rate per resource: Minimum, average, maximum rate of a resources indicates the number of cases a specified resource was able to complete within specific time.
- Process instances running late more than five percentage: indicates the number of tickets that are late. Impact of late delivery directly influences customer satisfaction and issues with this should be communicated on daily basis to responsible person. In this communication it is good to keep record on the tasks that cause delay and resources that are associated with the delay.
- Average delay for instances that are late indicates the average delay of the delayed cases, the average delay can be an indicator to need for assigning more resources to manage the volume of cases for example. It is important to define what type of delays are acceptable by the management.
- Other types of data such as total service time, waiting time and working time could be beneficial information.

By having a set of KPI's can help to explore the delays in the processes that are happening due to resourcing of staff or long processing times. A long processing time can be caused by multiple varied factors, and to understand what a long processing time is depends on the process averages. Minimum and maximum numbers tend to set the borders within which processes are acceptable to be completed. Comparing the task KPI's against minimums, averages and maximum numbers or rates helps to spot the cases which stand out of these norms. (Kumar, 2018.)

The quality of an outcome can be impacted negatively by quick work, which would be indicated by a short processing time. Therefore, it is good to understand if the causal effect is due to hasty work with a specific resource in the process. In the other hand, the quality of work can be poor if the processing time is too long. The related details within

a completed process should be taken into consideration. Number of errors is another effective way to explore the quality issues within the processes, as it indicates the number of errors that take place against every thousand cases.

Assessing a process, the cost of a process often is quickly increasing when involving multiple people in the process. Assessing the cost is easy through the hour cost of a resource combined with the time used. Automation often decreases the cost, as it frees resources from being involved in the process. While outsourcing processes relies on reducing costs of the processes. Visualizing KPI's through dashboards makes them easier to understand and to explore in further detail. (Kumar, 2018.) Visualising KPI data helps to make it easier to be actionable. Regardless of the selected KPI's they should reflect the intended direction of the organization in regards of the processes measured. (De Pourcq, et al. 2019.) The importance of using appropriate colour coding, graphs, and formats is to catch the attention of the reader to where it is most critical (Jebraeily et al., 2019).

Process analytics refers to research that focuses on process information that can be extracted from the process execution log (Kumar, 2018; De Pourcq et al., 2019). Aim of the process analytics is to identify delays and bottlenecks. Process metrics such as minimums, averages, maximus and means help to understand variance within a task, the delays within a task and what might be the cause of the delays. Understanding the cause of the delays helps to focus on the root cause. (Kumar, 2018.)

2.2 Service Management

The purpose of this chapter is to establish an understanding over IT Management methods in use by the case company and their intended functions and purposes. Starting with IT Service Managements use and its purpose. In the later sub-chapters focusing on the use of Agile Methods and purpose and Information Technology Infrastructure Library purpose and purpose. Last chapter focuses on the purpose and use of Incident Management.

Service Management (SM) is defined as "A set of specialized organizational capabilities for enabling value for customers in the form of services." Importance of the SM is due to integration of information technology to day to day lives of people and organizations. Especially businesses rely on IT solutions and services in every area of operations. It often comes down to effectiveness of the IT department to achieve their business objectives. Information Technology Service Management (ITSM) as management of three core parts focuses on: people, workflows, and information technologies (Hoerbst et al., 2011). IT departments support business critical processes that reach from the customer, partners, and internal functions. At the same time IT operations costs should not increase exponentially, while the quality of service should be of highest calibre. The need to balance between distinct factors such as cost, flexibility, time, and quality forms the Devil's Quadrant. (Agguter, 2020.)

While organizations are focusing on building a strategy around digital transformation, the purpose and importance of SM becomes more pertinent one. The current days competitive environment for businesses requires organizations to measure and review performance to understand standing in comparison to the competition and to especially ensure they can improve the service and product offering continuously. Utilization of the best ITSM practices help to sustain internal improvements providing benefits to the IT departments customers that are the internal users of the organization systems and the external customers such as partners or direct clients. (Agguter, 2020.)

Agguter (2020) defines value as "perceived benefits, usefulness, and importance of something". When there is little value in the use of services or product in IT services, the service provider quickly notices this when the client chooses another service provider. The

value of the service or product is not always connected to directly monetary value, but instead as time saving or having their service portrays a specific status. The service provider must comprehend what value their customers are seeking from their products and services, while being of value to the service provider themselves. When services are not managed properly the value often decreases if not ceases to exist for the customer. Value is only created when the product or service has more positive impacts than negatives. IT services must be measured, monitored, and maintained continuously to ensure they are working effectively. (Agguter, 2020.)

The customers of IT services assume that IT should be available, responsive, and communicates with them on a regular basis. IT and the technologies in use need to meet the customer expectations and especially their needs. Capabilities stand for the aptitude for an organization to execute a specific process. The more mature a process or an organization is, the better its ability to perform a specific process should be. As time goes on the service provider collects more experience in providing a specific service or a process to the customer. Expertise can only be developed when a service provider understands the nature of value for the customer. (Agguter, 2020.)

SM is not only about the IT focus on technology functionality, but it has moved towards end-to-end services and a value-based approach. Current ITIL 4 approach centralizes on the customer and the quality they receive from provided services or products. IT should be seen as enabler for the business and should be aligned with the business operations, strategies and plans holistically in the organization. As the complexity of IT services continue to increase in service delivery, there is an increasing need for more sophisticated approaches to the SM to control them. (Agguter, 2020).

From the organization point of view ITSM should be a two-way relationship in which value is co-created, this includes the value creation from the service provider and from the customer. While capturing the feedback from the customers has become more efficient with the expansion of online services, there is also a need to understand the role of the customer within the system. An efficient service relationship management helps to ensure that the service provider can meet the expectations of the customer and the stakeholders. Simultaneously the customers experience being heard and their needs are being

met. The purpose of co-creation is to ensure that the customer and the service provide create value together, and therefore the definition of roles becomes important. (Agguter, 2020.)

The value streams and processes can be considered as the steps that are taken by the organization to create and deliver products and services to the users. To achieve value creation an organization must have a comprehensive understanding of its activities through examining work, mapping, and analysing the value streams to identify unneeded steps to remove them. The activities must be analysed for improvements and optimise the value streams. Mapping the value streams offers a way to clarify, measure and enhance them. Mapping the value stream happens by a step-by-step process: (1.) Identify all the steps and activities in a process. (2.) Record the average time for the entire process chain, including the wait time. (3.) Map the entire process in a diagram to clarify the value-add times and the wait times between the steps. (4.) Identify the delays which can be removed. (Agguter, 2020.)

Metris is another term for measuring and establishes that measuring should always serve a purpose and not conducted for the sake of it (Brooks, 2006). Purpose for monitoring is to observe the services and their parts to identify changes which could negatively impact the performance of operations (Agguter, 2020). Metrics should be designed in a way that aligns with the customer needs, should be benchmarked, and ensured they are achievable. Most importantly, the metrics should be monitored to ascertain that intended outcomes are being reached and corrective actions can be taken, and they are not SLA's. Monitoring the metrics or KPI's should aim to explain what should be done now to take corrective actions before they become an issue and compromise reaching the SLA's. (Brooks, 2006.)

The outcomes of monitoring can be: (1.) informational, which does not need actions but explains trends or data itself. (2.) Warning, on which actions must be taken to avoid a negative impact. (3.) Exception, on which action must be taken and a negative impact on the business might have already happened. For monitoring there is a need to identify what to monitor and implement. To maintain monitoring practices, establish, and maintain the defined thresholds and criteria for monitoring. Implement and improve the processes for

the monitoring purposes. (Agguter, 2020.) According to Brooks (2006) the objectives of the metrics are:

1. Align IT with the business objectives.
    a. Enables accounting for IT processes.
    b. Informs the stakeholders of the SM performance.
    c. Enables the understanding of challenges in the IT performance and issues.
2. Ensure compliance with the requirements for the business operations are met.
    a. Guides the IT operations
    b. Helps to obtain the certifications.
    c. Helps to reach the Critical Success Factors (CFS's).
    d. Minimize the business interruptions.
3. Push the operational excellence in IT.
    a. Measure IT and the process performance.
    b. Control the ITSM processes.
    c. Manage IT.
    d. Increase the IT productivity and performance.
    e. Proof of Concept for the IT organization value creation.

Brooks (2006) argue that the results of IT metrics monitoring should not be reported in technical terms, but in business terms as they are monetary in nature and the purpose of IT is to provide an organization a return for their investments.

2.2.1 Agile Methods

Agile methods are no longer just IT department methods, but increasingly influence creation of what is known as agile organizational culture (Hidalgo, 2018). At the core of Agile practices and improving ways of working comes from understanding the four points as explained by Pham & Pham (2017):

- People and interactions over processes and tools.
- Functional software over bureaucratic documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.

In Agile practices the value is derived from satisfying the needs and wants of the customers quickly and continue to provide value through a service. While changes may come at any stage of the work, it should be included within the work to increase competitive advantage. (Pham & Pham, 2017). Mercan & Becerikli (2020) recognize the advantage of agile methods to be flexibility, however, they also point out the issue of flexibility introducing constantly changing aspects.

Work should be delivered frequently, therefore projects and development in IT should be measurable in length of weeks rather than couple of months. Integration of business people and developers should work together often. The work should be focused on people with motivation and enabling them through the support they need. In Agile, the best means to communicate is face-to-face meetings, as information is conveyed more efficiently. (Pham & Pham, 2017.) Practices which aim to collaborate cross-departments, increase flexibility and a manager limited authority can impact negatively when projects require tight management to ensure success. Differences between people due to collaboration can lead to problems. (Hidalgo, 2018.) The measure of success is a functional software. Through Agile practice the continuous attention to the technical and the design excellency increases agility, while simplicity is the key ensuring that work is done with least amount of work required. (Pham & Pham, 2017.) While Mercan & Becerikli (2020) bring attention that increased flexibility may contribute inability to predict when the work is completed.

2.2.2 Information Technology Infrastructure Library

Information Technology Infrastructure Library (ITIL) is among the best practices for implementing ITSM and adaptations of it are in use by the businesses globally. ITIL provides a framework that a business can use to ensure quality of the IT services delivered and supports organizations in IT services meeting the needs of the customers. Success of ITIL relies on the focus of practice over academic or theoretical approaches and centralizes the organization focus on co-value creation with the internal and the external customers. (Agguter, 2020; Hoerbst et al., 2011). Agguter (2020) states that the three major success points of ITIL are:

1. Vendor Neutral, ITIL is not focused on just one vendor, technology, or an industry, but can be adopted cross-industries regardless of the size and types of an organization.
2. Organizations need to realize how and what to adopt and adapt from ITIL to fit their business and customers.
3. Best practice, as ITIL draws from experiences cross industries it all helps to build a global SM practitioners pool which to learn from. This means that the best practice are proven activities that have been successes in other organizations.

While ITIL relies on the best practices they often come with tacit understanding over the systems and processes by the staff members. This information is not often documented, which increases the risks overtime when a senior staff member leaves. While there are risks of tacit information built by staff members, ITIL expects that a member of the IT services is part of the overall service experience to the customer. (Agguter, 2020.)

In shift from ITIL V3 to ITIL 4 has been development of focus from a process-orientation to practices and ITIL 4 describes practice as: "A set of organizational resources designed for performing work or accomplishing an objective." This change from processes to practices challenges organizational frameworks that are focused on monitoring processes. The main issue with monitoring predefined processes is that they establish a need to control, and therefore inflexibility may introduce negative impacts to the overall process objectives. (Agguter, 2020.)

It is not to state that processes have become irrelevant, instead they should be considered as a part of the overall picture. To consider the change from processes to practices there is first a need to understand the current performance of the processes and whether they are effective in their purpose through process improvement analysis activities. These processes should be documented to ensure they are easy to share and use. When a process is not defined in agreed manner, then there is great likelihood that the processes are completed in a different manner while thought that the processes are done as they should be. Policies in the other hand are used to document expectations of the management and their intention for a process. Documentation helps to ensure that the process development and implementation is done in a manner that is aligned with the intentions of the management.

These reusable processes should be made so that they can be measured, monitored, and improved. (Agguter, 2020.)

Establishing measuring and reporting is to help decision making based on information and to decrease risks and uncertainty. To accomplish better decision making there is a need to understand relevant data within the context. However, it is argued that when a measurement becomes a target to obtain, it becomes an inefficient measurement. A focused attempt to gain one good measurement can increase the likelihood of bad behaviours or creating unintended effects. To avoid this KPI's should be based on a team effort, not personal efforts. Information itself should be used to inform the management and enable decision making or prioritizing where to focus. Reports should be able to give a picture what is happening now and not month or week ago. From these reports it should be achievable to understand the trends that are happening. (Agguter, 2020.)

Risk management is vital to sustainability of practices, an organization and for creating value to the customers. While risk commonly is understood as a negative impact, it can as well offer opportunities. Risk management aims to understand the associated risks and map them to the related activity, however, at the same time it needs to understand the cost impact addressing a risk against the potential impact of the risk. Aim for risk management is to identify, assess and treat risks. There can be risks that cannot be avoided and some degree of uncertainty must be accepted. Risk management relies on the people within it to ensure that negative news and the people who bring them are not considered as punishable acts. (Agguter, 2020.)

Purpose for supplier management is to ensure that suppliers of an organization and their performance is managed in a way that helps to maintain the quality of service. To manage suppliers there is a need to: (1.) create transparency and maintain consistency. (2.) Maintain a supplier strategy and policy, and contract management information. (3.) Negotiating and agreeing contracts and arrangements. (4.) Managing relationships and contracts with the internal and the external suppliers. (5.) Managing supplier performance. With reliance on the supplier services comes a complexity of managing those relationships. To ensure supplier management is clear there should be an agreed approach that sets what is

expected, how and why it is expected. Transparency over these aspects help to ensure improved situation. (Agguter, 2020.)

2.2.3 Incident Management

Incident Management (IM) focuses on the recovery of a service used by a customer or on which they rely to get their daily work done (Hobbs, 2011). Mahalle et al. (2020) instead defines IM as "capability to effectively manage unexpected disruptive events with the objective of minimizing impacts and maintaining or restoring normal operations within defined time limits". Purpose of the IM is restoring operations as quickly as possible to minimize their negative impacts (Agguter, 2020). Mahalle et al. (2020) further divided the role of an incident; a problem and an error as follows:

1. An incident is an event that is not component of the standard service operation. Causing either an interruption or reduction of the quality within the services. A reoccurring incident may develop into a problem later.
2. A problem is unidentified cause of an incident, either a source of single or many incidents.
3. An error is the underlying identified root cause of a problem, to which a solution is developed permanently or through a workaround.

The IM processes focus on recording the failure and identifying the needed steps to recover the service for operations for the end-user to conduct their work. (Hobbs, 2011). The primary functions of daily IT operations are IM, to ensure issues within services are reported to the service desk (Mahalle et al., 2020). Both Hobbs (2011) and Mahalle et al. (2020) agree that in the IM process the focus is: (1.) How the end-user presents the issue to the support desk. (2.) Time it takes to manage the incident. (3.) What resources were used to restore the service. (4.) What actions were taken to restore the service. IM processes are by nature collaborative processes that engage several teams to identify, analyse, communicating progress and constructing a solution to the incident. (Mahalle et al., 2020.)

The teams associated in the incident resolution are divided into three distinct levels. Level 1 Support is normally an operations team such as Service Desk, Help Desk or Call Centre,

being the first point of contact for end-users. Purpose of the Level 1 Support is to assure that incident ticket contains all required details, criticality of the incident is correctly scoped and identify the nature of the incident. This information is needed to understand which business partners are to be contacted and what are the impacts and the expectations of the resolution. The criticality of the incident ticket defines which managers and teams should be engaged to ensure correct capability is assigned to deal with the incident and achieve a resolution within the SLA. (Mahalle et al., 2020.)

Lever 2 Support is usually referred as Command Centres, Network Operations Centre, or Distributed Computing Control Centres with several purposes. The purpose of Level 2 Support is to determine the root cause of the problems, drive applications of the permanent fixes or workarounds, proactive monitoring of the infrastructure and incident trends, continual improvement of the IM process. Level 3 Support focuses within the development groups of IT, such as engineering and development teams usually known as: Engineering, Architecture, Network Integration, or Application Development teams. Level 3 Support assures that the incidents escalated from Support Level 2 are resolved, engage in the IM activities, and conduct permanent fixes into the infrastructure to remove errors. (Mahalle et al., 2020.)

Criticality of an incident ticket states the relative importance of an incident. It is based on the impact and urgency to define time needed for actions to be taken. The impact defined by the number of users impacted and associated monetary loss for the business. Urgency is defined by the dependency of other business processes and applications. Both urgency and impact help to understand the snowball effect down the line for a business and the associated service time requirement within the SLA. (Mahalle et al., 2020). Incidents must be resolved with quality and involve timely updates to the customer. Prioritization of the incidents must respond to the criticality of the ticket and highest priority tickets need to be resolved first. (Agguter, 2020.)

Priority 1 incidents are the highest impacting disruptions within the IT services and have the potential to cause large financial, reputational, or operational losses. To manage the Priority 1 incidents, it is recommendable to define a separate short and efficient process to manage them. Prioritizing of the incidents helps to define the process to be followed

and engaging an escalation matrix in case of setbacks in resolving the incident or the resolution demanding instant changes within the systems. The escalation structure's purpose is to help reaching a timely resolution, improve the staff capability, level of effort and defining the priority of an incident. The timeframes the incident resolution adheres to are dependent on the organization in question and the responsibilities of escalation. The best organizations negotiate to assess the correct timeframe and the priority with the end-users. (Mahalle et al., 2020.)

