IT Service Management and Incident Management: Literature Review and a Case Study

Full Paper

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Abstract

Driving value, alignment between IT and business, manage IT Services, and customer satisfaction are the main objectives for the contemporary Information Technology Service Management (ITSM). ITSM also aims at encouraging harmonization between modern IT technology and ITIL framework regarding service operation. However, most of the companies and organisations struggle to comprehend the ITSM due to the dynamic nature and volume of IT technology and business values. A systematic literature review was conducted to understand the state of the current research in contemporary technology, especially cloud computing, automation, and machine learning. The review indicated that the focus of the existing research is skewed towards the innovative trend of the ITIL process using modern technologies. To demonstrate the findings from the literature, we adopted the case study method based on ITSM theory. Despite the current limitation, we found that most of the companies demonstrate more interest and enthusiasm for IT innovative technologies when it comes to ITIL implementation and ITIL service operation.

Keywords: ITSM, ITIL, Cloud Computing, Automation, Machine Learning, Incident Management

1   INTRODUCTION

Over the last three decades, a myriad of research papers has studied critical success factors in Information Technology Service Management (ITSM). Considering the fact that ITSM is not just a theory but a practice that is already in use in various formats within the industry, there is still a great need for continuous adjustment of ITSM theory as the IT environment advances. In recent years, the most outstanding advances in the IT environment have been cloud computing, process automation and Machine Learning (ML) (Marrone and Hammerle 2017). However, the most widely used internationally is the ITSM framework of the IT Infrastructure Library (ITIL) resources (Mahalle et al. 2018).

Nevertheless, during the recent five years, almost half of the research conducted about incident management of ITIL reflected modern technologies, particularly cloud computing, automation, and ML (Encantado Faria and Mira da Silva 2018; Fiegler et al. 2016). Likewise, the main goal of this paper is to clarify the trend of utilising these three technologies in ITIL service operations, especially through the systematic literature review of ITIL incident management and to encourage even more studies on this topic to be conducted and presented. Also, the findings from the literature review are used again for the case study of XYZ Bank for the purpose of analysing the organisation's challenges and provide realistic solutions. These solutions suggested to the bank can also be utilised by other companies because they are expected to reduce the operating costs while improving procedural efficiency, which all types of business want to achieve.

2   ITSM STANDARDS AND CONTEMPORARY IT TECHNOLOGIES

This study focuses on Incident Management using ITIL, which is the most reputable and widely used framework instead of Information Technology Service Management. In this section, ITSM, ITIL and Incident Management are briefly analysed. The Information Technology Service Management (ITSM) is a discipline system, which is process-focused for improving IT services and has now become a standardised approach in combination with process operation and organisational best practices (Garg and Misra 2017). The structural framework providers by ITSM to IT operational process are such that the organisations are able to have capable IT services to align with the Service Level Agreements (SLA) and then meet various needs of the business (Ghrab et al. 2016).

Moreover, ITSM is used for improving services provided by the organisation to meet customer satisfaction and requirements, as well as being increasingly important in accordance with the company's profitability objectives (Goby et al. 2016). Among the most renowned ITSM frameworks, the most widely adopted in the industry is ITIL. ITIL is a device providing the integration of best practices for IT service management. Likewise, the ITIL framework is aligned with the structure of the ITSM processes and delivery. The organisation is supposed to be aligned with the guidelines, concepts and principles of ITIL and apply IT service management in the organisational context, whether as an internal or external service provider. In spite of the current waves in innovative technology in the market, ITIL related studies seem to be hardly influenced by such IT trends, possibly due to the rigid nature of framework (Fiegler et al. 2016; Latrache et al. 2015).

ITIL categorises activities that are required for successful ITSM into five sequential steps, but the fourth step is Service Operation, of which Incident Management (IM) is one of the main activities. The incident is a report by an internal or external customers about any inconvenience, errors or failures experienced when they are using a service. Since its management is critical to business reputation and credibility, an increasing part of academic research about IM has been committed to ways of making ITSM fitted to RASCI (Responsible, Accountable, Supports, Consulted, Informed) standards. That is why researchers conducted incident management of ITIL to reflect the importance of modern technologies, particularly cloud computing, automation, and ML (Al-Hawari and Barham 2019; Zuev et al. 2018). This study involves three main contemporary IT technologies that have been used in research papers about ITIL incident management for the past five years. In the following section, cloud computing, process automation and ML are defined and identified along with the recent academic and industrial trends. Cloud computing is a technology that enables the system to be accessible from everywhere without physical restriction (Mahalle et al. 2018). Due to its positive effects like cost reduction and resource management flexibility, an increasing number of companies are adopting cloud computing rather than on-site solutions (Holloway et al. 2017).

