



Identification of operational risk of embedded Subscriber Identity Module (SIM) technology based on ISO 31000: Systematic Literature Review



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Abstract

In the current digital era, telecommunications industry technology is growing rapidly, impacting the demands for innovation in the telecommunications operator business. One of them is the change in the size of the Subscriber Identity Module (SIM) card model, which is getting smaller, and the use of embedded SIM (eSIM) technology on smartphones. This study aims to identify operational risk factors from the change in SIM card technology to eSIM. The research method used is the Systematic Literature Review (SLR) method. This study documents and reviews scientific journal papers from scientific databases published from 2015 to 2022 on risk management in the information technology field, following this research's objectives. The results obtained from this study showed that there were 43 journals studied, of which four had the theme of technology-embedded subscriber identity module (eSIM), and 13 discussed risk operations technology.

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INTRODUCTION

In the current era of technology 4.0, communication technology is the most important part of people's lives. The technology of the telecommunications industry is growing very rapidly, which has created an impetus for the telecommunications operator's business to innovate more with a competitive model. The operations of telecommunications industry companies, especially cellular operator companies, are inseparable from the continuity of all supporting facilities. In this case, one of the supporting facilities for the continuity of telecommunications operations is the Subscriber Identity Module (SIM) card, which is the key to the successful communication of connected cellular technology.

The change in the size of the SIM card model that is getting smaller shows the rapid development of telecommunication technology, namely the use of embedded subscriber identity module (eSIM) technology on smartphones. An embedded SIM is a digital SIM that activates a

cellular package from an operator without needing a physical SIM replacement on a cellular phone. Ten countries already offer eSIM technology services: Austria, Canada, Croatia, Czech Republic, Germany, Hungary, India, Spain, the United States, and Indonesia. [Figure 1](#) shows that 175 mobile operator service providers have launched commercial eSIM services for smartphones in 69 countries by the end of 2020.

In cellular operator companies, the threat due to the absence of sales made directly to customers is a challenge for eSIM technology. In addition, another possibility is that customers can easily change cellular operators from their devices without needing to replace physical cards [1].

The development of this eSIM will have an impact on the operational process between the use of a SIM card and an eSIM, from a financial point of view, it requires capital related to the new digital customer process that needs to be built, Technology investment for networks and IT platforms.

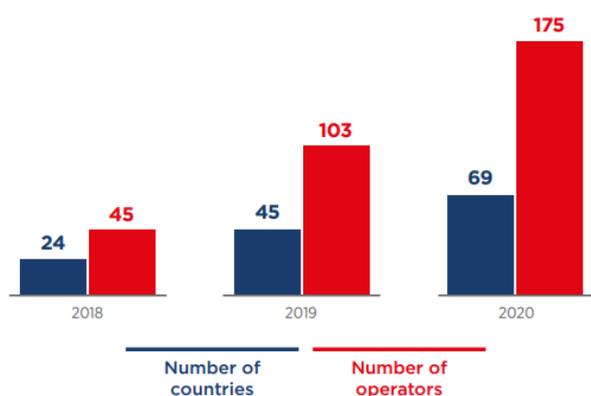


Figure 1. Number of Operators and Countries that launched eSIM

On the other hand, there are also changes related to the reduced logistics costs for SIM cards and reduced sales costs in the long term because they are online. Broadly speaking, according to [1], the major changes that occurred related to the transformation of SIM cards to eSIM in the operator's business model were as follows:

- Construction of new digital channels for eSIM purposes.
- A sales process that needs to be adapted to eSIM technology.
- Investment is needed for technology from the IT side and the network side.
- Expanding partnerships with specialized vendors to support reliable eSIM technology.

In Indonesia, the growth of telecommunications is very rapid following the development of the world. The increasing growth in the telecommunications sector by 10.88% in 2020 based on data from the Central Statistics Agency's Economic growth, proves this).

The Government of the Republic of Indonesia together with the Ministry of Communication and Information (Kominfo) focuses on the development of the telecommunications sector which has been launched since 2015. To support the development of telecommunications, the Government of the Republic of Indonesia launched the Roadmap Making Indonesia 4.0, so that Indonesia can adapt to Industrial Age 4.0. To encourage collaboration between industry players so that they can accelerate digital transformation following global norms, it is necessary to harmonize digital standards in Indonesia [2]. In connection with the change from SIM cards to eSIM, it is necessary to conduct an assessment regarding the operational risk factors that will arise related to this technological change. Therefore, it is necessary to identify, manage and control risks so that operator companies wishing to implement eSIM can

manage or narrow the scope of the consequences of these risks, namely by implementing or implementing risk management to realize controlled and controlled operations.