Without connecting the incidents logged with common data, it becomes impossible to understand the volumes and trends of what is happening (Hobbs, 2011). Instead, each of the incident brough to the IM table can be viewed as a new instance. When the connection between reoccurring, trending or relationships data cannot be identified, establishing a root cause analysis with results becomes increasingly difficult. Establishing a thorough process to set down the required details helps to manage future issues. (Hobbs, 2011). Mahalle et al., (2020) point that for the IM to mitigate risks there is a need to proactively classify the incident types based on priority, systems and operations impacted, staff from the service providers side managing the incident, identifying key stakeholders to communicate with.

Brooks (2006) define metrics to measure the IM as:

- Percentage of incidents incorrectly assigned
- Percentage of incidents resolved within target time by priority
- Average time to resolve incidents
- Percentage of incidents re-assigned
- Percentage of incidents incorrectly categorized

3 METHODOLOGY

This chapter presents the research approach and research methods used for this study and the reasons behind the choices, followed by how the data is gathered and analysed. The thesis is action research in the case company using mixed research methods for the data collection and analysis.

3.1 Research Approach

This thesis based on developmental action research using an iterative process to investigate and improve the IM monitoring in the case company. The study is limited to specific Service Provider processes. The aim is first to understand the current monitoring processes and then to identify what can be improved. The aim of the research is to establish a systematic incident management monitoring, enable better process evaluation and a more efficient monitoring in future. The research and development in this thesis follow the action research logic. The research questions for this thesis are:

1. What is the present performance of IT Incident Management ticket monitoring system?
2. In what ways can the incidents be identified and acted upon more efficiently?
3. In what ways can the system be improved to ensure improved customer experience?

The strategy for this research is Action Research in which the researcher influences the development through participation in the researched area. Coghlan & Shani (2018) argue that the basis for using the action research comes in situations where the immediate output has an impact on the organization. Action research is often considered management approach with the goal to building a better understanding of the researched issue. The purpose of action research is to ensure that the organizations associated with the research gain practical benefits, while meeting the needs of academic programs. When a researcher is not an expert of the researched phenomena, they usually collaborate alongside with a supervisor that is associated with the organisation and the phenomena. (Coghlan & Shani, 2018.)

The relationship between the case company and the service provider is based on outsourcing specific services from the case company to the service provider. The service provider technical agents work in collaboration with the case company employees in issues related to the tickets in IM area and in some cases developments in programming. As they have specialized technical expertise needed to manage the technical issues that the end customers raise as the incident tickets. The service provider is responsible for managing the processes, monitoring of the processes, the quality of processes and reporting the current situation to the case company. However, the case company finds having an overall picture difficult with the service provider due to cultural differences in communication and with lack of information brought up on issues. The service provider has a conflict of interest to ensure that their services do not lack quality and remain within the agreed service level agreements. The conflict of interest may impact the way the service provider report to case company and agreeing to issues brought up by the case company. Usually, issues are not brought proactively up by the service provider, unless the case company starts the discussion. This has led to a situation where the case company implements their own monitoring on the tickets when they can and observations on quality or other issues. The service provider should in fact do the monitoring, however, they provide comments and explanations against the case company observations after their monitoring expert has checked the issues with the technical teams.

The thesis uses an iterative process to research an area that is formerly unknown to the researcher. Due to their limited understanding, it is not possible to plan, predict or control entirely what findings come up during the research. Action research is an emergent inquiry process, typically it is not fully known which actions impact the phenomena that is being researched, and therefore it is not possible to predict or control what will take place during the research (Coghlan & Shani, 2018). With the purpose of impacting the researched incident management monitoring process, a systematic approach is needed to collect the data to have an objective approach during the thesis. Action research focuses on the organizational problem to understand participation of people within the system with dual-purpose to impact a change within the phenomena and producing information that can be acted upon (Coghlan & Shani, 2018). The thesis findings and actions taken are checked with an expert panel that establishes a co-creative and collaborative process to ensure correctness of the findings and solutions. Action research is an evolving process

which utilizes cooperation among participants and co-inquiry to establish research with people (Coghlan & Shani, 2018).

There is a need to establish a clear-cut methodological path which illustrates the starting point in the research (Yin, 2018). The starting point of the research can be from theory to practical understanding or vice versa. In either case, the pathway to accomplish the research goal should be explained in detail to display rigour and how the formal and specific procedures are followed during the research. A lack of rigour comes up when the researcher does not follow the practice set up, or lets illogical evidence influence the findings and outcomes of the research. (Yin, 2018.) Coghlan & Shani (2018) define the action research main assumptions in two:

1. Involvement of the people within the system produces higher quality information and understanding.
2. Understanding over a system is derived only from attempting to change it, as a human associated system contains variables that are hard to manage.

The duration of this thesis is one cycle of action research and the different stages within it are called phases to clarify the progression of the thesis work. The cycle starts with constructing the initial understanding of the IM monitoring area and establishing a scope and the limitations of this research. The start of a second cycle is not included within this research as it consists of analysis and optimization of the processes based on the findings this thesis cycle prepares. Coghlan & Shani (2018) define action research as a cyclical process with a purpose to construct, plan for action, taking action, evaluate action, which then lead further similar patterns as shown in Figure 4.

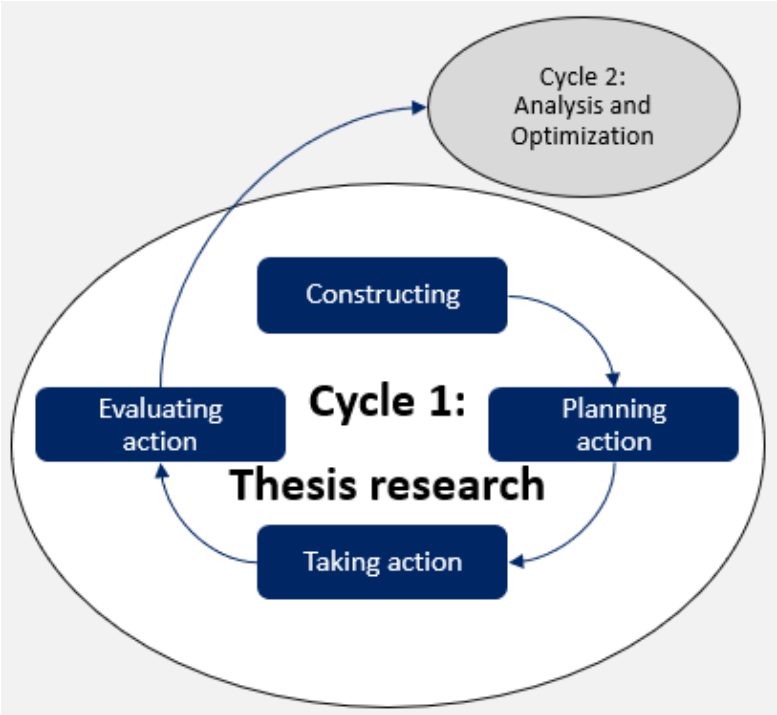

Figure 4: Thesis Cycle. Adapted from Coghlan & Shani (2018).

While this thesis signifies one full cycle, there is a possibility to identify minor development cycles, the purpose of which is to systemize and clarify some specific processes. This systemization and clarification are done to ensure transparency of information available and having uniformity in the process approach between different stakeholders. As these minor development cycles are completed, the end results are validated with the expert panel. The members of the expert panel come from the case company and the service provider who have years of experience within the processes and whose expertise range from technical, management and operational areas. The action research process in this thesis is described in closer detail in Chapter 3.2 Action Research Process. It is possible to have multiple action research cycles working simultaneously with contrasting time spans in one project (Coghlan & Shani, 2018).

Theory development in this thesis is based on the abduction approach as the research questions are based on a practical problem within the case company. Abduction approach shifts between deductive and inductive approaches and begins with observing the processes and starts from there to construct potential theory as to how it has taken place (Saunders, 2019). New surprising facts can be found as the research progresses. As

abductive approach shifts between deductive and inductive approaches, they often complement the theory building. (Saunders, 2019.)

The research uses mixed methods research as there are a limited amount of documentation available to the research area in the case company and the researcher is new to the researched area and the availability of information is in quantitative and qualitative forms. The data collection is collected through the IM ticket system information which consists of the ticket volumes, SLAs, and number of observations. The ticketing data are the basis of discussion in the weekly IM meetings between the panel of experts from the case company and the service provider. The research problem and the research questions are the basis for choosing mixed research method (Saunders, 2019). The two-way data collection enables the thorough exploration of the findings, while keeping the quantitative data as the priority for the research and the qualitative data being used as a supportive data when establishing understanding over the research area and the quantitative data relationships. (Saunders, 2019.) The use of quantitative research is the correct choice when the system key features and behaviours must be measured, and the purpose of the research is to find quantitative comparisons to understand differentiation within the system (Moutinho & Hutcheson, 2011).

While the quantitative data from the system is readily available in a form of raw data report, there is a need to establish understanding of its content through a systematic approach to ticket monitoring. Both the volumes and the raw data are result from actions of the people within the system. The quantitative data collection and analyses allows to better understand the official data within the case company, while the qualitative data collection and analysis enable understanding the perceptions of people (Saunders, 2019). The quantitative data analysis often results in an outcome that can be of use to a wider audience than its original sample, while the end outcome of quantitative research is to set up understanding of relationship between variables (Moutinho & Hutcheson, 2011).

This action research thesis takes place between August 2021 to end of April 2022 in the case company researching a particular problem.

3.2 The Action Research Process

This chapter illustrates the action research process used in this study. The thesis research is one cycle which consists of five divergent phases that may be conducted simultaneously. Some phases include additional minor cycles which were identified as necessary minor developments to establish a systemised approach to data collection and understanding its variables and discussions within the IM weekly meetings. Figure 5 presents the duration of the thesis cycle and the five phases and additionally the identified minor cycles are presented. Minor Cycles in Figure 5 will be identified through the BPM implementation methodology and are minor developments, issues or improvements that are identified during the process that need to be resolved to reach the intended outcome. Green colours indicate the phase or the minor cycle was concluded successfully and taken to practice, while orange indicates that the suggested development was not incorporated in practise.

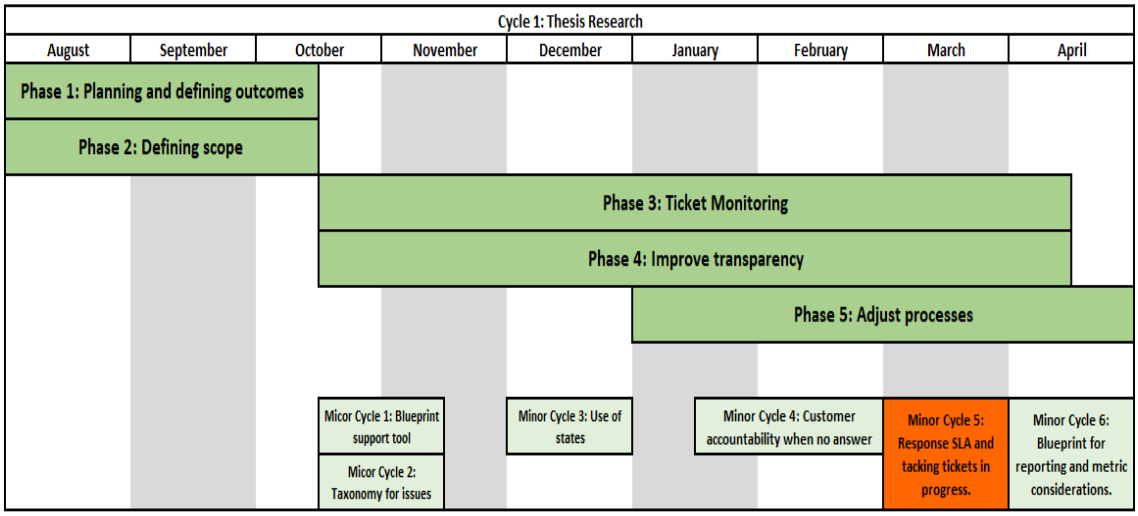

Figure 5: Cycle 1: Thesis Research.

Phase 1: Planning and defining outcome, the purpose is to establish the area of research based on the case company needs, which are explored and identified with the case company expert panel. During Phase 1 training is started with the supervision of the case company monitoring expert and mapping the general understanding over the research area within the case company. Establishing an understanding over the basic monitoring processes and defining the outcomes of the thesis research are the set outcomes.

Phase 2: Defining a scope, focuses on mapping the research area scope by establishing understanding over the current teams, processes and measures included within the case company IM monitoring. The aim of the phase is to limit the scope of the research to a manageable area which can be covered in the duration of the thesis research.

Phase 3 & 4: Ticket Monitoring and Improve transparency are intertwined as the ticket monitoring is the process which enables to understanding of the gaps or improvement areas and helps increase transparency of the IM incident tickets. As the process of ticket monitoring builds an understanding over the ticketing system data, actions can be taken to improve transparency while allowing to focus on new areas when one issue is corrected. At this stage it became evident that a tool is needed to understand the system, which starts Minor Cycle 1: Blueprint support tool. The purpose is to enable a systematic approach to the data collection and understanding of the tickets, while helping to ensure human error is minimized through programming. Minor Cycle 2: The taxonomy of issues is built through an iterative process with thematic analysis logic to identify 22 thematical issue categories for recurring issues found in the incident tickets. Minor Cycle 2 is built with the help of the support tool built in Minor Cycle 1, which is now validated and improved. The taxonomy of issues will be an integrated part of the support tool. The issue taxonomy enables to understand the volumes of issues and identifying which issues categories should investigated first due to impact of quality, delay, or potential bottleneck to correct or to improve the ticket monitoring process.

Phase 5: Adjust Processes, starts when the IM ticket observations findings deem necessary to adjust the current processes to ensure improved quality of processes and monitoring. The purpose is to ensure that the data available from the system is uniform and actionable for reporting purposes. Phase 5 balances between the concepts of “control” and “flexibility”, their beneficial and negative impacts on the processes with identified “efficiency” as the desired measure. Minor Cycle 3: Use of States, aims to clarify the use of different states used by technical agents within the system. These states have an impact on the service level agreements (SLA) measures from the system. Minor Cycle 4: Customer accountability when no answer, focuses on clarifying the process of waiting for a customer response, the number of emails sent as reminders, the escalation of the ticket and the point of closing a ticket with no response. Minor Cycle 5: Response SLA and tacking tickets in progress, aims to adjust the process of taking tickets In Progress state

for increased transparency of the resourcing capabilities of the service provider and their ability to cover the incoming incident ticket volumes.

Minor Cycle 6: The blueprint for reporting and metric considerations, begins after the other minor cycles have been closed. Minor Cycle 6 investigates the available raw data from the system and what are the current measurements done by the case company or the service provider. Based on what data is available and what metrics are being used, the BPM and the SM monitoring process calculations are developed to establish an initial report blueprint. The report blueprint aim is to understand the development of the IM tickets more efficiently and timely manner in the future. This report suggestion is then checked with the case company expert panel first and is the start of the Cycle 2: Analysis and Optimization.

3.3 Ethical aspects

There are ethical aspects that need to be considered with the thesis research and these are related to the processing and confidentiality of the data and ensuring mitigating potential harm of findings. The system data cannot be reported externally out of the case company, the case company and the service provider, and the employees related to the processes are not disclosed to ensure anonymity and avoidance of harm. Prior to starting the research, the consent was obtained from the case company who owns the processes and the related data. During the thesis work there are weekly IM meetings, two checkpoints with the expert panel members to ensure what findings have been identified and to keep them informed and aware of the research process. Ethical considerations on avoidance of harm, consent and anonymity should be ensured (Saunders, 2019). In data collection there is a need to ascertain that the data presented in the research does not cause harm or intrude the privacy of the company or its employees. To ensure objectivity there is a need to ascertain that data is collected accurately and fully, as lack in these may reduce the quality of the project. (Saunders, 2019.)

3.4 Data collection

In this research process there are six defined phases that provide a logical structure leading to the intended research outcome. The data consists of: (1) Reflective Journal, (2) IM ticket observations and (3) raw data report from the system.

A reflective journal is kept tracking the qualitative and quantitative details, and the feedback that come up in trainings, ticket data, meetings, observations, emails and arranged evaluation checkpoints. Each new event is noted as an own row starting with the date, see Figure 6. A reflective journal should be a standard practice during an action research work and the journal should record events, thoughts, and feelings in the research as they happen (Coghlan & Shani, 2018). The journal should focus on reflection and learning as a deliberate thinking and analysing and should capture main three points: (1) What took place on the event, (2) What you thought and felt about what happened, and (3) What is your reflection on both. Importance comes from connecting the reflections on specific incidents so that echoes of these reflections can be found in separate incidents, especially to express what was learned and what was not and what actions were taken to follow-up. (Coghlan & Shani, 2018.) Figure 6 illustrates the way a reflective journal is established for this study:

Date:	Source of Details	What was it about	Participants	Reflection	Actions taken
25.8.2021	Define type of the source of details Training Ticket Data Meetings Observations Email Checkpoint	This part describes the content of the source of details.	Informs the roles of participants other than the researcher in the source of detail if any.	This part contains the reflections of the researcher on the what the source of detail was about. Includes considerations, thoughts, possible connections or points to consider.	If there was any actions taken based on the source of detail, they are listed here.

Figure 6: A reflective journal for tracking information, reflections, and actions.

Participant observation data collection takes place in observations which include email exchanges, meetings, and trainings between the participants of the process. The participant observations are especially taking place on the IM weekly meetings between the case company and the service provider. In these IM weekly meetings the researched area is covered in established agenda and current volumes of tickets and observed issues are

discussed. Extra meetings between different participants of the process being researched are arranged between the case company and the service provider experts when such are needed. Observations are written down in the reflective journal. Participant observation is used when the researcher is involved within the researched activities and influences them (Saunders, 2019). Benefit of participant observation is the ability to reach a deep level of immersion in using it to understand the social environment and nuances around the research area, while data collected can be complex and include quantitative and qualitative data. (Saunders, 2019).