Likewise, automation means making a set of procedures run autonomously by algorithms, systems, robots or others without manual instructions or human's intervention. The benefit of process automation can range from a simplification of tasks, consistent quality control, minimisation of error, and more importantly, reduction of operating costs. Moreover, Machine learning (ML) is mainly about

finding patterns out of the existing dataset, which then can be made into a model for other new or future datasets for analysis Compared with process automation, machine learning starts with finding a pattern from experience. Besides this can deliver higher precision, correctness, effectiveness and efficiency. Overall, ML can not only be used for statistical analysis but can also be a monitoring and administration tool which lets the users have a high level of control over the data flow (Garg and Misra 2017; Zuev et al. 2018).

3   SYSTEMATIC LITERATURE REVIEW

This literature review aims at encouraging further and more research on harmonisation between modern IT technology and ITIL framework regarding IM. For the reviewing purpose, papers between 2015 and 2019 are analysed through a year on a year-topic matrix that shows an increasing trend to adopt new technologies in research papers. In order to display the form of the review, the methodology is introduced first. Here we cover question formularization, source and study selection, and the information extracted from the papers. In the analysis section, these previous studies are classified into three types of IT technologies. They are then categorised into three important ITSM elements of process, people, and tools. The challenges of the technologies and solutions are discussed using a technology-challenge mind map. As a recommendation, we encourage scholars to be more enthusiastic about contemporary IT technology in IM.

3.1   Methodology

For a systematic literature review (Kitchenham et al. 2009), research questions were formularised to clarify the goals of the study. Then, four reputable libraries were selected which had previous studies (Table 1). When then searched these studies using keywords proposed in Table 2. Lastly, we made a summary of the information extracted thus developing a concise statement of previous studies and goals.

3.1.1   Formulation of Questions

To explain the content of the subject, it is appropriate to break-down the explanatory items. In this systematic review, all the items below are related to the improvement of IM operations, based on modern technology.

- **Problem:** implementation of the ITIL framework has yielded excellent outcomes, but at the same time identifies that IM requires sensitive care. Therefore, business reputation and legitimacy rely on (IM's) solid operations. However, the essence of this research is centred in modern technology for the improvement of IM, using tools such as Cloud computing, automation and ML.

- **Question:** Could modern technology harmonise with the ITIL framework to enhance IM performance within highly tech-dependent industries?

- **Keywords and synonyms:** IT Service Management (ITSM), ITIL, IM, Cloud computing, automation, ML.

- **Intervention:** Analyse IM improvement according to modern technology.

- **Control:** There are no primary data for this systematic review.

- **Effect:** Identify all modern technology used to improve IM performance.

- **Outcome measure:** The number of studies harmonizing modern technology with IM.

- **Population:** Only included investigations with a focus on modern technologies (ITIL and IM) that are described within the ITIL framework and IM which have been published in the list of sources selected for the conduct of the systematic review.

- **Application:** Meet high expectations of customers within high technology-dependent industries, such as banks, broadband and Mobile phone companies.

- **Experimental design:** No statistical analysis methods will be applied (literature review is about IM actual increment).

3.1.2   Selection of Sources and Studies

In order to establish credible sources to perform searches for primary studies, the systematic review protocol is was used to determine the definition of source selection criteria, the language of the studies, identification of sources, definition of search strings, and selection of sources (Kitchenham 2004; Kitchenham et al. 2009). Regarding source selection criteria, there are relevant aspects to take into

