

Banking Information System Study Through Enterprise Architecture TOGAF

Fian Bagus Saputra^{1*}, Elly Rahmania²

¹ Information System, Surabaya State University

² Informatic Education, Surabaya State University

*Email: fianbagussaputra21004@mhs.unesa.ac.id

ABSTRACT

The development of information technology has changed different views in Indonesian society today. In the era of the industrial revolution 4.0, all industries including the banking industry have implemented the latest Information Technology in accordance with the needs of the industrial revolution. One of the readiness strategies is to make changes to information technology planning based on Enterprise Architecture. The Enterprise Architecture method of this research uses TOGAF (The Open Group Architecture Framework). The goal is to develop business architecture, application architecture, information architecture and technology so that they can adapt to the industrial revolution. The application of Enterprise Architecture needs to perform gap analysis and implementation strategies. Application system development does not need to be done totally, but there are several application systems that need to be changed. The application of Enterprise Architecture can be carried out starting from architectural design, gap analysis to implementation strategies so that they are able to face the industrial revolution 4.0.

Keywords: Enterprise Architecture; TOGAF; Gap Analysis; Implementation Strategy.

INTRODUCTION

The impact of the Industrial Revolution 4.0 (He et al., 2021), (Wang et al., 2021) has spread to various sectors and one of them is the banking and financial services sector. The impact of the financial and banking industry is competition from several Financial Technology companies. Competition in various industries is getting tougher, where companies that do not want to change their business and strategies will experience destruction or loss. Many banking companies do not adapt by adopting the latest technology, updating some services or not being creative and innovative, it can be ascertained that the company is experiencing difficulties in its business. One example that is affected is services in the retail banking sector that focus on consumers or individuals and small businesses. Where the market from banking will continue to be eroded, because technology-based financial companies continue to make breakthroughs, both in services and in the field of information technology. In this case, consumers are given the best convenience and service with the technology offered by Fintech companies (Tavana et al., 2020).

The previous decade the banking industry served its customers, by opening branch offices to the sub-district level throughout Indonesia. With the hope of providing closeness services between customers and the banking sector. After the presence of information technology and telecommunications, where currently the internet has become a public need and 24-hour banking services. Technology using Automated Teller Machine (ATM) technology is currently being abandoned by many people (van der Heide et al., 2020). The need for money transfers is no longer using ATMs, unless people want to withdraw cash, they still use ATM.

The presence of the internet in the banking industry, banks are making breakthroughs in the field of *Internet Banking* as a customer service. The purpose of internet *banking* services (Naeem & Ozuem, 2021) can reach consumers wherever customers are. Mobile *Bank-ing* service makes it very easy for customers to manage savings or other banking needs. Banking customers do not need to visit the kan-

tor branch, just with a Smartphone and take a photo with a camera and nasa- bah data sent through the banking website and can already open as banking customers. The use of Internet of Things technology (Goyal et al., 2019) as a form of banking services (Khanboubi et al., 2019). In addition, banks use *Crowd-based Financing, Virtual Money, Cyber Security* (Kiwia et al., 2018), (Hasan et al., 2021) and *Data Mining* (Schulte, 2018).

Enterprise Architecture in a company is the management of an organization for business processes and information technology infrastructure that designs between the integration and standardization of the company's operational model. By designing the architecture, it can provide a vision and foresight for the company's processes, systems, and information technology. Some companies also use the Framework to design enterprise architectures. Examples of the use of Enterprise Architecture are *the Zachman Enterprise Framework (ZEF)* and *The Open Group Architecture Framework (TOGAF)*. The architectural design method in TOGAF is called the *Architecture Development Method (ADM)*. It consists of a comprehensive and integrated process in development and *Maintenance Enterprise Architecture*. The stages of ADM can be described as follows.