Data collection from the IM incident tickets happen through observation in this thesis. To systemize the tracking of the tickets and their related details, a support tool is designed and programmed in Minor Cycle 1: Blueprint support tool. The support Excel VBA tool helps to ensure that the same data details are being collected from the tickets observed, and the programming ensures checks in the tool that a specific data are given in the format they are supposed to be obtained. The systematic approach and checks help to minimize human error. To build the support Excel VBA tool the researcher systematically checked 377 tickets from the IM monitoring system. The issues taxonomy established in Minor Cycle 2 is integrated into the tool to build understanding over the themes of issues that recurringly come up in the ticket monitoring. Document based data is often used as a primary data within research, however, it presents a difficulty locating the data, evaluating its usefulness in relation to the research questions and the objective (Saunders, 2019). This is common phenomena in cases where an organization grants an access to their database. (Saunders, 2019). Figure 7 illustrates the blueprint for the support tool.

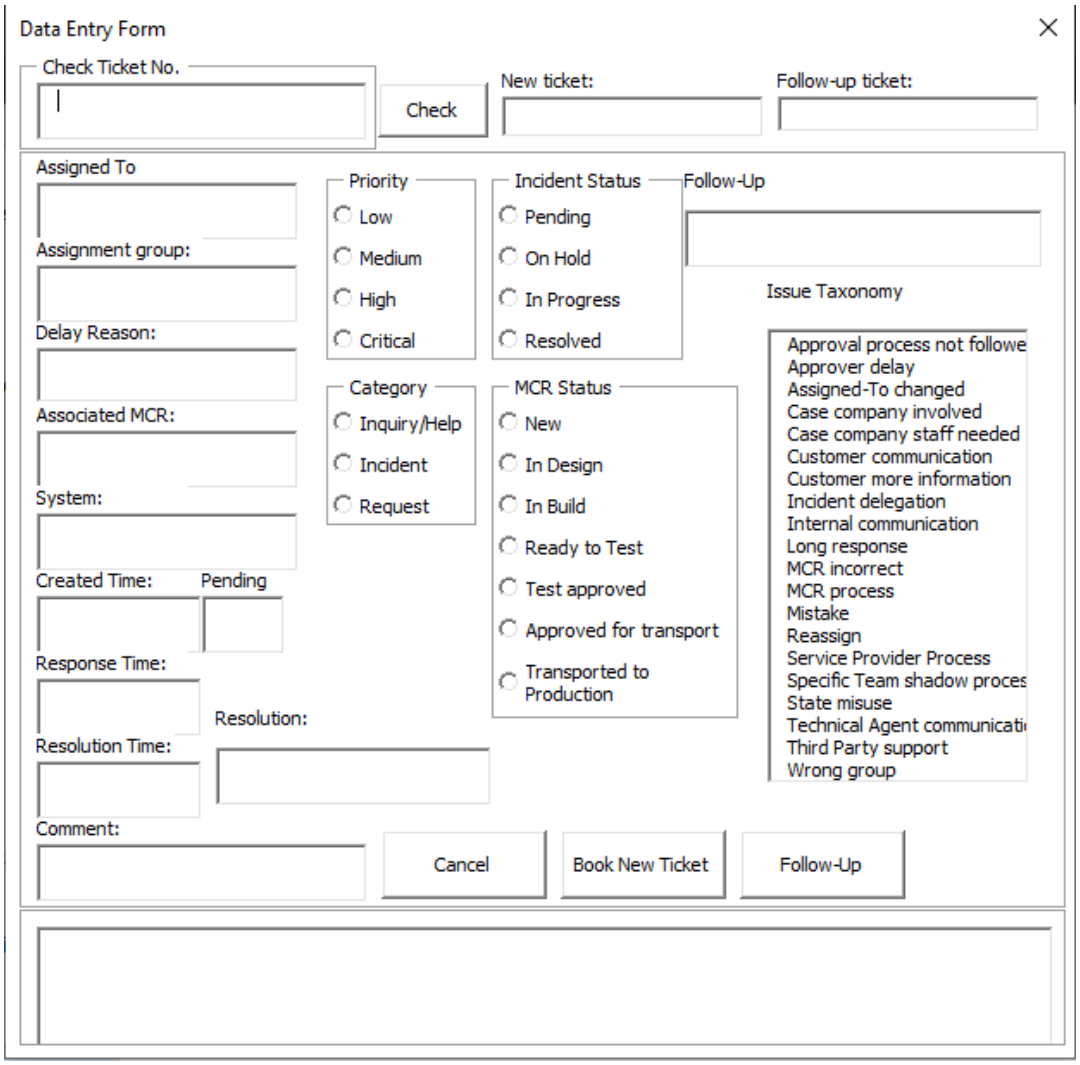

Figure 7: Excel VBA support tool blueprint.

When using the Excel VBA support tool, first the user checks the ticket number they are observing to understand if this a new ticket not previously observed or is this a ticket that is being observed again. If the ticket observed is a new ticket, then all the information needs to be filled if available for that ticket. If the ticket is a follow-up ticket, then the large rectangle shape at bottom of the Figure 7 will show the details per column already booked in the database with the booking date to ease the checking where to continue observing the ticket data since last time.

The issue taxonomy is established through a thematical analysis logic with the observation of 377 tickets based on the recurring themes, the current issue taxonomy with theme definitions in use in the Excel VBA support tool is illustrated in Table 1.

Issue Taxonomy	Explanation:
Customer communication	Communication from customer to ticket issues.
Customer more information	More information from customer needed.
Internal communication	Issues with transparency of communication on the ticket.
Third Party support	Delay happens due to support from Third Party.
Approver delay	Delay that happens due to approved.
MCR process	Delay that happens due to MCR process.
State misuse	When ticket is in wrong state such as Pending but work happens.
Service Provider Process	Used to circumvent tighter Response SLA limitations.
Technical Agent communication	Issues in communication from technical agent to anyone.
Approval process not followed	Approval process not followed by Service Provider.
Case company staff needed to resolve	Case company person is key contribution to resolve a ticket.
Case company involved	Case company person needs to confirm something.
Specific Team shadow process	Used to circumvent ticketing system use.
MCR incorrect	When state within ticketing system does not match state in another system.
Wrong group	Assigned to first group and changed from that to another.
Assigned-To changed	First assigned to a person and later changed to another.
Incident delegation	When incident is made by another person than by the person that noted the issue.
Reassign	When ticket is reassigned from one person to another.
Mistake	When there is a mistake in the process by Service Provider handling tickets.
Long response	When Service Provider response to ticket is nearing a week or more.
Customer confirmation	Ticket waits for customer confirmation.
Customer Action	Ticket waits for customer action.

Table 1: The Issue Taxonomy

Third data collected for the thesis is the raw data report from the ticketing system. This data includes both quantitative and qualitative data.

3.5 Incident Management Development

As the thesis uses mixed research there is a need to use data analysis for both quantitative and qualitative data. This thesis uses participant observations with a reflective journal to map down findings from diverse sources. The Excel VBA support tool with issue taxonomy allows to collect data for an understanding of the volumes of observed issues for Pareto Analysis.

During the thesis work there are two checkpoint meetings with the case company expert panel to follow-up on the current findings at the time, practical solutions, and challenges. During these checkpoint meetings the case company experts give their feedback to the presented findings, addition to checkpoint meetings there are weekly IM meetings where the case company and the service provider expert panel comment on the observations of the ticket monitoring. In a few cases a separate meeting was arranged between the

researcher and the expert panel's monitoring experts to cover specific findings in collaboration and to ensure collective understanding of them. The purpose of action research is through collaboration and co-inquiry with people to engage them for feedback and action (Coghlan & Shani, 2018).

A systematic reflection journal allows to check if some themes are reoccurring between different information sources, understand better the learning needs and the reflection on the content allows learning. With the action points the reflective journal helps to ensure that follow-ups are being taken as the thesis continues. Reflection is defined by Coghlan & Shani (2018) as a process in which the researcher steps back from the initial experience to question it and have insights. Not only is it necessary to describe the experience, but to conduct an analysis through exploration of connections between the behaviour and the outcomes, questioning ideas, and assumptions to build understanding. Reflection can only be conducted after what the researcher is reflecting on has already happened. While reflecting on an event that took place cannot influence the incident afterwards, it can help to define the direction in future what will take place. Reflection is often divided in three types: content, process, and premise reflection. Each type of reflection is critical in action research as they form meta-learning which is learning about learning. Reflection dynamic allows action research to be more than a problem solving or a project management solution. (Coghlan & Shani, 2018.)

The Excel VBA support tool with the issue taxonomy provides understanding of the themes of issues identified in the observations and as observations are booked into the tool database, they provide volumes. Quantitative data can be set around themes that emerge from the data and provide explanations for the findings in quantitative data (Saunders, 2019). The issue volumes help to identify and understand their impact in the monitoring and ticket processing, therefore establishing priority in which the issues should be tackled. The issue volumes will be presented in a Pareto Analysis and are the basis for understanding what areas of ticket monitoring could be improved. Pareto Chart is a way to compare categories to their volumes or total counts. The Pareto chart illustrates volumes of process breakdown in a decreasing order by a category, the visualization from highest to lowest volumes helps to focus attention to largest issues. (Martin, 2021.)

Quantitative analysis is conducted by using the KPI calculations introduced by Kumar (2018) and the SM metrics calculations by Brooks (2006). The raw data from system is taken into an excel-file and this will, with established understanding through learning process supported by the reflection journal, Excel VBA Support tool and issue taxonomy, enable understanding of the content of the data and their reflection in the system raw data outputs. The collected raw data is then used to calculate via Excel functions the different metric variances and presentation of volumes. The result for the report blueprint is checked with the case company expert panel.

3.6 Validation of results

The validation of findings and results in the study happens through the process of continual monitoring in the thesis to develop and improve the processes, the expert panel and triangulation. To ensure objectivity of the data, the researcher establishes a systematic way to collect the data introduced in Chapter 3.4 Data Collection. Coghlan & Shani (2018) recommend a systematic approach to understanding the research area. The observation collected in the Excel VBA support tool are validated through receiving feedback from the expert panel which consists of case company and service provider experts in service, monitoring, operational and technical areas. Figure 8 illustrates the expert panel feedback to the findings and results from the case company and the service provider, and the supervising and training received from the case company monitoring expert to the researcher.

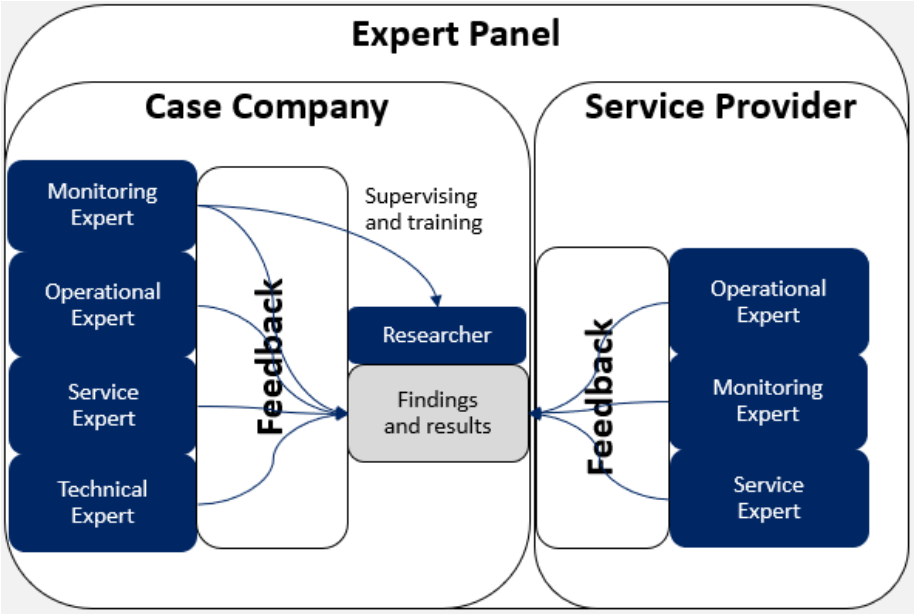

Figure 8: Expert Panel members and feedback on thesis findings and results.

Validation of the thesis findings and results happen in the IM weekly meetings with the expert panel and on a few weeks all the members may not be available. The thesis process includes two checkpoints within the cycle at the middle of the process and at the end of the process. Additional validation of the findings comes through practical implementation of the identified actions or tools in the case company processes directly. The purpose of the checkpoint meetings is to present the current findings, solutions and challenges identified to the case company expert panel and confirming the findings and to receive feedback. There are few extra meetings arranged with the service provider monitoring expert to ensure clarity of the findings and action points. Saunders (2019) defines validation as a process of verifying the data collected, analysis and findings to ensure their validity. When research uses Mixed Research method with quantitative and qualitative data triangulations can be used to confirm data and findings (Saunders, 2019). Participant validation happen when the data is sent back to participants to allow them to check the content of the data, findings and commenting on them. Participant validation is required in a process associated with action research due to the collaborative nature of the research. (Coghlan & Shani, 2018).

The thesis is conducted in phases to increase focus in certain improvement areas identified. As introduced in Chapter 3.4 Data Collection the researcher keeps a reflective journal for the duration of the research. Reliability can be increase by conducting the research

project in stages and writing memos (Saunders, 2019). There are number of challenges to reliability due to potential biases and incorrect interpretations. Only way to ensure that reliability does not suffer is to ensure the researcher remains methodologically rigorous in the way research is planned and conducted while remaining attentive to threats on reliability. (Saunders, 2019).

While the research was conducted in the case company, the established theoretical framework for BPM and IM processes are the same regardless of the organization. The approach can be adapted to fit the circumstances of a different company and framework to map down findings for any case. Generalization can be obtained by providing full description of the research questions, design, context, findings and following analysis of the research report (Saunders, 2019).

4 FINDINGS

This chapter covers the findings of the research, in the order of the Phases and which Minor Cycles are started and completed in relation to the Phases. The actual timeline is depicted in the Figure 9.

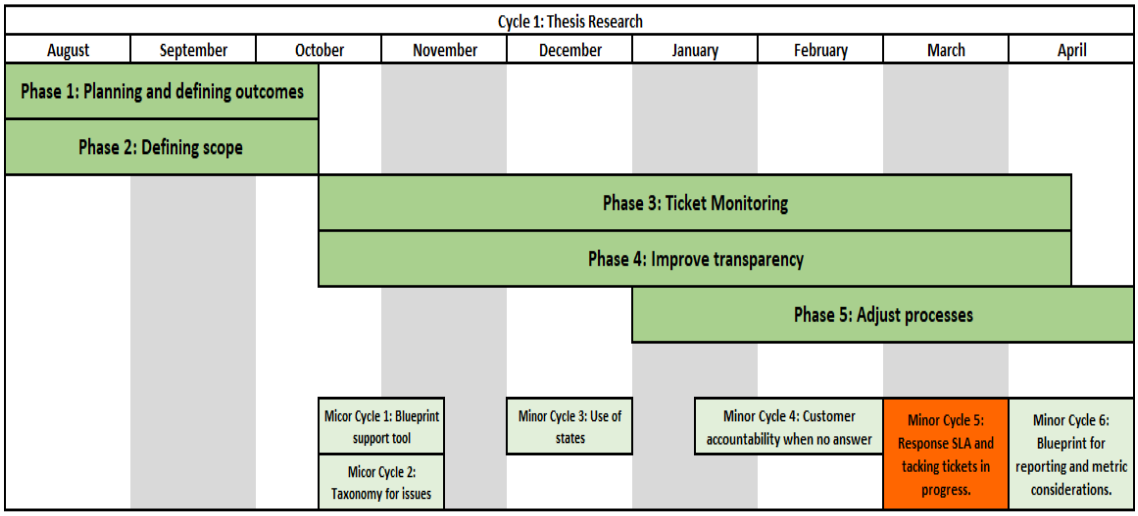

Figure 9: Cycle 1: Thesis Research timeline with phases and minor cycles.

4.1 Phase 1: Identify purpose and set desired outcomes

The purpose of first cycle of action research was to identify what the thesis should research within the case company and desired outcomes of the thesis work. The thesis purpose was concluded in two meetings with the case company expert panel members as they explored their pain points with the current IM monitoring. Due to the number of questions raised in the meetings, they defined the desired outcome to be in IM processing, monitoring, and reporting transparency and having a better understanding for taking actions within IM area. To answer the case company needs, the research questions are focusing on an objective and basic understanding of the content of the data from system and improving the system. With the case company expert panel, the identified purpose of monitoring is to:

1. Monitor incident activities of service provider.
2. Ensure the process quality meets the case company expectations.
    a. Expectations of transparency of processes.
    b. Expectation of documentation is up to date.

c. Expectation that communication is efficient, transparent, and clear.

A control point is set up to ensure the quality of the tickets monitoring by the researcher before the ticket observations are sent to the service provider and to ensure a feedback loop to the researcher. First monitoring observations are collected during Phase 1 and the current IM ticket monitoring relies on a person monitoring taking notes on a separate excel-file with five defined columns shown in Table 2:

Ticket No.	Reason of Observation	Service Provider Comment	Date of observation	Follow-up

Table 2: Current IM ticket monitoring details captured.

The first information is with ticket number on the first column row with following observations, comments, date of observation and follow-up on it. Part of this information is copy pasted from the monitoring system and observations are written based on the findings within the ticket chain details. There is a clear need to understand the agreements and ways of working with the service provider better, to understand how they reflect as actions within the system. In the case company there are limited amount of documentation available on the processes and the ones that exist cover high level process flow or generic details of IM. In comparison the Critical ticket management has been covered in high detail with clear processes set-up to ensure minimizing the impact of such incidents. It is brought up that there has not been time to monitor the tickets for six months due to growth of responsibilities.