account such as but not limited to research papers from 2015 to 2019; IT-related sources; publishing companies or websites suggested by experts; high-impact publications, availability of search mechanisms using keywords, no difference in search results by using the same set of keywords, and available case studies related to keywords. Moreover, as per language studies, primary studies have to be written in English, selected sources have been chosen dependent on the verdict of the authors of this paper. We include a number of journals where the ITIL framework and modern technology is commonly discussed, such as IEEE Explore, ScienceDirect, AIS and Springer. The research string has been developed using the keywords, mentioned above by combining them with the logical operator "AND" and "OR" as shown in table 1. The unique aspects of search engines, demands that searches need to be adapted. After the criteria have been set up, all content is taken into account to define sources as demonstrated in table 2. Any source selected needs to be evaluated according to the source selection criteria. The authors only add to the final list of sources so only one evaluation is done. After this evaluation, all the elements have been included in the final list of sources. Regarding the study's criteria in the context of a systematic literature review, the criteria to determine which should remain and which ones should be excluded is based on the authors' judgement supported by Kitchenham's proposal to use (IC), inclusion criteria and Exclusion Criteria (EC) (Kitchenham 2004). The title and keyword became inclusion criteria for the selection of primary studies. If these two criteria are not enough, the abstract is another filter and full text in some cases. Initially, we would be taking into account several studies related to IM or modern technology, but the proposal is to do an in-depth study specifically about the main object, which is the enhancement of IM.

	Search strings	# Papers
1	("Incident Management") AND (ITIL OR "IT Infrastructure Library")	1690
2	("Incident Management") AND (ITIL OR "IT Infrastructure Library") AND ("Cloud" OR "Cloud Computing" OR "Cloud System")	680
3	("Incident Management") AND (ITIL OR "IT Infrastructure Library") AND ("Automation")	488
4	("Incident Management") AND (ITIL OR "IT Infrastructure Library") AND ("Machine Learning")	158

Table 1. Search Strings

Source	Name	Web Site
1	IEEE Xplore	https://ieeexplore.ieee.org
2	ScienceDirect	https://sciencedirect.com
3	Springer Link	https://link.springer.com
4	AIS Library	https://aisel.aisnet.org/

Table 2. Research Sources

3.2 Analysis of the Systematic Literature Review

The analysis of the systematic literature review starts with the classification of the studies in order to determine trends in academic research about ITIL. Next, out of those studies, the ones that are using the above mentioned three IT technologies are discussed in the context of individual processes of Incident Management in ITIL. Then, in the last section, the discussion continues regarding the challenges of each contemporary IT technology with the solutions suggested by previous studies.

3.2.1 Classification of Previous Studies

One of the efforts can be found from the modern technology sector, and the trend is found especially from cloud computing, automation, and ML. A literature review was conducted on four reputable libraries which are IEEE explore, ScienceDirect, AIS and Springer with a period ranging from the year 2015 to 2019. As shown in Table 3, there were 24 research papers found which met the given criteria out of 3016 papers which we found all 24 papers were dedicated to ITSM topics and ignored any papers in the traditional area of framework comparison or case study. Overall, out of 24 papers, 14 recent technology papers consisted of eight about automation, seven about machine learning, eight about cloud computing, and one about automation and cloud at the same time.

3.2.2 Literature Analysis

This literature review from four well-known sources about ITIL and IM with focussing on modern technologies only included investigations that are described within the ITIL framework and in relation to IM. Based on our systematic analysis, papers from these criteria can be classified into three main

categories (figure 2) of Process, People and Tools, which are critical issues for contemporary ITSM. Firstly, there were three papers evaluating methods for automatic incident monitoring and detection on-demand or on cloud. We found that ticket closure was the most popular topic with three automation studies and one on ML analysis. The ML study about closure was also about an automatic recommendation system but based on a carefully drawn algorithm with minimized error. Based on our critical analysis we found that people in IM are mainly supported technicians who respond to the incidents. Since human resource is an expenditure from business viewpoint, the study suggests ML algorithms (or well-known mathematical algorithms) are needed to optimise resource allocation throughout daily working times (integration of people and ML). The reason we recommend integrating human with ML, automation and cloud computing, is to save time because we found in most of the articles, time is crucial for IM. Besides being time-saving and mass disruption countermeasures, quality assurance measures can be safely used in the cloud environment. Overall, this study found that ML, cloud computing and automation aimed to correctly encounter any unexpected mass disruption and human mistakes during the process of IM. Figure 3 illustrates our analysis based on the literature review.