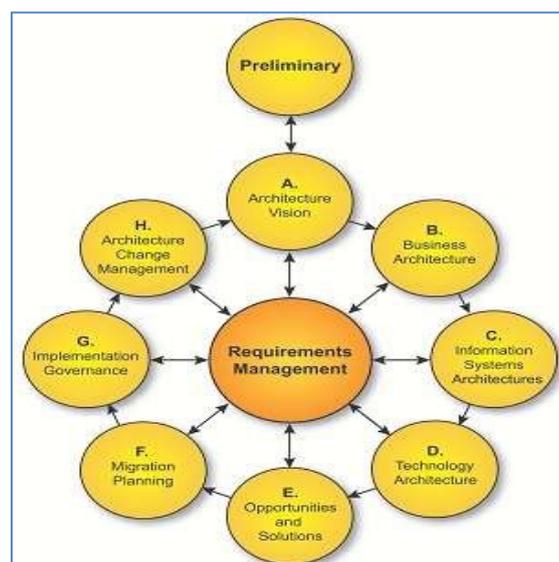


Figure 1. Stages of TOGAF Architectural Design

Develop *Enterprise Architecture* (Villalta, 2015) for banking that is designed and implements the latest technology in the era of the industrial revolution. By simplifying the business flow, it makes a banking company more agile in managing its business. In terms of business architecture, information architecture and technological architecture are very supportive. But keep in mind that it is not that simple in running a bank business that is increasingly being eroded by its competitors. It is also prepared to face an ever-evolving information system and a sustainable system (Hindarto et al., 2021), in the sense of a system that keeps up with the times.

The purpose of this study focuses on discussing aspects of the stages of the TOGAF method. The aspects discussed in this study are *Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, and Implementation Governance*. Where your- gensi from the application of *Enterprise Architecture* exists- it is that the banking industry is able to face the innovation of the industrial era 4.0

METHOD

The methodology of this study uses qualitative methods. The qualitative method is a metode research by collecting data in the form of raw data which is then carried out ana- lisa statistics and other analysis. Qualitative methods obtain the results of analysis of descriptions, analysis, and more detailed interpretations in an event.

There are several methods used in collecting qualitative data, namely participant observation, surveys, interviews with banks including literature studies, documents and some artifacts as supporting materials in research. This research consists of several stages. An understanding of business processes is obtained from field observations on banking and from literature studies on banking topics, such as several

journals related to bank discussions and supporting documents such as the journal Enterprise Architecture. This study examines the eight stages contained in TOGAF ADM. The six stages are *Architecture Vision, Business Architecture, Information Systems Architecture, Technology Architecture, Opportunities and Solution* and *Implementation Governance*. *Architecture Vision*, designing a business architecture depicted in the form of a business model canvas consisting of nine components. The components of the business model canvas consist of (1) *Customer Segments*, which provide information about customers from banking customers. (2) Value Propositions, providing information about the added value of banking products offered to customers or banking customers. (3) Channels, providing information about promotions, and introducing banking products. (4) Key Resources, providing information on resources, including human resources. (5) Key resources, providing information about the parts of the banking organization that are considered important in conducting business. (6) Cost Structure, providing information about operational costs or expenses. (7) Key Partnerships, providing information about partners or vendors who are bound to support the bank business. (8) Revenue Streams, providing information on the source of business income per bank. (9) Customer Relationships, providing information about parts that are closely related to banking customers.

Design information and data architecture. At this stage, it explains about the information stored in the storage medium and how it relates to the application used. This technological architecture explains the technology used.

RESULT AND DISCUSSION

The results of surveys and literature studies on the banking industry provide information in the design of *Enterprise Architecture* which consists of several stages of architectural design such as business architecture, application architecture, information architecture and technology architecture. After doing architectural design, continue by looking for gaps from the design that has been implemented. Then from the discovery of gaps, there is the implementation stage of the architecture that has been created. Business architecture is designed in the form of a business model canvas consisting of eight compotes, which are described in the figure below.

• **Business Vision**

This section describes the needs of the user regarding the information system that will be applied to the company or bank organization.