As observations are provided to the service provider, it is noted within the case company that these issues are not new with the service provider and have been brought up before. It seems that some issues are known with the management in the case company and happen due to monitoring fluctuation. When monitoring is happening, the quality of tickets improves. However, when monitoring decreases the quality of tickets follow. There should be a more systematic way to approach this and ensuring monitoring can keep up. The Response and the Resolution SLA's have been very clearly defined, while the system has technical issue of calculating them still. As the technical issue is being fixed, there has not been set up a manual workaround to keep eye on the SLA development.

As the new set of observations are sent to the service provider, they deny that any gaps identified in the observed tickets and instead provide explanations. This seems to be a defensive action from their part as the tickets were checked with the monitoring expert from the case company before being sent. Often in the comments from the service provider there are explanations that are not related to the observations made, or they aim to justify action based on processes that are not recognized by the case company. The current way of how ticket monitoring is done does not seem very systematic and getting an overall picture of the issues seems time-consuming as the reason of observation can be lengthy text, which needs to be read to understand the context. Especially in cases when larger set of information are listed in the monitoring file and a quick overall picture needs to be obtained.

The observations listing details from system, with an issue taxonomy to state the type of issue was established to do the monitoring in a more systematic approach. The Excel based Visual Basic Application (VBA) code was used to create a supporting tool to map down details in detailed manner. The added benefit is that a systematic approach helps to understand the information in the system, the logic used and how they translate into the reports from the system. The purpose of the Phase 1 was to identify the purpose of the research and set desired outcomes. The identified purpose was to ensure data transparency and continual monitoring so that further analysis could be conducted in Cycle 2. This establishes the desired outcomes as the research questions:

1. What is the present performance of IT Incident Management ticketing system?
2. In what ways can the incidents be identified and acted upon more efficiently?
3. In what ways can the system be improved to ensure improved customer experience?

4.2 Phase 2: Define scope of research

Phase 2 purpose is to define the scope of the research to ensure the development project remains manageable. Discussion with the case company expert panel expressed a desire to implement the thesis projects over IM monitoring area in general. To understand the scope of the IM monitoring area discussed a meeting with the case company monitoring

expert was arranged. Checking the monitoring area under the case company department the volume of tickets between June 2021 and November 2021 was approximately 18 000 tickets on 11th of October. Checking the ticket volumes for the same time under one specific service provider there are approximately 2000 tickets. It was concluded that the smaller volume included only certain area of processes and SLA's, which made the research scope manageable. The processes included specific enterprise resource planning system and integrated services of a specific service provider, which would ensure the tickets contents were related to one system. The contract terms and SLAs needed to understand only include this service provider.

This scaled down research could later be expanded if seen useful for the case company. The aim was to establish a scalable blueprint for systematic monitoring with tools currently available. The scale of the research decreased naturally due to volumes of information available within the ticketing system. As ticketing system functions similarly in other incident management areas, the scalability of the solution could be a reasonable prospect with a proof-of-concept obtained in the smaller version.

4.3 Phase 3 and 4: Ticket Monitoring and Transparency

The purpose of Phase 3: Ticket Monitoring and Phase 4: Improve transparency are intertwined, as improving transparency of processes cannot take place without monitoring the incident tickets. Phase 3 focused on establishing a systematic approach to collecting data in the incident ticket monitoring done by the researcher. To support the desired outcome of Phase 3, Minor Cycle 1: Blueprint support tool was developed to help minimize the human error in monitoring, understand the system data points and ensuring data correctness in the support tool database. Phase 3 identified a further need for Minor Cycle 2: The taxonomy for issues, this was achieved through a thematic analysis of the recurring issues observer within the 377 incident tickets. The purpose of Minor Cycle 2 was to establish easier understanding over the themes of the issues through categorization and their related volumes. Minor Cycle 3: Use of states was started by the observations monitored during Phase 3 and was a needed action for Phase 4.

During Minor Cycle 1 the researcher switched to using excel support tool, which enabled quicker monitoring of incident tickets. The benefit of the Excel VBA support tool was that the built data entry form enables a systematic copy and paste of details from the ticketing system, and it ensured some data are given in exact format. In comparison to the manual established form, which usually included around ten observations on the tickets sent to the service provider, the Excel VBA tool enabled to cover twenty-seven tickets in the same amount of time. As there was no need to separately check the excel file and the content of the observation in text form, the excel tool enabled a quicker booking of data to the observation database.

Phase 3 started Minor Cycle 2: The taxonomy for issues built simultaneously with testing the Excel VBA support tool from Minor Cycle 1. Establishing the issue taxonomy required observations from the incident tickets and for this purpose was used June 2021 tickets at first. The issue taxonomy can and should be adapted to the current needs in the organization in the future. As the number of identified issues grew, it uncovered bottlenecks and directs attention to things that need to be solved.

Once the initial form of the issue taxonomy was established, the Excel VBA support tool was used to monitor current tickets from November 2021 to April 2022. The initial training material for the Excel VBA support tool was 90 tickets that were created in June 2021. By the end of April 2022, the number of tickets observed were 377 tickets. With the increased volume of tickets observed the agreed method of control in Phase 1 to check through the case company Monitoring Expert first before sending observations to the service provider Monitoring Expert was experiencing delay. This control point was removed to ensure the observations can be given in timely manner and the service provider will provide comments to the observation, which ensures the learning process and feedback.

Reactions from the service provider on the increased monitoring volumes included both refuting of the observations and later increased monitoring to ensure the quality of the tickets. Based on the observations sent to the service provider, often the initial response was defensive denial or providing explanations. The case company expert panel members in IM weekly meetings brought up on separate times that the case company should utilize the analysis provided by the researcher to improve the quality of their services.

Comparing June 2021 tickets and the observed tickets from November 2021 to April 2022 indicate that there are far fewer quality issues during June 2021. In November 2021 ticket observations there is a lack of communication transparency in the tickets. Internal communication on the tickets to understand what is happening with the ticket, how it is being resolved and why with these specific ways is missing. This lack of quality happens due to fluctuation when monitoring decreases from the case company, the service provider does not ensure agreed processes are followed. As these issues were identified, they were informed to the service provider to check and to take corrective actions during the Phase 3.

The case company expert panel in the January 2022 checkpoint approved the created excel-file use and the issue taxonomy. The expert panel as quoted "See a real benefit of having this kind of a systematic solution to gather observations on tickets in one place." The tool enables the case company to have a more systematic follow-up on the tickets, ticket issues and on the service provider to take corrective actions to ensure quality. The issue taxonomy as established raise concerns especially with the issue of "State misuse," as its purpose was to identify when ticket was paused in "On Hold" or "Pending" states meaning the SLA was not running. This use of wrong state would enable to circumvent SLA calculations and need to be carefully monitored.

In a weekly meeting with the expert panel, the researcher explained clearly what is expected from communication and transparency in the tickets: What is being done, why it is being done and how it is being done. To ensure quality the service provider took corrective actions by establishing a checklist for the incident ticket communication, what is needed, how it should be added and why as noted in the Figure 10.

F	G	H
Date:	Source of details	What it was about
20.1.2022	Meeting	Discussion on respecting the In Progress -state. Was agreed that we will hold treshold of mroe or less 15 minutes on On Hold -state without needing to move to In Progress. This depends also on ticket criticality. The service provider to inform me and the case company monitoring expert if they do not receive information from customer in timely manner to their inquiries. So we can escalate it to the customer and following to customers manager. If still no response close the ticket. -Holding customer accountable to ensure ticket resolution. Brought to the service provider attention that the case company wants to have more focus on CR issues and what needs to be resolved. Problem first approach. Action: Explained to the service provider that the case company want from communication on the ticket: What is being done, How it is being done, why it is being done. Explained that if this is fixed this should lower quality issues in the tickets.

Figure 10: Reflection Journal note 96.

The checklist was provided to the service provider technical agents and the case company for transparency. As part of the transparency, agreed adjustments in the processes should be written down in one place where all parties can check what was agreed and when. This would help the members of the case company and the service provider to check what has been taking place if agreements were made in a meeting they could not attend. At the same time, it helps to check retrospectively what has been agreed and what has not.

4.2.1 Minor Cycle 1 and 2

This sub-chapter explains solely the establishing of Excel VBA support tool purpose, how it was done and what it does. As the Minor Cycle 2: Issue Taxonomy could not be created without Minor Cycle 1, the former is integrated into this chapter. The findings of these supportive tools are introduced in Chapter 4.2 Ticket Monitoring and Transparency. Purpose of this chapter is to create transparency on the use and the technical aspects of the solutions. The Excel Support tool VBA layout, functions and codes can be found in the Appendices 1 to 6.

Minor Cycle 1: Blueprint support tool was programmed in a macro-enabled excel-file with Excel's Visual Basic for Application (VBA) code and Excel functions by the researcher. The file type was later changed into binary-type (XLSX) due to exponential size growth of the file making it unstable. Binary-type files are smaller in size and enable faster inserting of data and enable VBA to function. This tool allows a more systematic approach to the ticket monitoring. An Excel function to count throughput time between the time ticket was created, taken under work and time the ticket is closed was added to database-sheet. This information will provide more transparency on the processing times and give indication on the course of SLA's and performance of the observed tickets. Noted issue with the function to calculate throughput time is that it does not consider holidays nor pending time on the ticket. However, it still gives good enough measure to understanding on the Response SLAs especially. Later was included a check that if ticket were assigned "Resolved" state, the data entry form would demand a check on the resolution note content.

The Excel VBA support tool helps to ensure that tickets are not booked twice on different rows. When a new ticket is checked, the VBA checks if the ticket number was already booked in the tool's database-sheet, if not it will take it as a new ticket. If the ticket was booked in the database, it will instead enable follow-up and present already booked data with the last booking date to help the researcher to continue from the last date of observation. The observed pending time in tickets refers to the time a ticket is in state "On Hold" or "Pending," this detail was counted for observed tickets by the researcher with the precision of 15 minutes, which is indicated by value 0,25 in the ticketing tool. In the Excel VBA support tool Table 3 illustrates the details that are captured from the IM ticketing system:

Ticket number	Incident ticket individual number.
Priority	Priority given by system.
Status	State ticket is at during the time of observation.
Comment	Notes of observation if anything that needs to be sent to Service Provider.
Assigned To	Person the ticket is assigned to
Assignment group	Group the ticket is assigned to
Delay Reason	Issue Taxonomy categories
Associated MCR	If MCR process is related
Creation Time	Time of ticket creation
Resolution Time	Time of ticket resolution
Response Time	Time of ticket is taken In Progress or noted by Service Provider
Time in Pending	Manually calculated approximate time in pending.
MCR status	State of MCR
System	Related system the incident ticket is created to.
Booking Date	VBA automatically books the date of observations to the row when added.

Category	Which incident category the ticket belongs to: Incident, Inquiry/Help, Request
Follow-Up	If ticket comes across in the second time observation, this is used to book what follow-up decisions were made and the date of observation follow up comes automatically through VBA.
Resolution	Demanded when ticket is set “Resolved” state. This detail is observing the incident ticket resolution note and its clarity.

Table 3: Excel VBA support tool captured details.

The data taken was organized through a data collection tool that enables a systematic approach to collecting both quantitative and qualitative data from the monitoring system and organizing it to database within the excel-file. At the bottom of the Data Entry Form showcased in Figure 11, is a window which was used when checking an incident number that has already been booked, it brings the gathered details from the database visible to make it easier to know what has been checked last time and what actions if any were taken.

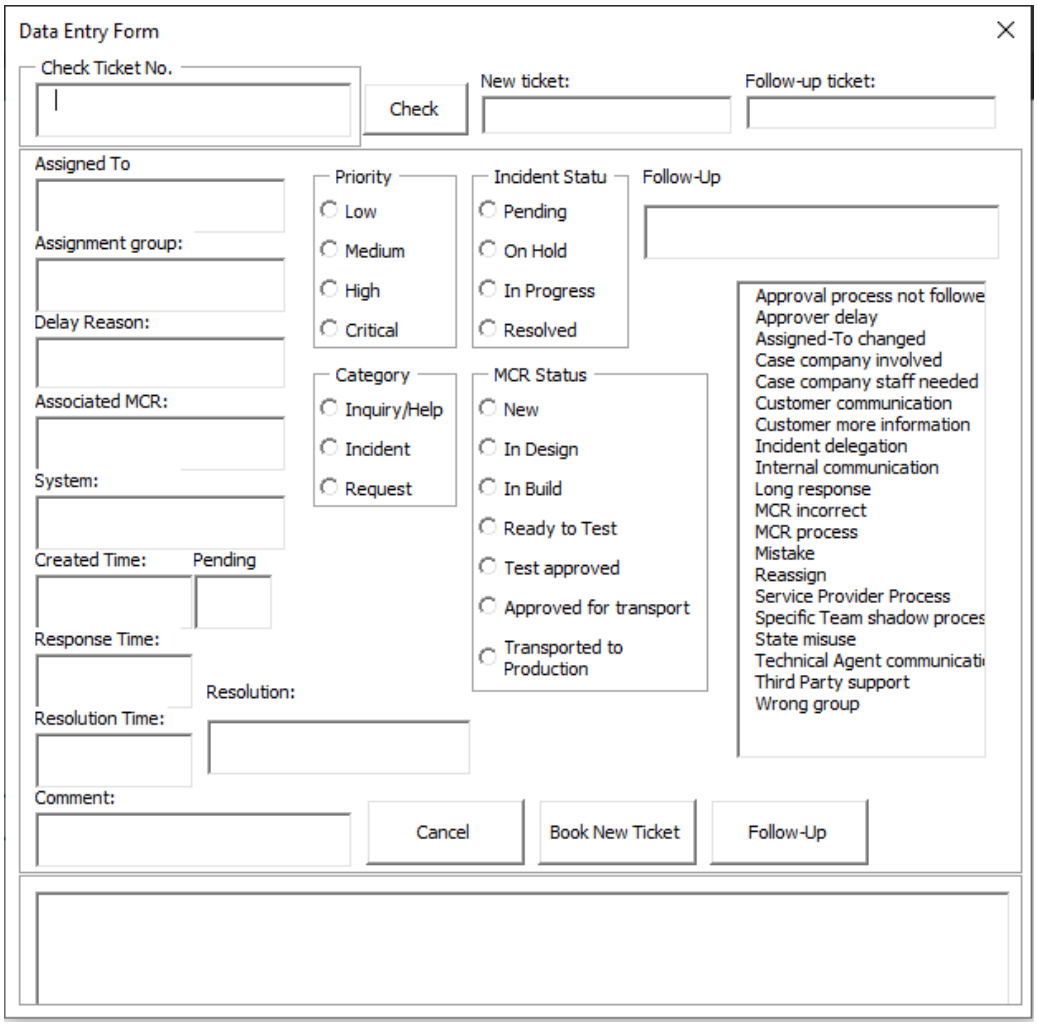

Figure 11: Excel VBA support tool Data Entry Form.

To support the systematic approach to ticket observations and to get indication on volume of types of issues the researcher established the Issue Taxonomy illustrated in Table 4. If a mistake or issue reoccurs often it was added as its own issue category if not fitting to the already established ones. The issue taxonomy allows quicker understanding on what types of issues happen and their volumes in the ticket observations. The volumes with the thematic categories can then be used as a basis for Pareto Analysis to help visualise the data and understand what issues identified are most recurring and should be targeted for corrective actions.

Issue Taxonomy	Explanation:
Customer communication	Communication from customer to ticket issues.
Customer more information	More information from customer needed.
Internal communication	Issues with transparency of communication on the ticket.
Third Party support	Delay happens due to support from Third Party.
Approver delay	Delay that happens due to approved.
MCR process	Delay that happens due to MCR process.
State misuse	When ticket is in wrong state such as Pending but work happens.
Service Provider Process	Used to circumvent tighter Response SLA limitations.
Technical Agent communication	Issues in communication from technical agent to anyone.
Approval process not followed	Approval process not followed by Service Provider.
Case company staff needed to resolve	Case company person is key contribution to resolve a ticket.
Case company involved	Case company person needs to confirm something.
Specific Team shadow process	Used to circumvent ticketing system use.
MCR incorrect	When state within ticketing system does not match state in another system.
Wrong group	Assigned to first group and changed from that to another.
Assigned-To changed	First assigned to a person and later changed to another.
Incident delegation	When incident is made by another person than by the person that noted the issue.
Reassign	When ticket is reassigned from one person to another.
Mistake	When there is a mistake in the process by Service Provider handling tickets.
Long response	When Service Prvoder response to ticket is nearing a week or more.
Customer confirmation	Ticket waits for customer confirmation.
Customer Action	Ticket waits fro customer action.

Table 4: Issue Taxonomy used in Excel VBA support tool

4.2.2 Minor Cycle 3: Use of states

The purpose of Minor Cycle 3: Use of states was to ensure with the service provider that in future the states in the ticketing system are used correctly due to their impact to the SLA calculations. This is an important measure which can impose penalties if breached. The aim was to clarify the use of states and what expectation cases there are.

There was only one allowed expectation to the use of “On Hold,” “Pending” and “In Progress” use and that was with a specific large process, which cannot be completed faster due to a system limitation. In this exception the ticket was allowed to be placed in the pause state to wait till it can be processed. The service provider with the lack of monitoring in the tickets have established a rule for themselves in which tickets can be paused before all communication related to the change of state are set into the system. The issue with this approach was that there was work being done and this work was not counted in the SLA. This approach had, however, not been agreed with the case company before being taken in use.

In the use of states, the service provider expert panel members wanted flexibility up to 30 minutes to add ticket communication notes. It was clarified that this is not the case and only up to 15 minutes delay can be allowed the tickets. Another clarification agreed was that sending a reminder to the customer of the ticket does not require change of state of the ticket. As the action does not take much time, and increased control would increase the monitoring complexity, signify extra step for technical agents and results in increased processing times. Third point raised related to use of states was the meeting calls with the customers or other parties related to the incident ticket. The service provider argued that there are passive and active roles in a call meeting and the technical agents were not actually doing anything during the meeting call. The researcher and the case company refused the argument. If technical agent is part of the call related to the incident ticket it is work to further the resolution of the ticket. The calls must be "In Progress" -state and no other option is allowed.