#	Source	Author	Modern Technology
1	IEEE	(Mahalle et al. 2018)	Cloud
2	IEEE	(Ghrab et al. 2016)	Automation
3	IEEE	(Latrache et al. 2015)	Automation
4	IEEE	(Garg and Misra 2017)	Automation, Cloud
5	IEEE	(Fiegler et al. 2016)	Cloud
6	IEEE	(do Amaral et al. 2018)	Automation
7	ScienceDirect	(Zuev et al. 2018)	Machine Learning
8	ScienceDirect	(Al-Hawari and Barham 2019)	Machine Learning
9	ScienceDirect	(Ordóñez et al. 2016)	Automation
10	Springer	(Diao and Shwartz 2017)	Machine Learning
11	Springer	(Efimov et al. 2017)	Cloud
12	Springer	(Beck et al. 2016)	Machine Learning
13	Springer	(Hoorpah et al. 2019)	Automation
14	Springer	(Ketata et al. 2018)	Automation
15	AISEL	(Stein et al. 2018)	Machine Learning
16	AISEL	(Maris et al. 2016)	Machine Learning
17	AISEL	(Goby et al. 2016)	Machine Learning
18	AISEL	(Encantado Faria and Mira da Silva 2018)	Automation
19	AISEL	(Kotha 2017)	Cloud
20	AISEL	(Almeida et al. 2016)	Automation
21	AISEL	(Marrone and Hammerle 2017)	Cloud
22	AISEL	(Morana et al. 2019)	Cloud
23	AISEL	(Ahuja and Gallupe 2015)	Cloud
24	AISEL	(Holloway et al. 2017)	Cloud

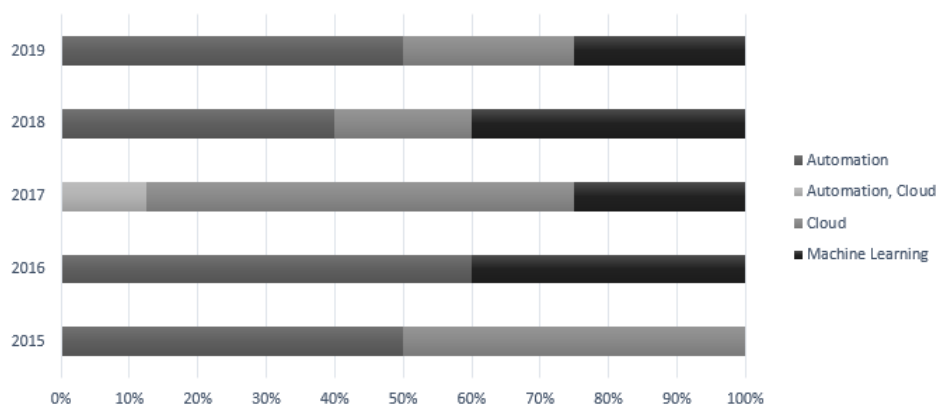*Table 3. Literature Review between the year 2015 to 2019*

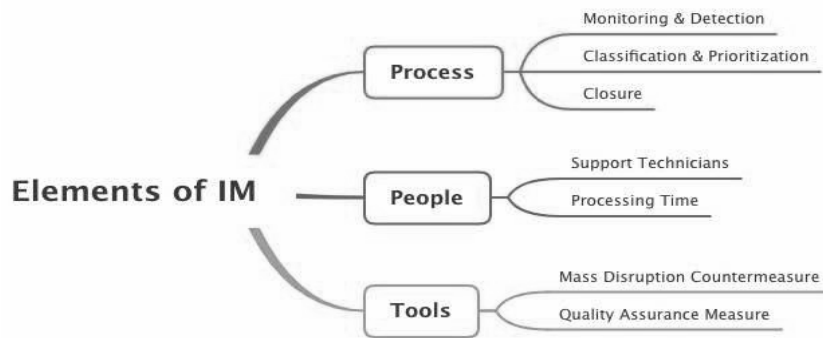*Figure 1. The Percentage of Contemporary Technology Studies within ITIL IM against all ITIL IM Studies*