Thus, research related to the risks that will arise with the change of a SIM card to an eSIM is an interesting thing to do, especially regarding the operational process when verifying customer data. Currently, the verification system does not exist and is vulnerable to hackers because if anyone knows the QR code, they can scan the QR eSIM and it will automatically replace it without any auto-confirmation to the customer. Research [1] examines eSIM service technologies that are ready for the mass market and are happening now. New technologies always have challenges; the advantage for Telia Finland is that they started investing and learning about this new technology at a very early stage in 2015. Furthermore, another research that has been done related to eSIM examines SIM card modeling and eSIM implementation schemes in Indonesia [3]. This study concludes that the forecast for the next 5 years of SIM card subscribers will saturate with an increase of 5.4%, and then the average revenue per user (ARPU) of the SIM card will increase by 84%, while SIM card production costs will increase by 67%.

Meanwhile, subscribers in Indonesia will increase by 15% when implementing eSIM. eSIM technology was reviewed before 2019 when there have been a research review of sim card modeling and design implementation schemes in Indonesia [3]. However, it was only recently implemented by one of the Indonesian operating companies in 2019. The advantage of eSIM technology itself is straightforward, easy, and practical. On the other hand, there are still some technological applications, both financial and operational side.

The research focuses on the operational risks that will be posed by eSIM technology. The study will then provide mobile operator companies with a proposal/strategy to minimize the existing operational risks, requiring a government policy governing these eSIM requirements, in which the study is concentrated only in Indonesia, an operational risk that results in the implementation of the eSIM itself.

The study aims to identify and analyze operational risk factors related to the changes in SIM card technology to eSIM and to propose appropriate risk strategies related to sim card changes to eSIM, where proposed risk mitigation will take an iso-based approach 31000:2018. This research hopes that the analysis of operational risks that arise due to changes in the use of SIM cards to eSIM can provide input to cellular operator companies in managing operational risks

related to eSIM implementation. The problem raised in this study is to identify the operational risks posed by the implementation of embedded SIM technology.

To help solve the problem, the following questions can guide this systematic review: What are the operational risk factors that might occur with the change in SIM card technology to eSIM? To create a solid basis for advancing knowledge and development theory using literature through three sequential activities of input, process, and output called a Systematic Literature Review (SLR). The study aims to identify and analyze operational risk factors related to the changes in sim card technology to eSIM and to propose appropriate risk strategies related to sim card changes to eSIM, where proposed risk mitigation will take an iso-based approach 31000:2018.

METHOD

This study uses the systematic review method as the main method. The purpose of this study is to develop a deeper and clearer conceptualization of operational risk and with the implementation of embedded SIM technology, what risks will arise. The researcher conducted a literature review using the procedures suggested by [4] and [5] for literature synthesis.

The Systematic review is a sequence starting from problem formulation, data collecting, data analysis, and data evaluation. The First step, define the problem, then collect journals that relate to the research subjects. The next step analysis of all the journals already collected by doing journal classifications and finally evaluating all the journals.

Problem Formulation

Research methods with complementary literature review with the following research chronology:

- Conducted a review of research studies that raised eSIM topics and operational risk. The result of the review was found in 43 journals.
- Then, of the 43 journals, it was classified into studies on information technology consisting of 7 journals and risk management in 36 journals.
- This study focuses on four journals that had the theme of technology-embedded subscriber

identity module (eSIM) and thirteen discussed risk operations technology.

Data Collecting

The purpose of data collection is to find empirical literature review studies published in journals from 2015 to 2022 to identify risks that may arise from the implementation of embedded SIM technology. The keywords used are "embedded SIM", "operational risk management", and "ISO 31000". The database or dataset used for this literature research is Google Scholar.

A total of 43 journals studied have been published in scientific journals. Of all the existing journals, there are 7 journals with the theme of information technology and 36 journals that focus on risk management. In this study reference source only used Google Scholar because Google Scholar is the largest indexer in the world, the index of Scopus is not necessarily at Google Scholar, and journal studies related to eSIM have not been carried out much.