4.3 Phase 5: Adjust Processes

The purpose of Phase 5 was to adjust parts in the IM monitoring to ensure uniformity in the technical agents approach to processing tickets, ensuring common understanding between the case company and the service provider expert panel members and lastly establish a blueprint for the IM monitoring reporting. Phase 5 includes three minor cycles that were defined as necessary to achieve the intended outcomes. Minor Cycle 4 focuses on establishing customer accountability and related process streamlining. Minor Cycle 5 aims to clarify Response SLA and in progress use, however, it was decided not to be implemented in practice. Minor Cycle 6 builds the blueprint for reporting based on the raw data available from the system by using BPM and SM metric calculations.

By adjusting the processes, the aim was to ensure that there was mutual understanding on what was expected from the service provider with the processes. At the same time there needed to be consideration for the impact of the change and the desired outcome which was "efficiency." If the impact was considered to not add further value to the process or increase unnecessary steps, then it should not be implemented. As there are expectations for the service provider, there was a need to consider the customer side as part of resolving the tickets. As there have been identified several tickets in Phase 3: Ticket Monitoring in

which the ticket state went to “On Hold” or “Pending”, this was handled as a separate process to first understand the process and to ensure the approach was fitting.

4.3.1 Minor Cycle 4: Customer accountability

The Minor Cycle 4: Customer accountability aimed to set up a systematic and shared approach to handling tickets in which the customer was expected to provider further information or take action to progress the resolution further. In the current approach the customer was waited for more information or action and sending several email reminders to the customer, without clear picture at what point the ticket should be escalated to the case company or be closed.

The customer responsibility must be established for the tickets they open, customer can be expected to provide more information or act in timely manner if requested by the service provider. Customer accountability formed the Minor Cycle 4, first by identifying different cases that came up and building better understanding what was the current setup in these cases. The current setup of waiting for customer response or action was:

1. If no response, send a reminder.
2. Send another reminder.
3. At some point include case company monitoring expert.
4. At some point the monitoring expert contacted the customer
5. At some point the monitoring expert escalated ticket to the customer and their supervisor.
6. At some point the ticket is closed if no response.

The current setup seems heavy in delay and the reoccurring checks tied up resources that could be better placed elsewhere. Issue was that there are no set defined timelines when reminders should be sent or how many reminders, which can prolong the processing. After checking incidents, the researcher proposed and checked with the expert panel that new setup is:

1. Service Provider contacts the customer up to three times for details, reminders included.
2. In case of no response, escalate to the monitoring expert and the researcher.

3. The monitoring expert or the researcher will contact the customer once to prompt a reply.
4. If no response, a second email was sent to escalate to the customer and their supervisor.
5. Third reminder is the last reminder, if no response within a week, the ticket will be closed.

4.3.2 Minor Cycle 5: Response SLA

Minor Cycle 5: Response SLA aimed to ensure that taking incident tickets “In Progress” -state from “New” would happen only when they can immediately start to be worked on. The aim was based on the BPM metric calculations that would help to understand if the current resourcing was able to manage the ticket volumes arriving to the service. At the same time, the calculation would help to understand how many customers are waiting for the service. Additionally, there was a consideration that the service provider was circumventing the tighter Respond SLA by taking tickets to wider Resolution SLA.

Phase 3 identified incident tickets which had been “In Progress” -state for a few days up to a week with no transparency if anything was taking place in resolving them. These observations lead to consider the possibility that Response SLA was being circumvented. The second adverse impact was that quick responses will not enable a realistic perception of the customer queue waiting service, or the resourcing capability to manage the tickets. Consideration by the researcher was that by adjusting the process that tickets are taken only to “In Progress” -state when they could be worked on.

The adjustment was discussed with the expert panel. The service provider explained that the same outcome would be attained through different KPI’s and metrics already in use by the service provider. It was agreed that this measure would not be implemented. Checking with the service provider the only metrics and KPI’s in use are illustrating the volumes of closed and opened tickets.

4.3.3 Minor Cycle 6: Blueprint for reporting and metric

The purpose of Minor Cycle 6 was to investigate how the current available data from the ticketing system could be better used to give an improved understanding over the service and performance levels provided by the service provider. Current reporting from the service provider focused purely on the volume of tickets that had been created against the volume of tickets that had been closed. While there was coverage of ticket volumes that are in other states than open or closed, the monitoring is straightforward. The ticketing system raw data provides some details that could be used to establish reporting and basis for calculations. Checking the provided report from system following column names are necessary:

1. Number – Ticket ID.
2. Priority – Criticality of the ticket.
3. State – Current state of the ticket.
4. Assignment group – Team responsible for handling.
5. Assigned To – Person responsible for handling.
6. Closed – Date and time the ticket was closed.
7. Contact type – Way the ticket was created.
8. Created – Date and time the ticket was created.
9. Created by – Who was the person creating the ticket.
10. Service offering – System the ticket is related to.

While the above column names provide some information, there was a need to extract some data from the given information. A column with header “Process time” was added which calculates the total processing time from the time ticket was created to time the ticket was closed. This calculation gives total service time per ticket.

In the prototype report was added another page with pivots based on the available data taken from the system and the total service time calculated though an excel function. The first pivot table monitors each ticket closed per resource per priority of ticket for each month. Each ticket has their processing time visible in the pivot table. To get insight of the allowed total processing time, the calculation was Respond time plus Resolution time and times that by 1.05. Each priority is calculated separately, and the formula is:

Process instances running late more than 5%: (Respond SLA + Resolutions SLA) x 1.05

Both the cases that are late and the cases that are within the process instances running late more than 5% calculation are noted. There are separate columns which only indicated they are late by text “late”, while the other four columns capture the processing time. In the last check are the cases that did not exceed Process instances running late more than 5%. Next two pivot tables showcase the count of created tickets and closed tickets in a month divided to the hour of creation. Each priority had their own column to indicate the volume. The intention of these pivots was to showcase the times tickets are commonly created and times tickets are commonly closed. The last pivot table showcases amount of ticket closed per resource per each month by the ticket priority they closed, in some months there was left a blank value to indicate that no assigned to was pointed which is a mistake by the service provider.

In the third sheet of the reporting file was used functions to capture minimum, averages and maximum process times from the pivot table sheet that listed process times per ticket for each priority. The purpose was to establish an understanding over the variance of processing times. First process time was calculated for each month per priority with their respective minimum, average and maximum process times. Functions used for calculations are demonstrated in Table 5:

Process time	Excel function
Minimum time	=MIN(Range)
Average time	=AVERAGE(Range)
Maximum time	=MAX(Range)

Table 5: Reporting functions in Excel used to calculate processing times.

For calculating the process rate per month following calculation was used:

> Process Rate = Number of tickets created in the priority class for that month / the work time in the month.

The work time in month was calculated by bank days, holidays are not included in this due to differences between two countries and the impact would be minimal against the

gained benefit. Working time per day was 9 hours. In the next part was calculated the Process time minimum, average, and maximum and process rate for each resource within the month. The calculations and excel functions are the same as mentioned above. To this was added another part which indicates the number of closed tickets within the period of month per priority, to accompany the process time and process rates. The volumes and priority were included to understand which priority cases were the basis of the process time.

In the third part of the sheet were placed the count of total created tickets per month with the count of total closed tickets per month. The ticket volumes can then be used to calculate Arrival rate, Service Rate and following Traffic Intensity per month. Table 6 shows the calculations for each respective rate:

Arrival rate	Total of tickets created per month divided by month working hours
Service Rate	Total of tickets closed per month divided by month working hours
Traffic Rate	Arrival Rate of month divided by Service Rate of month

Table 6: Arrival, Service and Traffic Rate calculations

Additionally, in the sheet was calculated the average cases of tickets which exceeded the throughput time per priority in total. Followed with average for month, in this calculation month was standard 30 days. Third calculation is the average delay per priority for cases that exceed throughput time. The same were calculated for cases which were within the throughput time for comparison and added a percentage of tickets closed within the throughput time per priority.

With the Excel VBA support tool created during Major Cycle Three and Four, there were data that can be used to indicate the percentage of error against the total volume of observed tickets. This in turn can be used as a basis for Pareto Analysis to indicate what issues created the top 20% of cases in the issue taxonomy. In total observed issues volume was 508, while observed tickets volume is 377. The volume of issues per issue category

are in Figure 12. In Figure 12 the blue columns indicate the total volume of the issues observed, while the red curve indicates the percentage of the issue category from the total volume of issues. The aim of Pareto Analysis is to focus attention to the highest 20% categories causing issues first for correcting. Wrong group does not include an action point, due to it not being exact enough and it was including many options why they have been observed. The definition needs to be further defined for future uses.

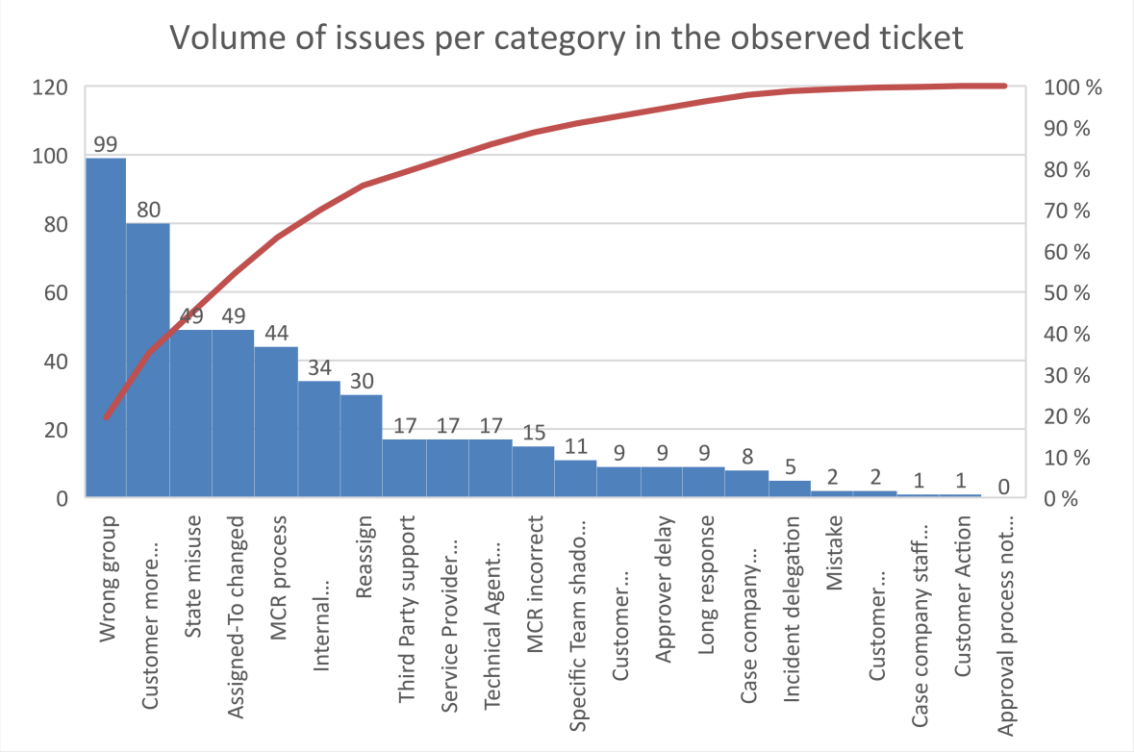

Figure 12: Pareto Analysis of observed issues defined by Issue Taxonomy.

The outcome of Minor Cycle 6 was checked and evaluated with the case company expert panel. The case company expert panel especially interested in checking the Traffic intensity rate, variance in process times and distribution of ticket closing between different hour times per month. It was concluded that more time was needed to check the data and their relationships. The expert panel was provided the blueprint report and the researcher with the monitoring expert are to check processing times to better understand if there were commonalities between them. Additionally, to understand better the closing pattern of tickets between months on the hours they were closed in and the resources list and people in it. To understand if there were unnecessary resources with accesses that do not

actually contribute to closing tickets. The analysis and optimization will be started and completed in Cycle 2, which is not included in the thesis research.

The second highest category Customer more information in Figure 12 was concerning and simultaneously found hard to tackle, as the instructions for the customer raising a ticket do include providing enough information, yet it was not followed. State Misuse-category is concerning due to the direct impact to SLA calculations and stronger actions from the service provider were wanted to ensure this volume decreases. The expert panel was also interested in understanding the volume in cases where the Assigned-To detail did not match the people conducting the work as shown in the ticket communication, a new category "Work Check" is included for further observations.

The expert panel agreed that suggested agreements file will be created which will include all the agreed adjustments from now on to be recoded in one place. This is to ensure shared understanding what has been agreed and to provide people the ability check what has been agreed in the past from one location.

4.4 Summary of results

As the research was an iterative and collaborative process to first define the research area, Phase 1 focused on identifying what was the purpose of the research. Through discussion with the case company expert panel, observations on the processes and reporting it became clear that to answer any improvement suggestions there the step is to establish understanding of the area. To have a possibility to measure and evaluate processes there needs to be available information to help decision making. This required establishing a systematic approach to understanding the processes, available data and turning that information into actionable reports.

In Phase 2 the scope definition was decreased from the original intent of covering the entire IM due to the high volume of tickets in the system and them covering several processes and SLAs that all were unfamiliar with the researcher. The scope while decreased would allow scalability due to the uniformity of availability of system data.

Phase 3 and 4 focused on establishing the systematic approach for the research in practice. Starting with understanding the current ticket monitoring, a need was identified for a more structured method to book the ticket monitoring data to ensure uniformity and to understand themes of issues within the system. In Minor Cycle 1 and 2 a supportive Excel VBA tool that helped to book data in a uniform form by implementing programmable checks and placing data in correct columns was built. Additional benefit of the Excel VBA tool was that it helped to understand the data in the system in a practical manner for Minor Cycle 6 when checking the system reports. To ensure a more uniform method an issue taxonomy was established with recurring issue categories with definitions to ensure continuous and fair treatment of observations.

The proof-of-concepts for the thesis solutions was obtained in meetings with expert panel, which lead the service provider to take actions to check details within the processes. The support tool and issue taxonomy were checked and evaluated with the case company expert panel. The expert panel identified that the systematic approach combined with having details of observations in one place adds value to the process. Through the more systematic approach the service provider takes actions to provide corrective actions internally to ensure process quality. Additionally, the issue taxonomy with the Excel VBA support tool enables a possibility to make a Pareto Analysis chart to visualize clearly what constituted the 20% of top issues within the observed tickets.

Phase 5 focused on delivering Minor Cycles that aimed to tackle specific issues that had been identified in Phase 3 and 4. Minor Cycle 3 outcome were the clarification that all tickets must include meeting times with anyone which was related to the ticket as “In Progress” state. Additionally, it was agreed that 15 minutes threshold was agreeable in the change of states, therefore, quick actions would not be slowed down by too tight control. To support this, the service provider at own initiative established a Checklist for their technical agent’s support. The checklist included what information needed to be included, the what, the how and the why of actions taken, who were the participants in the meeting calls, date, and time when the meeting was arranged and as well what the outcome of the meeting was.

Minor Cycle 4 outcome was establishing a rule that the service provider was to contact customer up to three times for more details or action, including the reminders. If no response from the customer, then escalation was done in the case company. The case company would then contact the customer once. If followed with no response after the first contact by the case company, the second contact included an escalation to the customer and their supervisor. The third time case company contacts the customer, their supervisor included, the case company states the ticket is closed within a week if no response.

Minor Cycle 5 lead to no change implemented as a discussion over this change with expert panel concluded that other metrics and KPI's catch if the tickets are too long in the system in reflection against SLA. However, it did lay foundation for Minor Cycle 6 in starting the discussion over metrics and KPI's in use.

Minor Cycle 6 identified a report blueprint with BPM and SM calculations was established that give insight to the volumes of open and closed tickets per month and processing times, rates per month and resources. Additionally, Arrival Rate, Service Rate, Traffic Intensity, Throughput times with the exceeding tickets volumes and tickets within the throughput times were calculated. These calculations were done on month accuracy and per resources. The Excel support tool with issue taxonomy enabled to establish Pareto Analysis to better present observed issues, while improving the observation accuracy and efficiency. Through Minor Cycle 6 was agreed with the panel of experts to start a file where all future adjustments to processes or agreements are listed for transparency and shared understanding.

5 DISCUSSION

This chapter reflects the findings against literature and produces a more detailed discussion and interpretation of the research and how they answer the established research questions. The IM monitoring process was researched and analysed, which enabled actionable improvements through the action research process which lasted nine months, included five Phases and six Minor Cycles with weekly meetings with the expert panel members, two checkpoints with the case company expert panel. As the outcome of this study a support tool was created which improves the ticket observations to identify delays and bottlenecks. In practices the ability to identify and correct delays and bottlenecks will help to attain improve the end customer satisfaction. Through the study conditions for the use of metrics and KPI's and development are set for the Cycle 2: Analysis and Optimization.

5.1 Approach to development project

This research uses the action research logic to establish understanding over the research area, co-creation of value and evaluation. This is supported by BPM implementation methodology to implement a more systematic structure and in a sense a process-approach. The systemic approach is built through implementation of existing technology, to increase efficiency and accuracy. Pham & Pham (2017) express that development should be catered on people who are motivated and extend them the support needed to accomplish the project. Coghlan & Shani (2018) identify action research as management method with cyclical process to construct, plan for action, taking action, evaluate action. Chang (2016) specifies that BPM is a systematic and structured way to analyze, improve, control, and manage processes with the aim to improve the quality. Chang (2016) identifies steps as commit, research as primary steps to starting a development project followed with analyze, design, implement and support stages in a cycle. Both action research and BPM implementation methodology have same steps and can easily be implemented within a business environment and adjusting the current needs. Pham & Pham (2017) argued that flexibility and collaboration are two central values of agile approach in today's IT

departments. With the IT departments desire to adopt to agile methods action research with its in-built flexibility and collaboration is an excellent fit.

