Business process monitoring system in supporting information technology governance

Lanto Ningrayati Amali, Muhammad Rifai Katili, Sitti Suhada, Tri Alfandra Labuga
Department of Informatics Engineering, Universitas Negeri Gorontalo, Gorontalo, Indonesia

Article Info

ABSTRACT

Information technology (IT) is essential in supporting an organization's business sustainability and growth, making it critically dependent on IT. Therefore, a focus on IT governance, consisting of leadership, organizational structure, and process ensuring that IT organization supports and expands the organizational strategies and goals is required. When the business supports the strategic significance of IT investment, the implementation of an IT strategy will lead to the adoption of an IT governance model. It will support and help the description of the benefit roles and responsibilities from IT systems and infrastructure. This paper aims to develop a business process monitoring system to support IT governance in improving user service and measuring organizational performance. The research method was the system development method with the Waterfall model. To measure the performance of the business process, the self-assessment method with performance matrix tools was applied. The study resulted in a business process monitoring system that can enhance the organization's primary business process in services, supporting the said organization's performance.

Corresponding Author:

Muhammad Rifai Katili
Department of Informatics Engineering
Faculty of Engineering, Universitas Negeri Gorontalo
Prof. Dr. Ing. B. J. Habibie Street, Gorontalo, Indonesia
Email: mrifaikatili@ung.ac.id

1. INTRODUCTION

IT governance is a commitment to awareness in the process of organizational management control of IT/IS resources, including software, hardware, brainware, databases, and communication networks. IT Governance is defined as a pattern of authority/policy on IT activities (IT process) [1]. In that, the pattern is to develop policies and management of IT Infrastructure, the use of IT by end-users efficiently, effectively, and safely, as well as an effective IT project management process [2]. Several governments or private organizations have started to implement IT governance to achieve a combination of business and IT [3], [4]. The use of IT is very comprehensive in every aspect of the organization's efforts to support the organization [5], [6]. Therefore, the use of technology causes a critical reliance on IT, requiring a particular focus on IT governance [7], [8].

In references [9]-[11] it is stated that IT governance affects the IT business's alignment, and both affect the business value or organizational performance. The increase in demand for services and cost savings for the community, business, and organization causes the need for IT governance. On the other hand, it cannot be denied that IT increases the organization's business value, both in its main and supporting activities [12]. IT is used as a strategic tool for organizations to increase competitive advantages in times of increasing uncertainty, leading to higher dependence on the IT environment [13], [14]. Hence, the effective management

of IT and its alignment with business goals is crucial for organizational success. According to [15], [16] that the success of implementing IT in an organization depends on the business processes used to manage the technology.

The business process monitoring system is built based on the organization's need for the significance of IT in supporting its business processes. There are many constraints on organizational performance, i.e., service to data users, measurement of employee performance, and planning of various improvements using business process improvement tools. In references [17]-[19] business processes are defined as the art and science of monitoring how work is done in an organization to ensure consistent results and take advantage of improvement opportunities. According to [20], business processes can be understood as a set of integrated organizational capabilities related to strategic alignment, governance, methods, technology, people, and culture. The use of business processes has been instrumental to represent an organization's business and activities [21]. The increasing service for users, the increasing importance of information technology for process design, and the overall recognition that the process forms a critical organizational asset, have made this business process system indispensable. The compelling business processes facilitate the monitoring activity. This is possible because the processes or activities in an organization have clearly defined the owner of the process, the process completion time, the required inputs, the outputs produced, and the procedural references used in completing the process [17].

The use of the business process monitoring system in an organization is crucial to maintain and widen the organization's strategy and purpose. It is even more important considering the lack of system built without being based on the organization's need for the importance of analysis and design starting from the main, supporting, and developing business processes. It has been stated by Rahimi *et al.* [22] that the importance of the business process and the improvement of TI centrality concerning the organization's performance requires a particular focus on the business process governance and IT governance in the organization. This is also accompanied by the expansion of business processes that support IT in organizations and considering the impact of business processes and IT on organizational success [23]-[25], [15]. This paper proposes the development of a business process monitoring system to support IT governance in improving user service and measuring organizational performance. It also presents that alignment between business process systems and ITG is needed. The study considers the need for alignment by building a business process monitoring system and IT governance to identify the organization's need for IT's importance in supporting its business processes.

2. RESEARCH METHOD

This research employed the Waterfall system development method [26] with research stages, as shown in Figure 1. The study was conducted at the office of statistics Indonesia (BPS) of Boalemo Regency.

The next stage involved a business process analysis, which was performed in some stages [17], [27], [28]. Firstly, measure the performance of running business processes using modern performance measurement. The modern performance measurements included quality, speed, reliability, flexibility, and cost. Secondly, evaluate the performance through the self-assessment method using performance matrix tools. These tools divided business processes into four quadrants of performance measurement from unnecessary to necessary improvement. At this stage, the data were collected from a performance measurement questionnaire that produced the index value of performance and interest. Thirdly, develop plans, which served to provide a decision on whether or not to develop a business process.