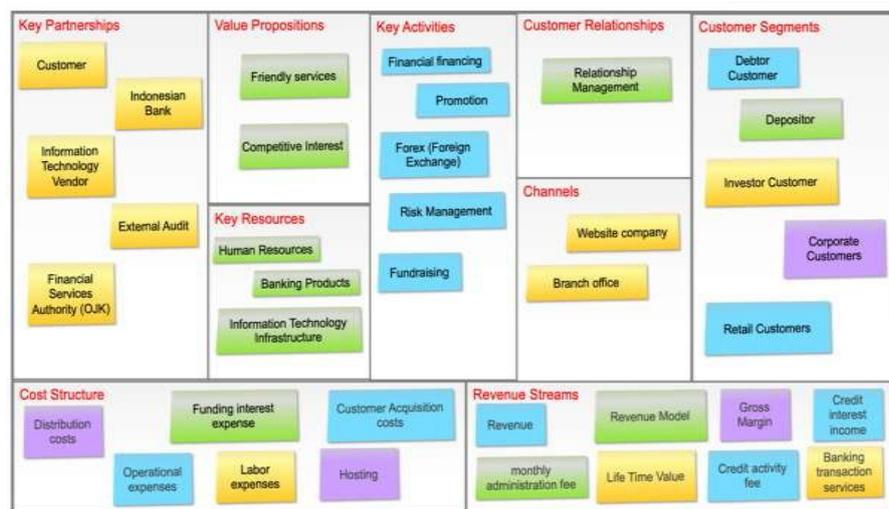


Figure 2. Banking Business Architecture

Customer Segments. In one of the bank industries, it can distinguish customers into five groups: (a) Debtor Customer, which is a customer who uses a loan product from a bank. These customers can be divided into retail or MSME customers (Micro, Small and Medium Enterprises) and corporate loans or enterprise loans. (2) Depositor shall be a customer or customer who places his funds at the bank in the form of a deposit. (3) Customer investors are customers who are interested in buying investment products from banks. (4) Corporate Customer and (5) Retail Customer.

Channels are a medium for promoting banking products. Banking companies promote products by opening branch offices, company websites, social media such as on Twitter and making marketing brochures. *Customer Relationships*, is a banking activity in establishing relationships with customers or banking customers. As for investment products, responsibility is devolved to the *Customer Relationship Management department*. *Bank Value Propositions* should be an attraction for aspiring banking companies. This is one of the best marketing methods, in addition to knowing banking products. In addition, it is a service to customers in a friendly manner, financial services or low interest and eliminates administrative costs.

Key Resources. The Banking Industry in carrying out its business activities, uses its power to produce good services and products. *Human Resources* in banking companies must be ready by making breakthroughs in the face of the industrial revolution, *Banking Products* that can always create good bank services and products supported by *Information Technology Infrastructure*. *Key Activities*. One of the next banking activities is (1) *Financial Financing* is a banking business that functions to distribute funds to customers. For example, financing home ownership loans (KPR), motor vehicle ownership loans (KPM), and others. (2) *Fundraising* is a bank's effort to raise nasabah funds. These fund collections are like savings, current accounts, and time deposits. (3) *Risk Management* is a calculation of the level of risk from banking activities to keep them under control in distributing credit to customers. (4) *Forex* (Foreign Exchange) is a service or service for buying and selling foreign currencies. (5) *Promotion*, the activities of banks to offer products to customers or prospective customers.

Revenue Streams. Banking companies have many sources of income. Some of the provisions such as Revenue, Revenue Model, Gross Margin, Credit Interest Income, Monthly administration fee, Lifetime Value, Credit activity fee, Banking transaction services. All activities generate income for the company.

Cost Structure. Banking companies also have a *Cost Structure* where all expenditure activities are regulated in *the Cost Structure*. The following *cost structures* such as: *Distribution costs*, *Funding interest expense*, *Customer Acquisition Costs*, *Operational expenses*, *Labor expenses*, *Hosting for media purposes penyimpanan system and database*.