Both action research and BPM implementation methodology give a structure to the approach of research, even if the researcher is not an expert of the area. Coghlan & Shani (2018) identify that action research is especially fitting when the research through participation impacts changes in the organization, improves learning outcomes and in cases of non-expert starting the process an adjustment of supervising is added. Action research identify co-creation of value and collaborating with people to get results as the corner stone's according to Coghlan & Shani (2018). SM identify the same parts as action research as the core for management to include people, workflows, and IT according to Hoerbst, et al. (2011) and Agguter, (2020) adds co-creation of value. Usually in organizations no development project is started, done, and completed without association of people for feedback, ideas, and their contributions. Additionally, the findings during the projects are not usually entirely known even though a tentative plan has been established. Action research as evolving process promotes collaboration and collaborating with people to ensure best outcome as explained by Coghlan & Shani (2018). Adding BPM implementation methodology aspects help to ensure points of control, between stages to ensure that the project does not drag on. As Chang (2016) explains that idea inclusions should be closed to ensure the project does not continue to grow beyond control.

5.2 Ticket Monitoring and Transparency

Chang (2016) argues that more efficient processes should be developed with the use of existing technologies. In this study through Excel VBA tool have been presented as a solution that each user could adapt to their situation and Pareto Analysis with the issue taxonomy will illustrate their findings in the data to act on. Even if the actual Excel VBA support too is not used in practice, it showcases what important data points to capture for efficient monitoring of tickets might be and they can be adapted to other applications. Calculations for different measures and rates are introduced with their formulas to use for other cases. As Agguter (2020) explains best practices are proven activities that have been successes in other organizations.

Agguter (2020) argues that supplier management is needed for organization to ensure level of performance. To manage suppliers there is a need for transparency, consistency, communication and understanding the performance levels as agreed by Agguter 2020, Gudelj, et al. (2021), Kumar (2018) and Werner, et al. (2021). Considering the number of researchers agreeing to the importance of monitoring consistency, it is a surprising find in the thesis that the monitoring by case company was not taking place. There clearly is a need for a more systematic approach and less arduous process to enable quick and easy access to understanding what is happening within the IM area. Kumar (2018), Hobbs (2011) and Mahalle et al. (2020) stress the importance of connecting the information to actionable points, otherwise all tickets remain separate incidents. Martin (2021) illustrates that Pareto Analysis is an excellent tool for exploring and understanding categorical issues. In this thesis the issue taxonomy is established to have an easier understanding on the issues that are recurring and how often they happen, so that bottlenecks can be cleared fast. Pareto Analysis was used to visualise the collected data. The case company expert panel had an idea of the issues, however, there was no actual data to demonstrate the issue and their development prior to this thesis. Chang (2016) expresses those unmonitored processes create risks.

Kumar (2018), Gudelj, et al. (2021) and Werner, et al. (2021) that understanding the processes are essential for any consideration of evaluation and improvements, and these require consistency of monitoring. As the case company had no actual prepared data for decision-making, getting a clear picture of the current situation required to establish means of obtaining information in an objective manner and information that would be measurable and comparable. Agguter (2020) further argues efficient relationship management and transparency requires understanding of different stakeholders' needs and a process for co-creation of value. The findings of the thesis support that when parts of the processes were clarified and established in a systematic approach with specifications, the quality started to improve in the observed tickets.

Establishing measurable metrics and KPI's are considered essential in BPM and SM for improved understanding over the processes as stated by Werner et al. (2021) Jebraeily, et al. (2019) and Hobbs (2011). Agguter (2020) argues that the measures and KPI's should not be implemented to monitor individual performance but team performance. However, Kumar (2018) points out that cost is an important variable for KPI's. It can be argued that

if the quality of provided service by technical agent does not meet the required standards, they are unnecessary costs for an organization. However, the aim of KPI's is not in ensuring unproductive staff members are caught, but to identify what is not functioning. When what is not functioning is identified, corrective actions can be taken before it becomes an issue. Therefore, it is important to understand whether employees can meet the requirements. If not, then the question is, is there a need for further training or are the established expectations and KPI's unrealistic.

5.3 Adjusting processes

Agguter (2020) states that the customers of IT services expect availability, responsiveness, and communication from IT with the technology meeting their wants and needs. Even BPM is stated to be an approach to meet the end customers' expectations by Gudelj et al. (2021) and Chang (2016). The metrics and KPI's established by Brooks (2006) and Kumar (2018) measure performance of the service and often focus on the technical agents working on the tickets, with few measuring the queue itself. Kumar (2018) states a need to understand the reasons for the delays to get to the root causes. If more information is needed from the customer, the thesis findings support that the question from technical agents to the customer must be readable, understandable and have specific questions to the customer if something is needed. There is a need to consider the customer accountability towards the resolution of the ticket. Incident tickets do get stuck when the customer who raised the incident do not provide more information or take actions when asked to by the technical agents. No action or communication from the customer ties up the resources from the IT department to do periodical checks, discussions between members and therefore increase loss of productivity. In the thesis it was seen as a necessity to ensure the customer accountability is established with clear reminding process, escalation process and finally closing the opened incident ticket if no response is received.

Brooks (2006) states that even IT metrics monitored should be reported in business terms. While Agguter (2020) identifies metrics, measurement, and reporting as an essential part of functional SM. Chang (2016) argues that the purpose of monitoring is to enable analysis of information and therefore information must be captured in an understandable form. Kumar (2018) argues that without understanding the data there is no possibility to

optimizes the processes. The purpose of KPI's and metrics according to Werner et al. (2021) is to identify abnormalities. Gudelj (2021) states that the information from monitoring enables stronger decision-making and understanding the impacts of actions. At the start of this thesis, it was established that none of the case company panel of experts had a clear understanding of the current way of monitoring and what was happening with the processes. There was no established reporting other than the one produced by the service provider, which is just volumes of opened and closed incident tickets, without real analysis done on the content. Through the Excel VBA support tool this thesis provides better understanding on the number of errors in quality and easier method to take the data to decisions and actions. Secondly, checking the blueprint of the suggested reporting measures already in its first form introduced discussions points for the case company expert panel and interest to understand them more closely.

6 CONCLUSION

This chapter purpose is to clarify how the thesis research answers the three research questions. These explanations are included with the recommended actions for the case company in the checkpoint meetings arranged during the process of the thesis work.

The research question was answered as follows:

1. What is the present performance of IT Incident Management ticket monitoring system?

The present performance of the IT Incident Management ticket monitoring system in the case company is established in Chapter 4 through Phases 1, 3 and 4, and 5. The current way of keeping notes of observations from system tickets relied on manual writing of data to personal separate excel-file, with the explanations of observations being sentences. As the file is personal it has limited access and no methods to quickly gather overall picture without having to go through the reasons of observations compared with the service provider comment explanations. The system used for the IM incident tickets cannot calculate Response or Resolution SLAs for the time being and there are no other metrics, KPIs or manual SLA calculations conducted.

Monitoring of incident tickets have not been carried for six months, attempt to quickly gather an overall image what was happening in the tickets concluded in being too time-consuming process to be done in a brief time. The service provider provides a weekly presentation on the volumes of created tickets and closed tickets, which then are further split between different states and areas of operations where they occur. This presentation does not include the quality issues that emerge in the tickets and such monitoring is not actively done by the service provider, or at least such issues are not brought to the case company. Observations of the tickets are stored in the personal file and are sent in a separate email to the service provider who then provides agreements or disagreements to observed issues.

There are high level documentation on IM area, with specific process flow map and explanations for Major Incident Management, which are Critical priority tickets in the IM

ticket system. These measurements are done systematically and are not missed. Agreements made in regards of the IM processes are often done in meeting discussions which rely on the service provider note keeping skills and can be found in their respective weekly meeting presentation file. In some cases, agreements or decisions made are between few individuals and there is no agreed place to keep this information for everyone to access or to check later.

2. In what ways can the incidents be identified and acted upon more effectively?

Each Minor Cycle identified and conducted aimed to improve the processing of incident tickets either by clarifying their content, ticket communication and transparency or transparency over the data that is being collected by the system or through weekly observations on the incident tickets. Minor Cycle 1 and 2 resulted in practical solutions through establishing the issue taxonomy and the Excel VBA support tool for ticket monitoring. Systemising the approach to monitoring by creating a ticket observation database first on a personal file. The Excel VBA support tool helped to clarify follow-up on the already observed tickets in the point that it made easier to check what was observed last time and when the last point of observation was made.

This systematic approach is acknowledged as the research moved forward and resulted in actions from the case company and the service provider to improve the quality of IM processes. Ensuring the quality is essential as foundation for understanding how to identify and act upon the incidents more efficiently. Minor Cycle 3 resulted in mutual understanding of ticket states, which are basis of SLA calculations. From monitoring perspective Minor Cycle 6 establishes the process and service calculations based on the available data. Establishing more transparency which tickets should be acted on based on processing times and delays averages. The aim of the report is to mitigate formation of issues before they take place, rather than pinpoint what issues there are. Therefore, if processing and service time calculations start to exceed averages or nearing average throughput times, it should help to identify to check what is happening with a specific incident ticket.

In the other hand where the service provider and the case company IT departments are held accountable for quick resolution of incidents, there must be accountability for the customer actions. Through Minor Cycle 4 the research clarified the future approach to

ensure if technical agent inquiries are not responded to in a timely manner there is clear escalation pattern and closing of case if no reply. The established approach helps to minimize the impact of no response tickets in locking up resources to check them and waste of time and costs associated.

3. In what ways can the system be improved?

Ticket monitoring and observations should be able to be done in the ticketing system. The expert panel members should be able to place quality notes on the tickets where quality issues take place, without having to use an external application for such notes. This would streamline the ticket monitoring process to happen in one place, in comparison to having three different systems in use to cover these issues. The added benefit is that these observations then should be able to be taken out in the system report as their own column, which would then enable monitoring issues volumes more efficiently. As the suggested improvement is related to technical development, the alternative improvement would be to place the ticket observation file in a common location for the expert panel members to access. Implement a weekly routine when observations should be done and when the service provider checks the new observations. This would remove the unnecessary emailing of observations, ensure quality of observations in the file correspond the common reality between the expert panel members, and the expert panel have a way to check what types of issues are coming up.

Reporting should use the data available from the system and favourably be automated. While actual automation to have reports from system may rely on the technical development of system, alternative way is to establish a report blueprint where the data from system can be copy pasted from excel file. Having readymade template report in which the raw data can be updated easily allows more timely reports from the system for checking. This report with processing times and process throughput time calculations would help to identify incidents that are about to breach the SLA's. Understanding the variances between process times, rates and volumes help to have a better clarity which cases stand out and should be checked. Checking the cases then would help to identify the root causes of negative development for the processes and help to enact corrective actions. Additionally, it could help to give understanding over the areas that are high on volumes and the spread of volumes throughout the year.

6.1 Practical implications

There is a strong recommendation to ensuring that monitoring of tickets is kept continuous. When attempting to evaluate processes there is a clear need to clarify how to processes work, what the expectations from processes are and whether those expectations are clearly communicated. A systematic practice should be implemented to keep information available, shared and agreed practices and changes should be documented for later checking in one place so that they are commonly understood by all parties involved. To improve processes, there needs to be historical data available that can be used to understand the current performance, its weaknesses, and strengths and for this data transparency and common processes are imperative. The case company does have follow-up actions in the form of analysing and optimization cycle starting after based on the reporting data provided by the thesis work.

6.2 Limitations and further research

While the outcomes and the context presented in this research work in this case company, they may not apply to other cases. A limitation of this study is that there is a need to work for adapting the solution to be used in other cases, mainly because organizations tend to have their own adaptations of processes. The BPM and SM metrics and KPI's are adaptable measures for any case and commonly identified metrics cross-industries. Regardless of the industry a quick recovery from technical incidents and minimizing their impacts is essential for daily operations.

BPM process improvements are a complex process in any organization and require a long-term commitment to carry through with understanding the foundations that current settings have created. As organizations, people and processes are often vastly different cross-organizations and industries there is difficulty to establish one model to fit them all for improvement approach. Findings of this iterative research to explore and evaluate case company's monitoring approach and processes cover a specific function within the company. With BPM methodology, action research and Agile and ITIL thinking within the case company the approach of the research was naturally fitting. Literature research in BPM, SM and Action research support the notion that approach to researching an area

should start from understanding the current situation and fitting the solution to that context.

Researching the established processes and evaluating them require time, collaboration and understanding of common ground rules and wants of different stakeholders. While the actual size of implementation was just a portion of the case company IM, there is a scalability side of the presented solutions to include more data or to specify the tools for specific area. While defining the research into either quantitative or qualitative research would have been possible, to better understand and create practical value for the case company mixed research helped to reach better results. Further research could focus on implementing the methodology in this research to different application or even a larger data set. Other research questions that rise is for technological research such as data analysis and automations to check how implementation of researched features could be done, or how better understanding over the data available could be established. The same study could prove be interesting to be conducted from the service provider side to see how the case company actions influence their operations in a similar context.

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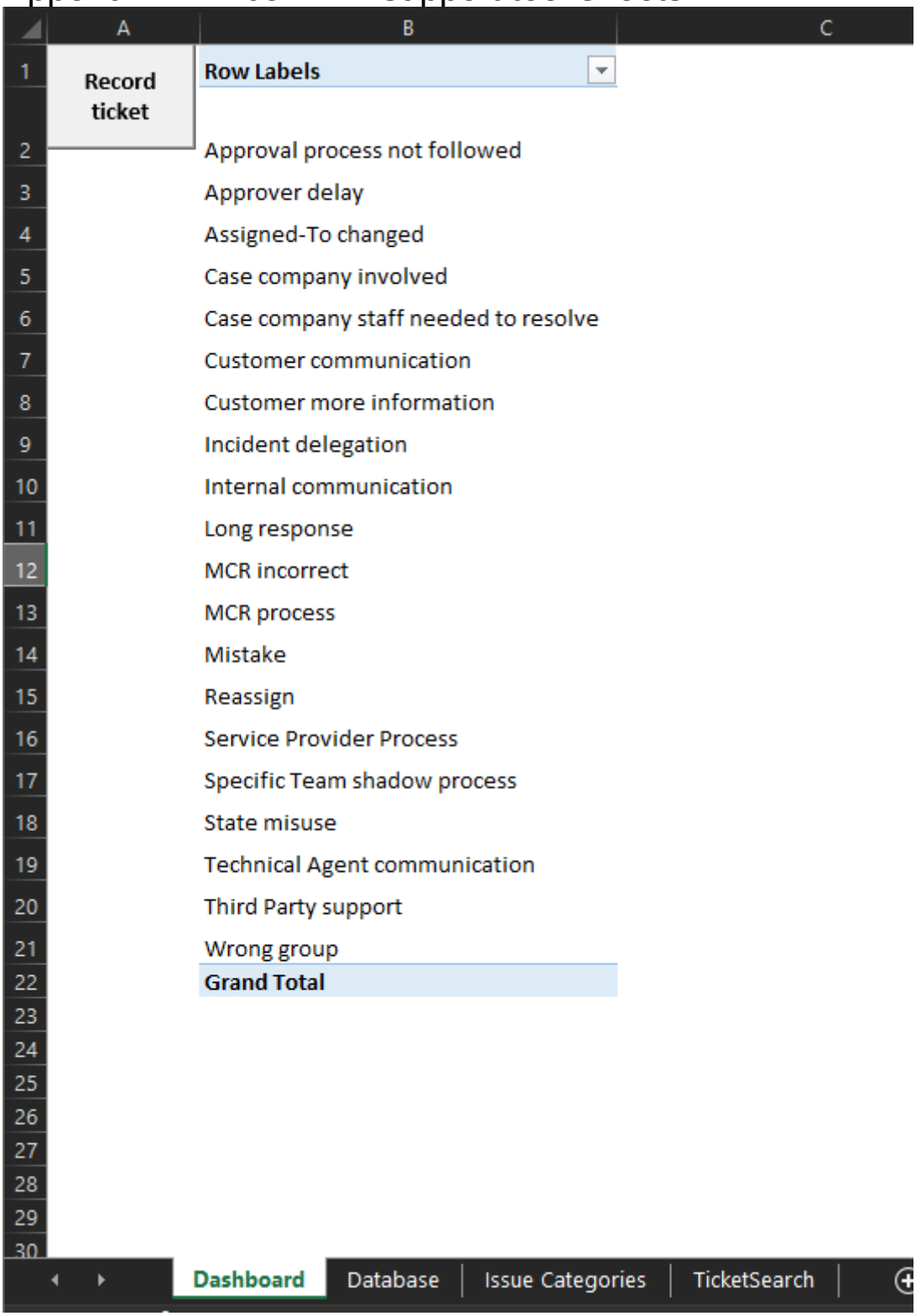
APPENDICES:

Appendix 1: Excel VBA support tool sheets



	A	B	C	D	E	F	G	H	I	J	K
1	Ticket Number	Priority	Status	Comment	Assigned To	Assignment group	Delay Reason	Associated MCR	Creation Time	Resolution Time	Response Time
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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42											
43											

Dashboard | Database | Issue Categories | TicketSearch

	L	M	N	O	P	Q	R	S	T	U	V	W
1	Time in Pending	MCR status	System	Booking Date	Created By:	Resolution	Category	Response SLA	Resolution SLA	Follow-Up	Follow-Up 2	Follow-Up 3
2								0:00:00	0:00:00			
3								0:00:00	0:00:00			
4								0:00:00	0:00:00			
5								0:00:00	0:00:00			
6								0:00:00	0:00:00			
7								0:00:00	0:00:00			
8								0:00:00	0:00:00			
9								0:00:00	0:00:00			
10								0:00:00	0:00:00			
11								0:00:00	0:00:00			
12								0:00:00	0:00:00			
13								0:00:00	0:00:00			
14								0:00:00	0:00:00			
15								0:00:00	0:00:00			
16								0:00:00	0:00:00			
17								0:00:00	0:00:00			