Data Analysis and Evaluation

Based on the description of the stages described above, 43 papers related to the themes raised in this study were found, consisting of 7 papers with the theme of information technology and 36 papers discussing risk management. The next stage is grouping journals related to the operational risk of embedded SIM technology, then reviewing an in-depth analysis of articles related to the results of research conducted in the discussion and conclusion chapters.

RESULTS AND DISCUSSION

Research data entered the systematic review is the result of analysis and summaries of journals that have been studied related to operational risk with the embedded SIM technology. Based on the results of a search for journals that raised the topic of operational risk of embedded SIM technology, 43 papers related to the themes raised in this study were found, consisting of 7 papers with the theme of information technology and 36 papers discussing risk management, as listed in [Table 1](#).

Table 1. Forty-three Reference Journals

Category	Author Name
Related to Risk	[6]; [7] [8]; [9] [10] [11] [12] [13] [14] [15] [16] [17] [18] [19] [20] [21] [22] [23] [24] [25] [26] [27] [28] [29] [30] [31] [32] [33] [34] [35] [36] [39] [40] [41] [42] [46];
Related to Information Technology	[3]; [41]; [1]; [42]; [43]; [44]; [45]

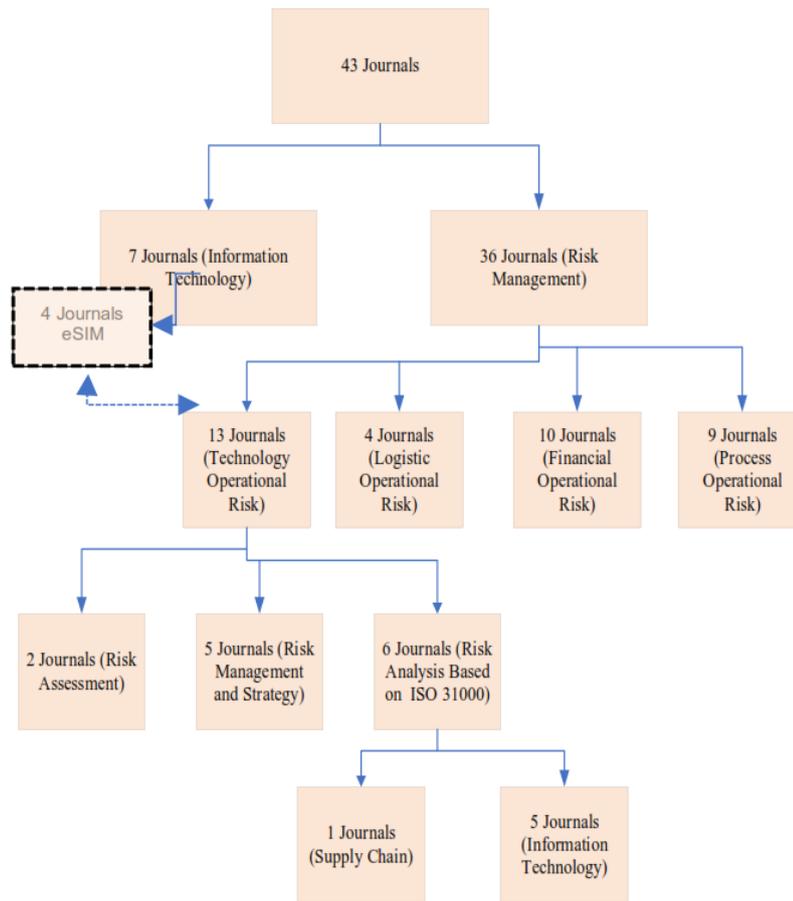


Figure 2. The Journals Map of Technology Operational Risk

The review of 43 journals resulted in a more specific categorization related to operational risk and narrowed down to the findings that 30.23% of the journals were the most relevant in explaining operational risk technology. A more detailed mapping of the journal reviews as shown in Figure 2 can be explained as follows.

- From the 43 journals, it was classified into studies on information technology consisting of 7 journals (16,28%) and risk management in 36 journals (83,72%).
- Furthermore, the study focused on 36 risk management journals covering four categories, namely 13 technology operational risk journals (36.11%), four logistics risk journals (11.11%), ten financial operational risk journals (27.77%), and nine operational risk journals (25%).
- Subsequent reviews focus on 13 (36.11%) technology operational risk journals. The results explain that technology operational risk includes risk assessment in two journals (15.38%), risk assessment and risk management in five journals (38.46%), and risk analysis based on ISO 31000 in six journals (46.16%).