Keys Partnership. The Bank has partners in carrying out its business, including (1) Customers, apart from being customers, customers can become partners. For example, as a promotional medium and so on. (2) Bank Indonesia, is the central bank of Indonesia that plays an important role in determining financial policy in the Republic of Indonesia and keeping finances stable. To provide banking finance reports, a credit reporting application system is needed. (3) The Financial Services Authority shall have a role in overseeing the activities of the financial services sector in order to create a fair, transparent system and protect the interests of customers or nasabah. OJK also requires banks to provide reports on a certain basis. (4) *External Audit*, the bank also uses the services of an external audit company which is used to control and ensure that the banking process runs in accordance with the banking *Standard Operation Procedure* and can be accounted for. Because the bank business is the *Trust* or trust of the nasabah user of financial services. (5) *Information Technology Vendor*, In the implementation of banking operations, it is always supported by the information technology vendor, so that the bank can concentrate on carrying out banking activities. Of course, the vendor is given a binding agreement and maintains banking confidentiality. Every certain period of the agreement with the vendor is reviewed and audited from the bank to ensure information technology support from the vendor.

- **Application Architecture**

The application architecture describes the existing system in banking, but in this study it does not explain the entirety of the existing system in the bank. The reason is to maintain confidentiality in business in banking. But the general picture of banking is nasabah money storage, lending, promotion and low administrative services. So that banks can channel credit to prospective debtors with low financial services. The information technology section classifies into seven sections as follows:

(I) *System Executive Information*, (II) *System Payment, Audit, Reporting Bank Indonesia*, (III) *System Customer Relationship Management*, (IV) *System Core Business*, (V) *System Asset Management* (VI) *System Internet and Mobile Banking*, and (VII) *System Security, Support and Monitoring*.

- *System Executive Information*, is a system that aims to provide summaries reporting of all banking application systems. A kind of dashboard management, so that banking leaders can find out information with the banking business. Because all application systems will boil down to this system. There are these two systems, namely *AMI, Smart Executive Inventory, Asset and Ratio* and *AM2 Smart Executive Finance and Performance Report*.



Figure 3. Application Architecture

- *System Payment, Audit, Reporting Bank Indonesia.* It is an information system that is intended for banking activities with external parties. Such as: BJ 1. *Smart Reporting Indonesian Bank and OJK System.* Which aims to report on credit activities and the use of nasabah fund collection (deposits, current accounts and tabungan).
- *System Customer Relationship Management.* It is an information system that aims to serve customers or customers per-bank. The system is like DJ 1. Smart Portal, KPI and Sales Force, this system is also a medium for promoting banking products. DJ 2. Smart Customer Relationship Management, this system is a service to customers or customer banking.
- *System Core Business.* It is a collection of core systems of banking. One of the main services of Banking is fund collection and credit distribution. System information services such as KJ 1. *Smart Funding, Guarantee System, KJ2, Smart Risk and Investment System, KJ 3. Smart Data Warehouse System.*
- *System Asset Management.* Is a collection of systems that aim to manage banking assets. Here's a collection of application systems like: HT 1. Fraud Detection, Anti Money Laundering, to detect wishful fraud. HT 2. *Smart Finance, Human Resource, Treasury Report,* to manage finances, manage human resources that carry out banking industry operations. *System Treasury Report,* to manage assets and develop assets to be more productive.
- *Internet and Mobile Banking System.* feeds a collection of application systems by utilizing internet media as a relationship between the banking business and customers or other external parties. Here's an internet-based application system: HI 1. *Smart Internet Banking,* this application is used for bank services with internet-based services. One of the services is to use a computer or laptop and do banking transactions without having to visit a bank office. It can be for 24 hours. HI 2. *Smart Mobile Banking,* a banking application system service using a Mobile Phone device. Users install banking Mobile Apps and perform banking transactions with Mobile Phone. HI 3. *Smart Virtual Branch, HI 4. Queue Teller Management System*
- *System Security, Support and Monitoring.* It is a collection of application systems that are supporting in supporting banking operations. DA 1. *Security Monitoring.* This application is useful for detecting cyberattacks or intrusions on Data Center devices in banking. Therefore, with this monitor application, it is expected to be able to detect cyberattacks in banks. DA 2. *Network Monitoring.* This application system is useful for monitoring the banking network, it is expected from this system to be able to monitor the network. DA 3. *ATM Monitoring,* this system is able to monitor the condition of the ATM machine, fill in the money at the ATM. From this monitoring information, the ATM money replenishment department can immediately replenish, as well as make repairs or maintenance to the ATM. DA 4. *Device ATM System, Monitoring.* One of these monitorings is useful for monitoring equipment, such as monitoring the condition of ATM in the event of destruction or theft.
- **Information Architecture**