	A	B
1	**Issue Taxonomy**	**Explanation:**
2	Customer communication	Communication from customer to ticket issues.
3	Customer more information	More information from customer needed.
4	Internal communication	Issues with transparency of communication on the ticket.
5	Third Party support	Delay happens due to support from Third Party.
6	Approver delay	Delay that happens due to approved.
7	MCR process	Delay that happens due to MCR process.
8	State misuse	When ticket is in wrong state such as Pending but work happens.
9	Service Provider Process	Used to circumvent tighter Response SLA limitations.
10	Technical Agent communication	Issues in communication from technical agent to anyone.
11	Approval process not followed	Approval process not followed by Service Provider.
12	Case company staff needed to resolve	Case company person is key contribution to resolve a ticket.
13	Case company involved	Case company person needs to confirm something.
14	Specific Team shadow process	Used to circumvent ticketing system use.
15	MCR incorrect	When state within ticketing system does not match state in another system.
16	Wrong group	Assigned to first group and changed from that to another.
17	Assigned-To changed	First assigned to a person and later changed to another.
18	Incident delegation	When incident is made by another person than by the person that noted the issue.
19	Reassign	When ticket is reassigned from one person to another.
20	Mistake	When there is a mistake in the process by Service Provider handling tickets.
21	Long response	When Service Provider response to ticket is nearing a week or more.
22	Customer confirmation	Ticket waits for customer confirmation.
23	Customer Action	Ticket waits for customer action.
24		
25		
26		
27		
28		
29		

Dashboard | Database | Issue Categories | TicketSearch

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Ticket Nu	Priority	Status	Comment	Assigned	Assignme	Delay Rea	Associate	Creation Time	Resolutio	Response Time	Time in P	MCR statu	System	Booking D	Response	Resolutio	Category	Follow-Up	Follow-Up	Follow-Up 3
2																					
3																					
4																					
5																					
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Dashboard | Database | Issue Categories | TicketSearch

Appendix 2: Excel VBA Datasheet Response SLA function

```
=(NETWORKDAYS(I2;K2)-1)*("17:00"-"8:00")+IF(NETWORKDAYS(K2;K2);MEDIAN(MOD(K2;1);"17:00";"8:00");"17:00")-MEDIAN(NETWORKDAYS(I2;I2)*MOD(I2;1);"17:00";"8:00"
```

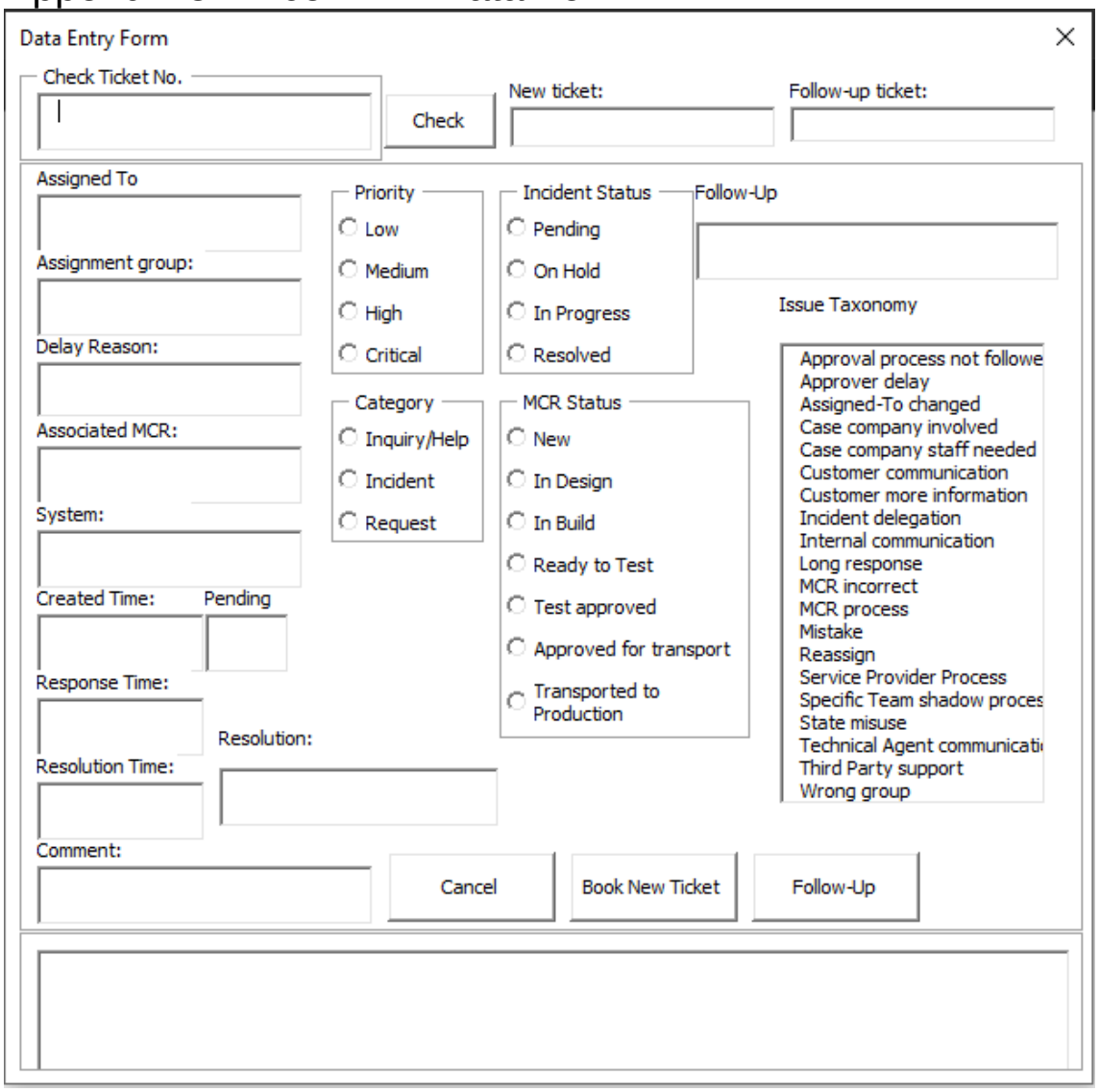
Appendix 3: Excel VBA Datasheet Resolution SLA function

```
=(NETWORKDAYS(I2;J2)-1)*("17:00"-"8:00")+IF(NETWORKDAYS(J2;J2);MEDIAN(MOD(J2;1);"17:00";"8:00");"17:00")-MEDIAN(NETWORKDAYS(I2;I2)*MOD(I2;1);"17:00";"8:00")
```

Appendix 4: Excel VBA support tool Record ticket button code

```
Sub RecordingTickets()
    DataEntryForm.Show
End Sub
```

Appendix 5: Excel VBA Data Form



Appendix 6: Excel VBA support tool Data Entry From code

BookTicket | Click

```
Private Sub BookTicket_Click()

Dim iRow As Long
Dim valilehtil As Worksheet
Dim valilehti2 As Worksheet
Dim valilehti3 As Worksheet
Dim sDate As String
Dim strFile As String
Dim NextRow As Long

'Defining sheets which are being referenced
Set valilehti2 = Worksheets("Database")
Set valilehti3 = Worksheets("Dashboard")
'NEED TO RECONFIGURE TEXT BOXES SO THAT THEY GO IN ORDER FOR TABULATOR USE

'Removes spaces after text, not between text.
TextBox3.value = Trim(TextBox3.value)
TextBox4.value = Trim(TextBox4.value)
TextBox5.value = Trim(TextBox5.value)
TextBox7.value = Trim(TextBox7.value)
TextBox8.value = Trim(TextBox8.value)
TextBox9.value = Trim(TextBox9.value)
TextBox10.value = Trim(TextBox10.value)
TextBox11.value = Trim(TextBox11.value)
TextBox12.value = Trim(TextBox12.value)
TextBox13.value = Trim(TextBox13.value)
TextBox14.value = Trim(TextBox14.value)
TextBox15.value = Trim(TextBox15.value)

'-------------------------------------------------------------------------
'Defining where textbox values go, later used to pick up data to specified column locations.
'Comment for ticket
Comment = TextBox3.value
'Associated CR
CR = TextBox4.value
'Seller to be changed to Assigned To
AssignedTo = TextBox5.value
'Delay Reason:
Delay = TextBox7.value
'TicketNumber, received from Check button to Ticket Number.
TicketNumber = Me.TextBox8.value
'Time been in pending, adding that will only accept numbers check.
Pending = TextBox9.value
'Agginment Group
AssignmentGroup = TextBox10.value
'System
System = TextBox14.value
'Created, Resolution and Response times bookings.
CreatedTime = TextBox11.value
ResolutionTime = TextBox13.value
ResponseTime = TextBox12.value
'SDate used for booking date, for tracking.
Resolution = TextBox15.value
sDate = Date
```

btnCheck | Click

```
'First define how new row is found with empty spaces for new ticket recording.
NextRow = valilehti2.Cells(Rows.Count, "A").End(xlUp).Row + 1
'-------------------------------------------------------------------------
'Defining checks for textbox values that are necessary to book a ticket
If Trim(Me.TextBox8.value) = "" Then
    Me.TextBox8.SetFocus
    MsgBox "Add ticket number."
    Exit Sub
End If
If Trim(Me.TextBox11.value) = "" Then
    Me.TextBox11.SetFocus
    MsgBox "Add ticket creation time."
    Exit Sub
End If
    If Me.optReso.value Then
        If Trim(Me.TextBox15.value) = "" Then
        If Sheets("Database").Range("Q" & NextRow).value = "" Then
            Me.TextBox15.SetFocus
            MsgBox "Insert Resolution data"
            Exit Sub
        Else

    End If
    End If
    End If
'-------------------------------------------------------------------------
With Sheets("Database")
'-------------------------------------------------------------------------
'Defining all OptionButton values and recording column locations in Database -sheet
'Priority buttons.
    If Me.optLow.value Then .Range("B" & NextRow).value = "Low"
    If Me.optMed.value Then .Range("B" & NextRow).value = "Medium"
    If Me.optHigh.value Then .Range("B" & NextRow).value = "High"
    If Me.optCrit.value Then .Range("B" & NextRow).value = "Critical"

'Ticket Status, need to be considered if this should be given numerical presentation.
    If Me.optPend.value Then .Range("C" & NextRow).value = "Pending"
    If Me.optHold.value Then .Range("C" & NextRow).value = "On Hold"
    If Me.optInProg.value Then .Range("C" & NextRow).value = "In Progress"
    If Me.optReso.value Then .Range("C" & NextRow).value = "Resolved"

'Category status
    If Me.optInquiryHelp.value Then .Range("R" & NextRow).value = "Inquiry/Help"
    If Me.optIncident.value Then .Range("R" & NextRow).value = "Incident"
    If Me.optRequest.value Then .Range("R" & NextRow).value = "Request"
'MCR status
    If Me.optNew.value Then .Range("M" & NextRow).value = "New"
    If Me.optInDesign.value Then .Range("M" & NextRow).value = "In Design"
    If Me.optInBuild.value Then .Range("M" & NextRow).value = "In Build"
    If Me.optReadyToTest.value Then .Range("M" & NextRow).value = "Ready to Test"
    If Me.optTestApproved.value Then .Range("M" & NextRow).value = "Test Approved"
    If Me.optApprovedForTransport.value Then .Range("M" & NextRow).value = "Approved for Transported"
    If Me.optTransportedToProduction.value Then .Range("M" & NextRow).value = "Transported to Production"
```

btnCheck | Click

```
'Textbox values going to specified columns with the empty row location.
    .Range("A" & NextRow).value = TicketNumber
    .Range("D" & NextRow).value = Comment
    .Range("E" & NextRow).value = AssignedTo
    .Range("F" & NextRow).value = AssignmentGroup
    .Range("G" & NextRow).value = Delay
    .Range("H" & NextRow).value = CR
    .Range("I" & NextRow).value = CreatedTime
    .Range("J" & NextRow).value = ResolutionTime
    .Range("K" & NextRow).value = ResponseTime
    .Range("L" & NextRow).value = Pending
    .Range("N" & NextRow).value = System
    .Range("O" & NextRow).value = sDate
    .Range("Q" & NextRow).value = Resolution

End With
'-------------------------------------------------------------------------
'Notification for use that ticket x was recorded into the database.
        With RecordingDone
        .Caption = TextBox8.value & " ticket recorded."
        End With

Me.TextBox3.value = ""
Me.TextBox4.value = ""
Me.TextBox5.value = ""
Me.TextBox7.value = ""
Me.TextBox8.value = ""
Me.TextBox9.value = ""
Me.TextBox10.value = ""
Me.TextBox11.value = ""
Me.TextBox12.value = ""
Me.TextBox13.value = ""
Me.TextBox14.value = ""
Me.TextBox15.value = ""
Me.TextBox1.SetFocus

exitHanlder:
    Exit Sub

End Sub
```

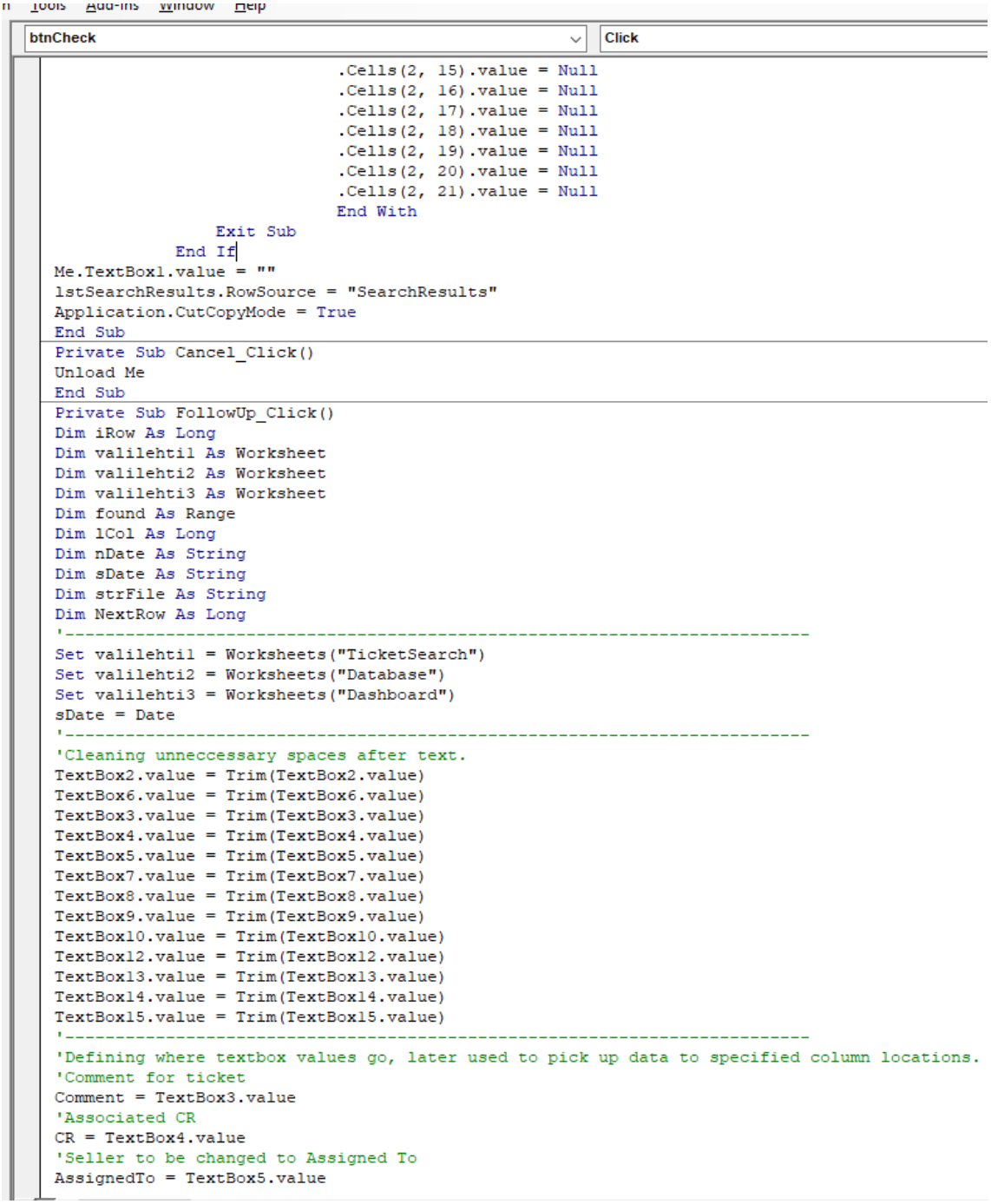
```
Private Sub btnCheck_Click()
Dim RowNum As Long
Dim SearchRow As Long

'These check rownumbers
RowNum = 2
SearchRow = 2
```

btnCheck | Click

```
'-------------------------------------------------------------------------
'Looping through the rows, as the row first checks first row, if not found checks the nex
'Checks until ticket number found or no ticket number found. If found, moves ticket numbe
'If ticket is not found, moves ticket number to new ticket recording.
Application.CutCopyMode = False
Worksheets("Database").Activate
        Do Until Cells(RowNum, 1).value = ""
            If InStr(1, Cells(RowNum, 1).value, TextBox1.value, vbTextCompare) > 0 Then
            With Worksheets("TicketSearch")
            .Cells(SearchRow, 1).value = Cells(RowNum, 1).value
            .Cells(SearchRow, 2).value = Cells(RowNum, 2).value
            .Cells(SearchRow, 3).value = Cells(RowNum, 3).value
            .Cells(SearchRow, 4).value = Cells(RowNum, 4).value
            .Cells(SearchRow, 5).value = Cells(RowNum, 5).value
            .Cells(SearchRow, 6).value = Cells(RowNum, 6).value
            .Cells(SearchRow, 7).value = Cells(RowNum, 7).value
            .Cells(SearchRow, 8).value = Cells(RowNum, 8).value
            .Cells(SearchRow, 9).value = Cells(RowNum, 9).value
            .Cells(SearchRow, 10).value = Cells(RowNum, 10).value
            .Cells(SearchRow, 11).value = Cells(RowNum, 11).value
            .Cells(SearchRow, 12).value = Cells(RowNum, 12).value
            .Cells(SearchRow, 13).value = Cells(RowNum, 13).value
            .Cells(SearchRow, 14).value = Cells(RowNum, 14).value
            .Cells(SearchRow, 15).value = Cells(RowNum, 15).value
            .Cells(SearchRow, 16).value = Cells(RowNum, 16).value
            .Cells(SearchRow, 17).value = Cells(RowNum, 17).value
            .Cells(SearchRow, 18).value = Cells(RowNum, 18).value
            .Cells(SearchRow, 19).value = Cells(RowNum, 19).value
            .Cells(SearchRow, 20).value = Cells(RowNum, 20).value
            .Cells(SearchRow, 21).value = Cells(RowNum, 21).value
            SearchRow = SearchRow + 1

            End With
            End If
            RowNum = RowNum + 1
            TextBox2.value = TextBox1.value
        Loop
            If SearchRow = 2 Then
                TextBox8.value = TextBox1.value
                Me.TextBox2.value = ""
                Me.TextBox1.value = ""
                            With Worksheets("TicketSearch")
                            .Cells(2, 1).value = Null
                            .Cells(2, 2).value = Null
                            .Cells(2, 3).value = Null
                            .Cells(2, 4).value = Null
                            .Cells(2, 5).value = Null
                            .Cells(2, 6).value = Null
                            .Cells(2, 7).value = Null
                            .Cells(2, 8).value = Null
                            .Cells(2, 9).value = Null
                            .Cells(2, 10).value = Null
                            .Cells(2, 11).value = Null
                            .Cells(2, 12).value = Null
                            .Cells(2, 13).value = Null
                            .Cells(2, 14).value = Null
```