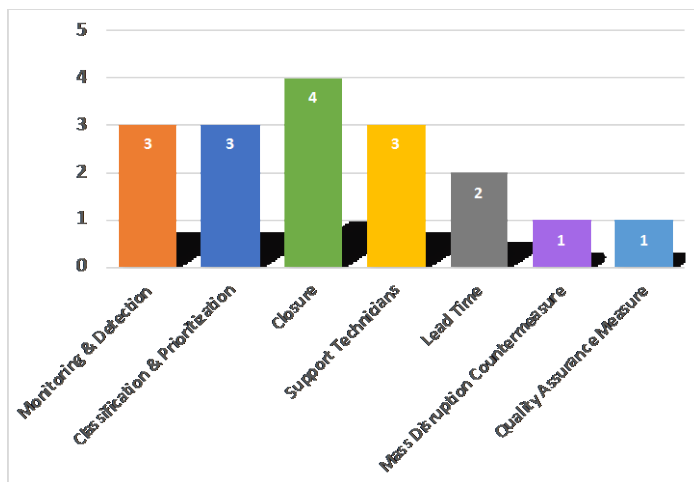*Figure 2. Important Elements in Incident Management*

Figure 3. Literature Review as aspects of the Focused Elements of Enhancement

3.2.3 Discussion of Literature

In order to appreciate this literature, understanding of the three contemporary technologies and their challenges are illustrated in Figure 4. Firstly, cloud computing allows access to a service from anywhere by detaching service from physical servers. Moreover, cloud computing involves geographically distributed servers, but this may raise miscommunication issues, or there may be a lack of synchronisation due to the limitation of distance (Efimov et al. 2017). Another challenge of cloud computing can come from its size because scalability and extensibility, which are best advantages of cloud computing, can affect the service quality and put process abeyance into question (Fiegler et al. 2016). Secondly, automation makes a system run by itself without the help of humans. Besides, its minimisation of human intervention is aimed at cost reduction, but risk of faulty decision making needs to be considered. Moreover, automated systems are run by predefined rules that are first set by humans, therefore, converting real-world factors into yes-or-no binaries and variants can be a very ambiguous work, and even after it is done, incidents that are not defined by existing rules will end up becoming out of control (Ordóñez et al. 2016). Lastly, ML is the generation of algorithms through training a machine with existing data and its application to the new data set. By minimising errors, ML can add credibility to automation, but it still not error-free (Diao and Shwartz 2017). Moreover, ML is a study of methodology, and therefore, the research on ML frequently lacks information on implementation methods and often leaves these issues for further investigation (Lehrig et al. 2015). As a conclusion to the literature review section, many types of research already exist about utilisation, application and importance of ITIL and IM. The focus of these studies has been enhanced by using other mechanisms, especially with contemporary technology. In this paper, cloud computing, automation and ML are investigated as the topics regarding IM within the ITIL framework. Most of the studies gave attention to IM process, especially to incident closure, whereas other studies examined the optimization of workforce allocation and lead time prediction. For the cases not covered by already suggested rules and algorithms, extra efforts were made to develop emergency countermeasures and automated quality assurance process. All in all, the literature review comes to the conclusion that there must be more research in this area with significance of the innovative IT technologies as a way of practicing ITIL.
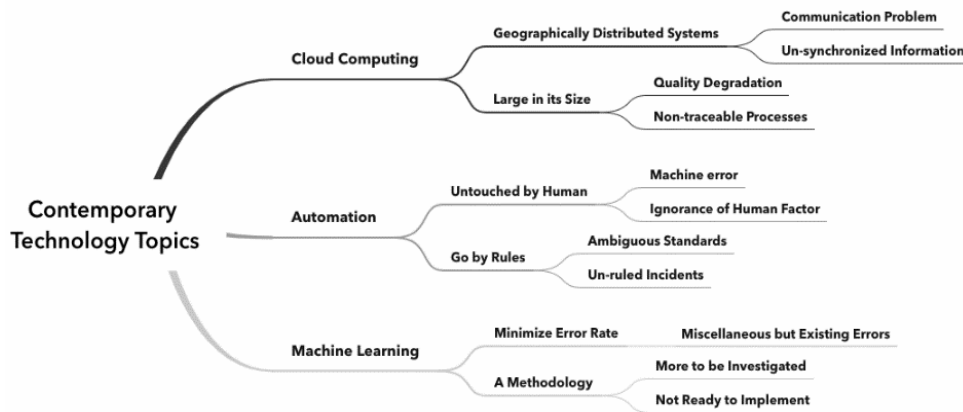
Figure 4. Contemporary Technology Topics and their Challenges