Information architecture is a system that tours the storage media from the activities generated by the application system. Because the grouping of datasets is very important, namely for maintenance needs and managing data-base Information architecture is functionally grouped in five main parts. The upper part is to carry out reporting activities or Executive Information System. There are two groups, the first group to present information on Inventory, Asset and Capital Adequacy Ratio per bank. The second

group is to present information regarding Finance and Performance Report of banking. The right part of the information architecture is used for banking customer service, and there is a database relationship with the Executive Reporting database. The following is the information architecture related to bank customer service: Db 9. Internet banking, all activities related to internet banking are stored in the Internet Banking database. Included in the relationship between databases is also grouped in the customer database. DB 11 Virtual branch, this application system handles branch office problems virtually, the database is also connected to the core banking database. DB 13 ATM monitoring, DB 12 Queue Teller management System, accommodates data flow from service queue activities with bank cashiers.

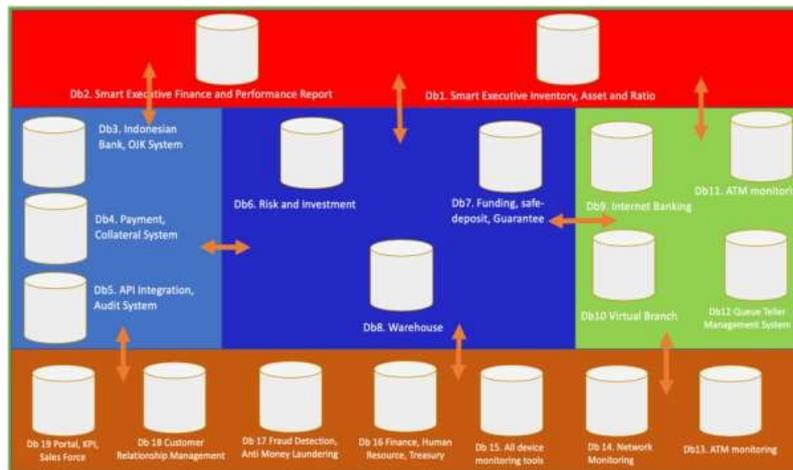


Figure 4. Information Architecture

The middle section contains information architecture for *DB6 Risk and Investment*, *DB7 Funding-Safe Deposit*, *DB8. Warehouse*. *DB6 Risk and Investment* information architecture has a relation database with *Database Funding* and *Database Warehouse*. *Relational* or relational is interpreted for the purposes of other system processes. The left section contains information architecture about *DB3 Indonesia Bank and OJK*, *DB4 Payment and Collateral systems* and *DB5. Audit sistem*. In this information architecture, there are also relationships or relationships with other *databases*. The bottom section is an information architecture about *Db 19 Portal, KPIs, Sales Force*; *Db 18 Customer Relationship Management*; *Db 17 Fraud Detection, Anti Money Laundering*; *Db 16 Finance, Human Resource, Treasury*; *Db 15 All device monitoring tools*; *Db 14 Network Monitoring* and *Db 13 ATM monitoring*. This structure aims to group with information systems that are internal.

- Technology Architecture

The technology architecture used is *cloud computing*. Where currently the central server is no longer placed in the *data center* room. But all *servers* are already placed in the position of *cloud computing*. The data center room already manages *servers* that are already in the *cloud*. Maintenance operations are also more efficient, where server storage technology does not provide large electrical power and a place for servers. In addition to the many advantages with the use of *Cloud Computing*, in addition to saving costs.