Tools Add-Ins Window Help
btnCheck
Click
.Cells(2, 15).value = Null
.Cells(2, 16).value = Null
.Cells(2, 17).value = Null
.Cells(2, 18).value = Null
.Cells(2, 19).value = Null
.Cells(2, 20).value = Null
.Cells(2, 21).value = Null
End With
Exit Sub
End If
Me.TextBox1.value = ""
lstSearchResults.RowSource = "SearchResults"
Application.CutCopyMode = True
End Sub
Private Sub Cancel_Click()
Unload Me
End Sub
Private Sub FollowUp_Click()
Dim iRow As Long
Dim valilehtil As Worksheet
Dim valilehti2 As Worksheet
Dim valilehti3 As Worksheet
Dim found As Range
Dim lCol As Long
Dim nDate As String
Dim sDate As String
Dim strFile As String
Dim NextRow As Long
'--
Set valilehtil = Worksheets("TicketSearch")
Set valilehti2 = Worksheets("Database")
Set valilehti3 = Worksheets("Dashboard")
sDate = Date
'--
'Cleaning unneccessary spaces after text.
TextBox2.value = Trim(TextBox2.value)
TextBox6.value = Trim(TextBox6.value)
TextBox3.value = Trim(TextBox3.value)
TextBox4.value = Trim(TextBox4.value)
TextBox5.value = Trim(TextBox5.value)
TextBox7.value = Trim(TextBox7.value)
TextBox8.value = Trim(TextBox8.value)
TextBox9.value = Trim(TextBox9.value)
TextBox10.value = Trim(TextBox10.value)
TextBox12.value = Trim(TextBox12.value)
TextBox13.value = Trim(TextBox13.value)
TextBox14.value = Trim(TextBox14.value)
TextBox15.value = Trim(TextBox15.value)
'--
'Defining where textbox values go, later used to pick up data to specified column locations.
'Comment for ticket
Comment = TextBox3.value
'Associated CR
CR = TextBox4.value
'Seller to be changed to Assigned To
AssignedTo = TextBox5.value

FollowUp | Click

```
'Delay Reason:
Delay = TextBox7.value
'TicketNumber, received from Check button to Ticket Number.
Pending = TextBox9.value
'Agginment Group
AssignmentGroup = TextBox10.value
'System
System = TextBox14.value
'Created, Resolution and Response times bookings. EI TARVITA CREATED TIME
ResolutionTime = TextBox13.value
ResponseTime = TextBox12.value
'SDate used for booking date, for tracking.
sDate = Date
Resolution = TextBox15.value
'-------------------------------------------------------------------------
'Checks if Follow-up textbox is empty, if it is empty prompts user to add content.
If Trim(Me.TextBox6.value) = "" Then
    Me.TextBox6.SetFocus
    MsgBox "Add follow-up text."
    Exit Sub
End If
'-------------------------------------------------------------------------
'Retrieves followup value that needs to be recorded.
FollowUpText = TextBox6.value
'-------------------------------------------------------------------------
'Defining what row the follow-up information should be booked to. So check tickets row location.
Set found = Sheets("Database").Columns("A").Find(What:=TextBox2.value, LookIn:=xlValues, LookAt:=xlWhole)
'Defining booked cellrow
BookingRow = found.Row
'-------------------------------------------------------------------------
'Setting a check that if resolved is selected, then ensures that resolution reason is given.
'IF empty, will not go through.
If Me.optReso.value Then
        If Trim(Me.TextBox15.value) = "" Then
        If Sheets("Database").Range("Q" & BookingRow).value = "" Then
            Me.TextBox15.SetFocus
            MsgBox "Insert Resolution data"
            Exit Sub
        Else
        End If
        End If
End If

    'Records date when information is added with the follow-up textbox content
    'Checks the last column location with data in ticket numbers row and adds details there.
    With valilehti2.Cells(BookingRow, Columns.Count).End(xlToLeft).Offset(, 1)
    .value = sDate & " " & FollowUpText
    .NumberFormat = "mm/dd/yyyy"
    'Informs user that follow-up text for ticket number has been recorded.
    End With
        With lblfollowupdone
        .Caption = TextBox2.value & " follow-up recorded."
        End With
    Me.TextBox2.value = ""
    Me.TextBox6.value = ""
```

FollowUp | Click

```
With Sheets("Database")
    '-------------------------------------------------------------------------
    'Defining all OptionButton values and recording column locations in Database -sheet
    'Priority buttons.
        If Me.optLow.value Then .Range("B" & BookingRow).value = "Low"
        If Me.optMed.value Then .Range("B" & BookingRow).value = "Medium"
        If Me.optHigh.value Then .Range("B" & BookingRow).value = "High"
        If Me.optCrit.value Then .Range("B" & BookingRow).value = "Critical"

    'Ticket Status, need to be considered if this should be given numerical presentation.
        If Me.optPend.value Then .Range("C" & BookingRow).value = "Pending"
        If Me.optHold.value Then .Range("C" & BookingRow).value = "On Hold"
        If Me.optInProg.value Then .Range("C" & BookingRow).value = "In Progress"
        If Me.optReso.value Then .Range("C" & BookingRow).value = "Resolved"

    'Category status
        If Me.optInquiryHelp.value Then .Range("R" & BookingRow).value = "Inquiry/Help"
        If Me.optIncident.value Then .Range("R" & BookingRow).value = "Incident"
        If Me.optRequest.value Then .Range("R" & BookingRow).value = "Request"
    'MCR status
        If Me.optNew.value Then .Range("M" & BookingRow).value = "New"
        If Me.optInDesign.value Then .Range("M" & BookingRow).value = "In Design"
        If Me.optInBuild.value Then .Range("M" & BookingRow).value = "In Build"
        If Me.optReadyToTest.value Then .Range("M" & BookingRow).value = "Ready to Test"
        If Me.optTestApproved.value Then .Range("M" & BookingRow).value = "Test Approved"
        If Me.optApprovedForTransport.value Then .Range("M" & BookingRow).value = "Approved for Tra
        If Me.optTransportedToProduction.value Then .Range("M" & BookingRow).value = "Transported t
    'Textbox values going to specified columns with the empty row location.

'-------------------------------------------------------------------------
' Adding new named values to pick up old details from SearchTicket
'-sheet so that when new data is added the old data is not overwritten,
'but old data and new data added together.
    NewComment = valilehtil.Cells(2, 4).value
    NewAssignedTo = valilehtil.Cells(2, 5).value
    NewAssignmentGroup = valilehtil.Cells(2, 6).value
    NewDelay = valilehtil.Cells(2, 7).value
    NewPending = valilehtil.Cells(2, 12).value
    NewDate = valilehtil.Cells(2, 15).value
' Rows here first check if TextBox has received value. If no value added, then does nothing.
'If TextBox received value then checks if the row already has a set value. IF there is a value
'then it takes the old added value and new value adding them as the newest value.
'This is done to ensure older inserted data is not lost. IF there is no value from earlier add
'then adds the new value only.
If TextBox3.value = Empty Then
    Else
        If .Range("D" & BookingRow).value = "" Then
                Range("D" & BookingRow).value = Comment
                Else
                Range("D" & BookingRow).value = NewComment & " " & Comment
        End If
End If
If TextBox5.value = Empty Then
    Else
    If .Range("E" & BookingRow).value = "" Then
            Range("E" & BookingRow).value = AssignedTo
```

FollowUp | Click

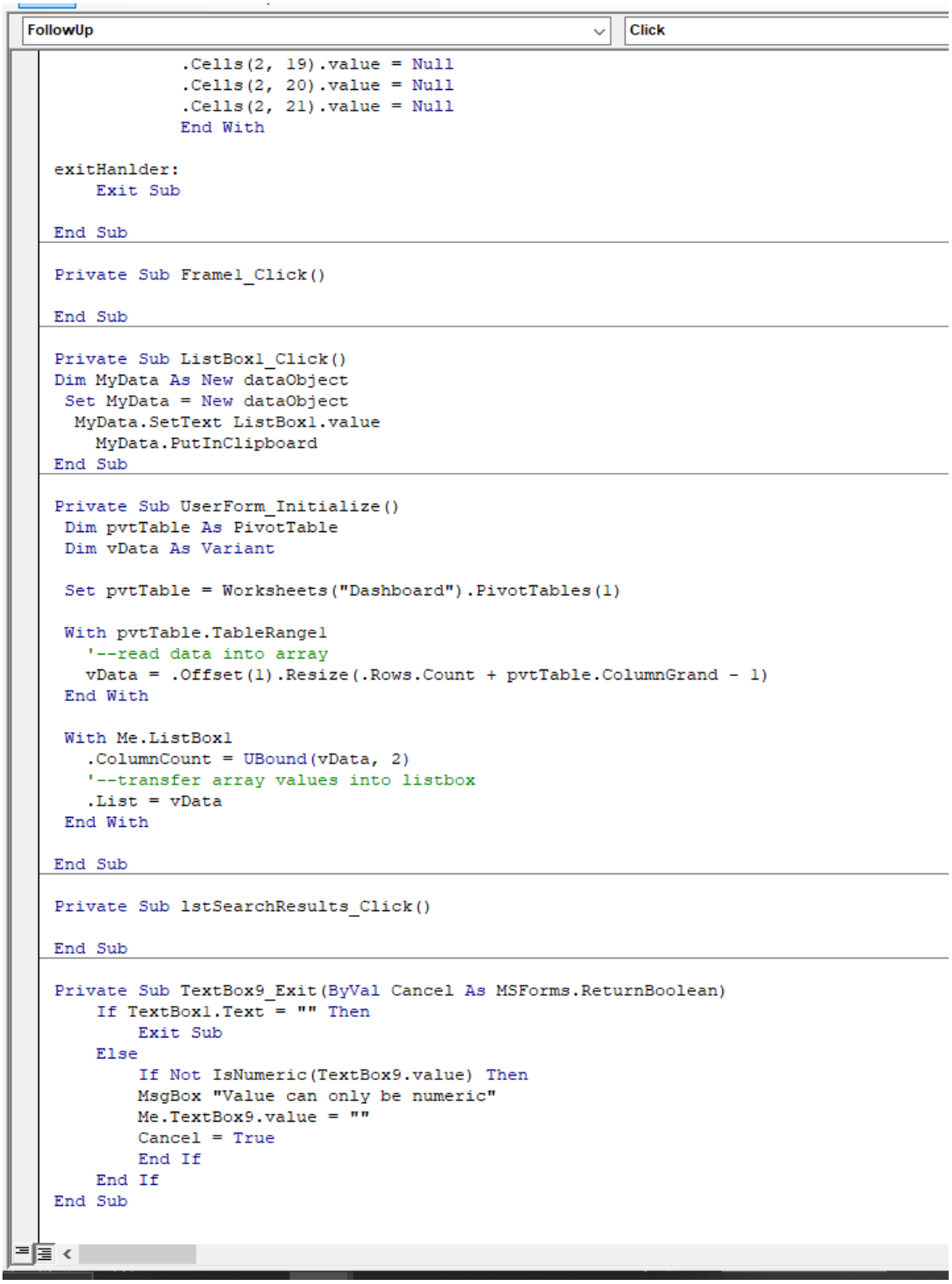
```
            Range("E" & BookingRow).value = NewAssignedTo & " " & AssignedTo
    End If
End If
If TextBox10.value = Empty Then
    Else
    If .Range("D" & BookingRow).value = "" Then
            Range("F" & BookingRow).value = AssignmentGroup
            Else
            Range("F" & BookingRow).value = NewAssignmentGroup & " " & AssignmentGroup
    End If
End If
If TextBox7.value = Empty Then
    Else
    If .Range("G" & BookingRow).value = "" Then
            Range("G" & BookingRow).value = Delay
            Else
            Range("G" & BookingRow).value = NewDelay & " " & Delay
    End If
End If
If TextBox4.value = Empty Then
    Else
    If .Range("H" & BookingRow).value = "" Then
            Range("H" & BookingRow).value = CR
            Else
    End If
End If
If TextBox13.value = Empty Then
    Else
    If .Range("I" & BookingRow).value = "" Then
            Range("I" & BookingRow).value = ResolutionTime
            Else
    End If
End If
If TextBox12.value = Empty Then
    Else
    If .Range("J" & BookingRow).value = "" Then
            Range("J" & BookingRow).value = ResponseTime
            Else
    End If
End If
If TextBox9.value = Empty Then
    Else
    If .Range("L" & BookingRow).value = "" Then
            Range("L" & BookingRow).value = Pending
            Else
            Range("L" & BookingRow).value = NewPending + Pending
    End If
End If
If TextBox14.value = Empty Then
    Else
    If .Range("N" & BookingRow).value = "" Then
            Range("N" & BookingRow).value = System
            Else
    End If
End If
```

FollowUp | Click

```
    If .Range("O" & BookingRow).value = "" Then
            Range("O" & BookingRow).value = sDate
            Else
            Range("O" & BookingRow).value = NewDate & " " & sDate
    End If
If TextBox15.value = Empty Then
    Else
    If .Range("Q" & BookingRow).value = "" Then
            Range("Q" & BookingRow).value = Resolution
            Else
    End If
End If
End With
'-------------------------------------------------------------------------------
'Notification for use that ticket x was recorded into the database.
        With RecordingDone
        .Caption = TextBox8.value & " ticket recorded."
        End With

Me.TextBox3.value = ""
Me.TextBox4.value = ""
Me.TextBox5.value = ""
Me.TextBox7.value = ""
Me.TextBox8.value = ""
Me.TextBox9.value = ""
Me.TextBox10.value = ""
Me.TextBox11.value = ""
Me.TextBox12.value = ""
Me.TextBox13.value = ""
Me.TextBox14.value = ""
Me.TextBox1.SetFocus

'Cleaning the search results
            With Worksheets("TicketSearch")
            .Cells(2, 1).value = Null
            .Cells(2, 2).value = Null
            .Cells(2, 3).value = Null
            .Cells(2, 4).value = Null
            .Cells(2, 5).value = Null
            .Cells(2, 6).value = Null
            .Cells(2, 7).value = Null
            .Cells(2, 8).value = Null
            .Cells(2, 9).value = Null
            .Cells(2, 10).value = Null
            .Cells(2, 11).value = Null
            .Cells(2, 12).value = Null
            .Cells(2, 13).value = Null
            .Cells(2, 14).value = Null
            .Cells(2, 15).value = Null
            .Cells(2, 16).value = Null
            .Cells(2, 17).value = Null
            .Cells(2, 18).value = Null
            .Cells(2, 19).value = Null
            .Cells(2, 20).value = Null
            .Cells(2, 21).value = Null
            End With
```


FollowUp
Click
.Cells(2, 19).value = Null
.Cells(2, 20).value = Null
.Cells(2, 21).value = Null
End With
exitHanlder:
Exit Sub
End Sub
Private Sub Frame1_Click()
End Sub
Private Sub ListBox1_Click()
Dim MyData As New dataObject
Set MyData = New dataObject
MyData.SetText ListBox1.value
MyData.PutInClipboard
End Sub
Private Sub UserForm_Initialize()
Dim pvtTable As PivotTable
Dim vData As Variant
Set pvtTable = Worksheets("Dashboard").PivotTables(1)
With pvtTable.TableRange1
'--read data into array
vData = .Offset(1).Resize(.Rows.Count + pvtTable.ColumnGrand - 1)
End With
With Me.ListBox1
.ColumnCount = UBound(vData, 2)
'--transfer array values into listbox
.List = vData
End With
End Sub
Private Sub lstSearchResults_Click()
End Sub
Private Sub TextBox9_Exit(ByVal Cancel As MSForms.ReturnBoolean)
If TextBox1.Text = "" Then
Exit Sub
Else
If Not IsNumeric(TextBox9.value) Then
MsgBox "Value can only be numeric"
Me.TextBox9.value = ""
Cancel = True
End If
End If
End Sub