4 CASE STUDY

For this research paper, a bank case study has demonstrated and analysed the finding and result of our literature review. Through this analysis and investigation, primitive ITSM practices that are common in the banking industry are also expected to be identified and resolved with modern technologies (ML, cloud computing and automation). The analysis starts with the investigation of the organisation's ITSM elements, resources, capabilities, and IT service processes. It also covers the shortcomings of the organisation in terms of service operation activities and goes so far as to recommend solutions to resolve the current problems. As one of the recommendations, process automation is discussed using academic research conducted throughout recent years.
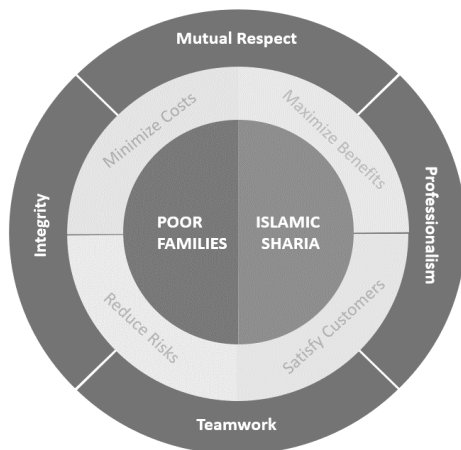

Figure 5. Objectives and Values of XYZ Bank

4.1 Profile of Case Organization

XYZ Bank, one of the biggest commercial banks in Indonesia, is also a subsidiary of the commercial group (as per the code of ethics the name of the bank was changed to XYZ). The Bank came to take its current structure business in 2010 by merging with another large bank ABC.

Geographic Location	Public/private	Size	Business focus
Indonesia	Public	Large	National
Industry sector	Commenced ITIL implementation	Initial ITIL process	Other ITIL processes underway/implemented
Finance	2014	Service Desk, Problem Management, Incident Management	Service Level Management, Capacity Management, Availability Management, Continuity Management

Table 4. Profile of Case Organisation

ITIL Justification	
Trigger	Desire to support underprivileged families and maintain Islamic sharia law for banking.
Prior Crisis	NO
ITIL Service Operation Processes	
Service Desk	Flaws within service capacity management, change management and request fulfillment.
Incident Management	Communication management and customer service.
Problem Management	Communication management and customer service.
Critical Success factors	
Senior Management Commitment	Not mentioned
Training	Not well-trained
Staff Awareness	No - high dependency on the vendor
Careful Software Selection	Yes - Used existing CBS tool specialized in Islamic banking
Use of Consultants	Yes - IT department Team
Reliance on ITIL Publications	Moderate
Culture Change	No
Customer-Focus Metrics	Insufficient focus on customer

Table 5. Justifications, Operation Processes and CSFs for Case

The bank currently owns only 25 branches promoting t the theme of a branch-less bank, with 40 operational function offices covering 70% of the nation. The bank mainly sells financial products, funding to the rich and financing to the poor. Table 4 is showing the profile of the case study for this research paper. Based on our critical analysis as we summarised in figure 5, we found that XYZ bank has two critical business objectives which can support an increasing number of Indonesians who want to bank abiding by the Islamic rules of Sharia and empower Indonesian underprivileged families who have limited access to banks. Therefore, to meet those two main objectives, the bank purports to maximise funding for customers and offer them benefits while minimising the risks and costs (figure 5).

4.2 Case Study Methodology

The analysis of case study helps us to demonstrate our findings from the literature review (summarised in table 5). In order to meet its business objectives, XYZ Bank conducted a quality inspection of its various IT services. Although there was no prior crisis that led this bank to do the inspection, they realised that there were some flaws in their ITSM processes, and they wanted to solve them. In terms of Critical Success Factors (CSF), staff training, and awareness were lacking as was compliance with ITIL requirements. Moreover, we found that their customers are not satisfied with their service. Therefore, the discussion of solutions and recommendations by ITSM had to address these issues and enhance the IT services in the organisation. In the longer term, these three modern IT technologies are expected to provide assistance in improving incident management thus the whole IT operation. As a result they achieved all the bank's business objectives and are able to make continuous developments for the future.
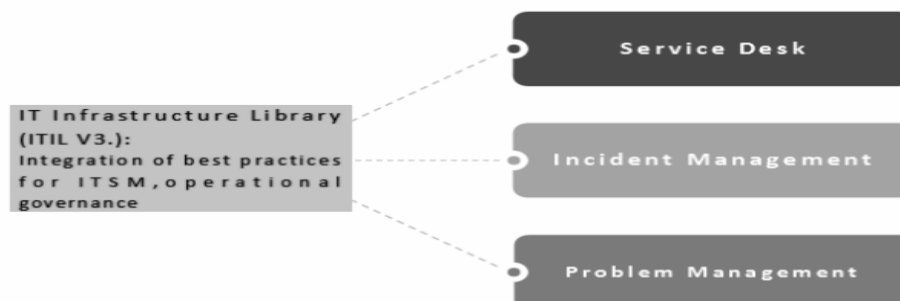