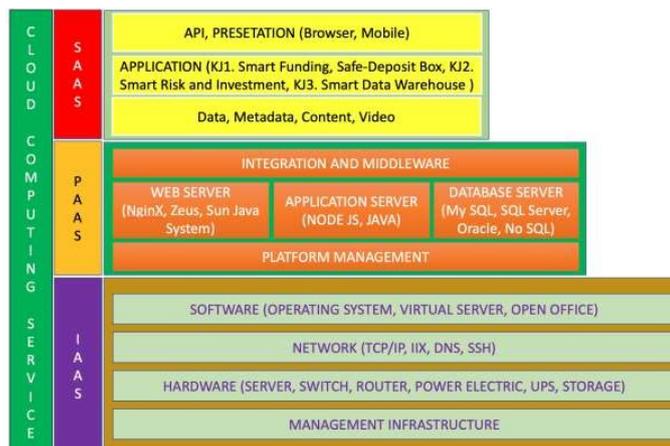


Figure 5. Technology Architecture

Currently, using *cloud com services* is a trending and fairly easy device. No need to be afraid that data is leaked and lost data, because it has been done with strict and appropriate *cyber security*. The use of *Intrusion Detection System (IDS)*, *Intrusion Detection System (IPS)* can reduce the impact on data leakage. In the architecture of *Cloud Computing* technology used has three layers. The *Infrastructure as a Service (IAAS)* layer is a layer that manages infrastructure such as Management Infrastructure, *Hardware (Server, Switch, Router, Power Electric, UPS and Storage)*. Software in the cloud such as *Operating systems, virtual servers, open offices. Networks* used such as *TCP/IP, IIX, DNS and SSH*.

Platform as a Service (PAAS) is the second layer that contains *Platform Management, Web Server* such as *(Ngix, Zeus, Sun Java System)*, *Application Server (Node Js, java)*, *Data-base Server* such as *My Sql, Sql Server, Oracle and No Sql*. *Integration and Middleware* are the second layer. *Software as a Service (SaaS)* is the third layer. SaaS is used three namely *API (Application Programming Interface)*, *Presentation (Browser, Mobile)*. *Application Banking, Content, Video, Metadata and data*.

- **Implementation Governance**

The *Implementation Governance* stage is the stage of starting the implementation of the plan that was generated from the previous stage. Strategically is the application ranging from preliminary, gap analysis, business architecture, application architecture, information architecture, technology architecture as well as opportunities and solutions. Considering that the implementation of planning takes a lot of time, the step is the phasing of each planning.

The initial implementation stage can be done by preparing and evaluating the business architecture, because this architecture is related to the excitement of the banking business facing the industrial revolution of the 4.0 era. Banking adjustment is to modify and add features to today's evolving needs. Especially how to modify about the banking business according to the needs that are developing today and in the future.

The next stage is the application architecture and information architecture can be implemented simultaneously. The next stage is to modify and add infrastructure, especially strengthening network and system security. *Tahan* architecture of this technology is absolute or as the main priority, considering that the *per-bank* information system is accessed openly through the internet media.

CONCLUSION

The banking world in the face of the industrial revolution must make breakthroughs so as not to be abandoned by customers. Because currently the financial market is not only banks that can channel credit to the public. The presence of the Fintech industry adds to the competition to take the financial market. Moreover, the ease of facilities used by fintech is also increasingly favored by the public. Services start with the ease of paying for the transportation application system, online shopping, the ease of channeling credit, making the Fintech industry grow rapidly. If banking companies are not prepared to face the advancement of the Fintech industry, it is certain that the banking market is starting to be taken by its competitors. Nowadays, the Fintech industry is still taking the retail market, it does not mean that the corporate market is not taken. If banking is not ready, then in the future the corporate market can be taken by Fintech companies.