- Of the six journals that describe risk analysis based on ISO 31000, they are divided into two criteria consisting of 1 journal discussing supply chain (16.67%) and five journals discussing information technology (83.33%).
- While there are seven other relevant journals on information technology, there are 4 journals (57.14%) whose contents discuss eSIM.

Further discussion of this literature review will specifically focus on the relationship between technology operational risk and eSIM implementation. This is important because of all the previous studies reviewed in this study, no one has examined and discussed it. In simple terms, this can be described as shown in Figure 3. Thirteen technology operational risks comprise the risk assessment, management risk & strategy, and ISO 31000. The classifications relate to the journal eSIM in identifying possible risks of implementation of eSIM.

The three aspects function as a guide in implementing risk management operations on eSIM as a process to make possible risk factor identification and use ISO 31000 because it is simple, obvious, and compact.

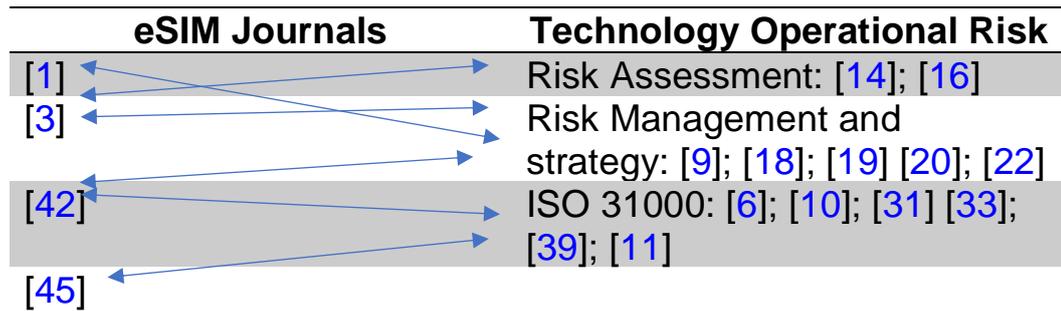


Figure 3. Relationship Between Technology Operational Risk and eSIM Implementation

Four journals related to eSIM technology research conducted by [3] examine SIM card modeling and how the eSIM implementation scheme in Indonesia. The result concluded that the forecast for the next five years SIM card subscribers will experience saturation with an increase of only 5.4%. Meanwhile, the ARPU of the SIM card has increased by 84%, and the cost of production of the SIM card will increase by 67%. In terms of the challenges of the existence of eSIM technology in the future, research from Finland explained this [1] where the challenge for eSIM from the operator's perspective is to be able to open the door for new business models and potentially affect sales from cellular operators to customers.

Another possibility with the existence of an eSIM is that device vendors can directly sell devices to customers. This will have a major impact on the operator's business model and ability to compete in the consumer business, where customers and data are the main competitive advantages. There is no regulatory process for eSIM technology yet, research conducted by [42] states that special legislation is still needed to regulate registration issues, consumer protection, and remote SIM provisioning features to overcome technological disruption caused by using eSIM technology

eSIM with switching model of the context "that is a combination of eSIM and virtual SIM (vSIM) models with enough modifications, and this model has particularly two intents to use the same hardware components to reduce cost and space, the other is parallel enabling all the profiles installed in universal integrated circuit card (UICC) according to network demands [45].

CONCLUSION

The results of a review of several journals that raised the theme of operational risk with embedded SIM technology concluded that operational risk factors that would arise from the existence of eSIM technology could come from human resource factors, external factors,

technological factors, and process factors. Of the 43 papers that have been reviewed and come from Google Scholar, there are 16.28% of papers with themes related to information technology, and 83.72% of papers discuss risk management more. The result of a study of 43 journals focusing on 9.30% of journals relating to eSIM and 30.23% of journals relating to technology operational risk.

For further research, it is expected to reach the decision analysis process in conducting vendor selection which supports eSIM technology and assessing risk analysis from the financial side. Other future research needs to be done to discuss actual studies of the relationship between eSIM and technology operational risk.

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