Figure 6. Three Main IT Service Processes by ITIL for XYZ Bank

4.3 Case Study Analysis

To analyse of the case study, the framework of ITIL was adopted to achieve optimized services provided by XYZ bank. In the case of an assessment by ITIL they implemented three main processes in IT service

for operational governance, which are desk services, incident management, and problem management (Figure 6). The service desk, which is called IT Help Desk in XYZ bank, carried out several important processes for the bank, especially in request fulfilment and incident management. Staff need to attend customer's needs and give a response in an effective and efficient manner. The service desk is the Single Point of Contact (SPOC) of the bank, requiring highly trained team and appropriate tools to keep operations running as designed. In the banking industry, the service desk plays a significant role as they have a large number of transactional operations. With the intention of meeting customer requirements, IT Help Desk facilitates cost reduction for the company's and improves satisfaction (Al-Hawari and Barham 2019). We found that some sections are aligned with the standard, but others need improvement. The "IT Application Support Division" is the IM for XYZ bank. All IT incidents are dealt with in this process. The bank is facing multiple IT incidents in their daily operations, because of the high amount of transactions they need to perform their business.

Besides, in terms of problem management, as a means of proactive action, problem management is conducted by the IT operation department of XYZ bank, targeting long-term issues to focus on the analysis of root cause problems of and minimisation of repeated errors. Problem management helps to identify the correct method of sorting out the root causes of IT issues (Figure 7). In XYZ bank, however, based on our analysis, there is a lack of information exchange between Problem Management with Configuration Management and the Service Desk, which means the users are unable to follow up the progress of incidents that have been handled previously. Therefore, we recommend that a separate and independent interface need to be built.

Figure 7. The Factors for Problem Management

4.4 Further Recommendation for Organization

Even though XYZ bank has most of the IT service operation processes in place, the processes are not perfectly aligned with ITIL best practices. So, the XYZ bank must restructure the organisation, processes and operations. Moreover, there must be a group of well-trained experts who professionally monitor, classify, prioritize and solve the upcoming issues (Continuing Improvement Service). Also, the bank should be able to utilise KEDB and configuration items to secure credibility in a timely manner. On the other hand, there is another and even smarter choice for the bank to automate the processes by themselves or outsourcing to a third party. If the bank sincerely wants to make positive differences in its IT service operation processes, automation may help them to achieve their goals (business objective). Another benefit of incident automation is improving the correctness and exactitude at work. The bank can take advantage of the accuracy of automated computation to effectively deal with such issues. The positive outcomes are closely connected to the organisation's branding, better communication with customers, agile services and cost reductions.

5 LIMITATIONS

In the literature review, we have identified the possible constraints encountered for cloud computing, automation and ML. Also, we investigated the impact, financial and security risks, and the implementation costs of the technologies are necessary to develop further discussions on this topic. Only one case study was analysed in this paper, and the industry that was investigated is limited to the banking industry. Although the learning from this case study could also be extended to other cases in different business areas, there still a need for more case studies; cases particularly coming from industries where incident management could have a considerable impact in their business revenue.

6 CONCLUSIONS AND FUTURE WORK

The literature review indicates that existing research approaches provide a holistic view of the ITSM Knowledge ecosystem. Their purpose is to utilise the benefit of contemporary IT technologies such as cloud computing, process automation and ML as we showed in the systematic literature review. To

supplement our findings from the literature review we offer a case study of XYZ bank, its ITSM processes and implementation of ITIL. As seen from the case study, the challenges include but are not limited to miscommunication, lack of change management and poor customer interactions. Therefore, we found that innovative IT technology (figure 4) can improve the bank's daily businesses and help the bank to align business with IT objectives.

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