Preparation in the face of competition in the financial industry, resulting in companies having to make changes. Discussion of business architecture, application architecture, information architecture and technology architecture is aimed at facing the industrial revolution of the 4.0 era. In the technological architecture, it is also discussed about the security of systems and networks, considering that this industrial revolution has moved banks closer to society. So in protecting systems and networks, *Cyber Security Hardening* or strengthening is implemented for network and system security.

Implementation in implementing the architecture requires strategic steps and is structured so that in implementation, application systems and networks are not disturbed. A mature strategy will result in good planning and implementation. Considering that the banking system should not be disrupted in daily operations.

REFERENCES

- Goyal, P., Sahoo, A. K., & Sharma, T. K. (2019). Internet of things: Architecture and enabling technologies. *Materials Today: Proceedings*, 34 (xxxx), 719-735. <https://doi.org/10.1016/j.matpr.2020.04.678>
- Hasan, S., Ali, M., Kurnia, S., & Thurasamy, R. (2021). Evaluating the cyber security readiness of organizations and its influence on performance. *Journal of Information Security and Applications*, 58, 102726. <https://doi.org/10.1016/j.jisa.2020.102726>
- He, X., Xiong, D., Khalifa, W. M. S., & Li, X. (2021). Chinese banking sector: A major stakeholder in bringing fourth industrial revolution in the country. *Technological Forecasting and Social Change*, 165(December 2020), 120519. <https://doi.org/10.1016/j.techfore.2020.120519>
- Hindarto, D., Indrajit, R. E., & Dazki, E. (2021). Sustainability of Implementing Enterprise Architecture in the Solar Power Generation Manufacturing Industry. *Sinkron*, 6(1), 13–24.
- Khanboubi, F., Boulmakoul, A., & Tabaa, M. (2019). Impact of digital trends using IoT on banking processes. *Procedia Computer Science*, 151, 77–84. <https://doi.org/10.1016/j.procs.2019.04.014>
- Kiwia, D., Dehghantanha, A., Choo, K. K. R., & Slaughter, J. (2018). A cyber kill chain based taxonomy of banking Trojans for evolutionary computational intelligence. *Journal of Computational Science*, 27, 394–409. <https://doi.org/10.1016/j.jocs.2017.10.020>
- Naeem, M., & Ozuem, W. (2021). The role of social media in internet banking transition during COVID-19 pandemic: Using multiple methods and sources in qualitative research. *Journal of Retailing and Consumer Services*, 60 (October 2020), 102483. <https://doi.org/10.1016/j.jretconser.2021.102483>
- Schulte, P. (2018). Mobile Technology: The New Banking Model Connecting Lending to the Social Network. In *Handbook of Blockchain, Digital Finance, and Inclusion* (1st ed., Vol. 2). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-812282-2.00013-9>
- Tavana, M., Hajipour, V., & Oveisi, S. (2020). IoT-based enterprise resource planning: Challenges, open issues, applications, architecture, and future research directions. *Internet of Things*, 11, 100262. <https://doi.org/10.1016/j.iot.2020.100262>
- van der Heide, L. M., Coelho, L. C., Vis, I. F. A., & van Anholt, R. G. (2020). Replenishment and denomination mix of automated teller machines with dynamic forecast demands. *Computers and Operations Research*, 114. <https://doi.org/10.1016/j.cor.2019.104828>
- Villalta, R. (2015). Enterprise architecture in the Peruvian banking. In *CISCI 2015-Decima Cuarta Conferencia Iberoamericana en Sistemas, Cibernética e Informática, Decimo Segundo Simposium Iberoamericano en Educacion, Cibernética e Informática, SIECI 2015 – Memorias* (pp. 269–274). https://api.elsevier.com/content/abstract/scopus_id/84959359455
- Wang, X., Sadiq, R., Khan, T. M., & Wang, R. (2021). Industry 4.0 and intellectual capital in the age of FinTech. *Technological Forecasting and Social Change*, 166 (May 2020). <https://doi.org/10.1016/j.techfore.2021.120598>