Based on performance matrix tools, coordinates were set in each variable to determine the position of the business process performance variable in the performance matrix tools. Performance index values (NIK) of performance were the dots in the Y-axis, while performance index values (NIK) of importance were the dots in the X-axis. After both NIK were obtained, the values were mapped in an importance-performance matrix, as shown in Figure 2. The image shows the running business process that is divided into four quadrants. In quadrant I, an unimportant process unnecessary to be developed is found; the performance is also flawed. Quadrant II is a region that requires performance improvement because it is known that its processes are essential, which are the monitoring process and staff performance. Quadrant III is a region that has good performance, although unnecessary to be periodically developed. Finally, quadrant IV is a region with good performance and high importance; thus, it must be maintained. Based on the data mapping results and the analysis using performance matrix tools, the business process that is deemed as necessary to be improved exists in quadrant II.
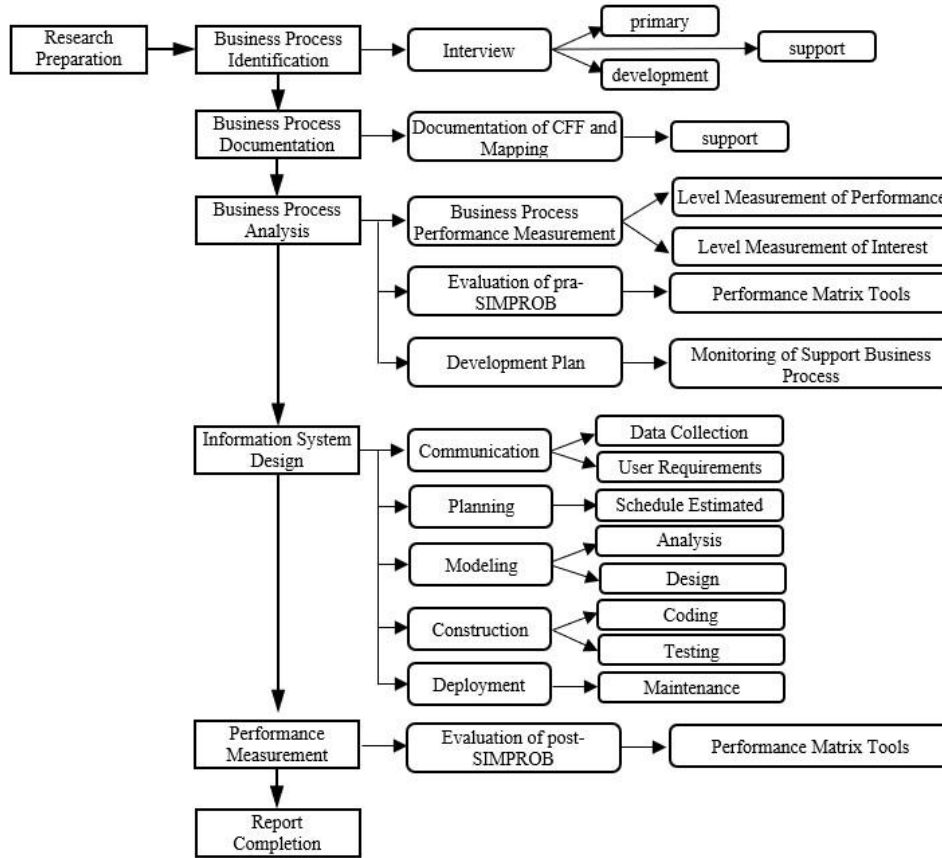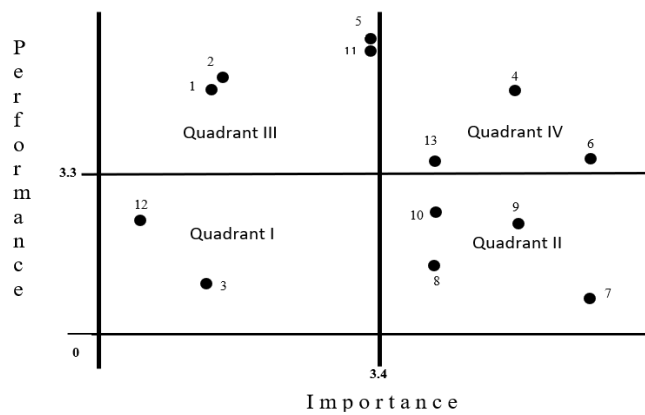
Figure 1. Research procedure

Figure 2. Performance matrix tools

The information system design relied on the Waterfall method that comprised communication, planning, modeling, construction, and deployment.

a. Communication (project initiation and requirements gathering) by gathering all user needs in the design of the system to be built;

b. Planning (estimating, scheduling, tracking) by establishing software work plan that included technical tasks to be performed, the results to be made, and the work schedule for the construction of a monitoring information system of business process;

c. Modeling (analysis and design). The process of translating the requirements specification into a design that focused on the analysis and design of data structure, software architecture, interface design, and database;

d. Construction (codes and tests). This stage included coding to translate modeling (analysis and design). This stage was done by making coding using the PHP programming language and testing the implementation system (TIS) using black box and white box;

e. Deployment (delivery, support, feedback). This stage functioned to maintain the developed system and was carried out periodically. This stage also introduced the use of the system to the user.

3. RESULTS AND DISCUSSION

The development of technology helps computers to produce large amounts of data, so it needs to be treated with great care to get its benefits [29]. The key to a business strategy to create a competitive advantage is to understand the data and information that an organization generates in its business. Therefore, information processing gradually becomes the basis for achieving a competitive advantage [30]. A business process monitoring system is built to obtain information regarding budget requests, achievements, and employee performance targets. This system is created to improve business processes in serving data users and measuring performance based on the data obtained. İn this developed system, the IT's value must be in line with the business focus value and measured in a transparent way that shows the impact and contribution of IT investment in the value formation process of the organization.

In general, this system's development includes processes that indirectly generate value for the organization but are required to support the main processes (dissemination of accurate data, data integrity, and reliability for users). Figure 3 shows a level 0 diagram of all the input, process, and output flows of a business process monitoring system.
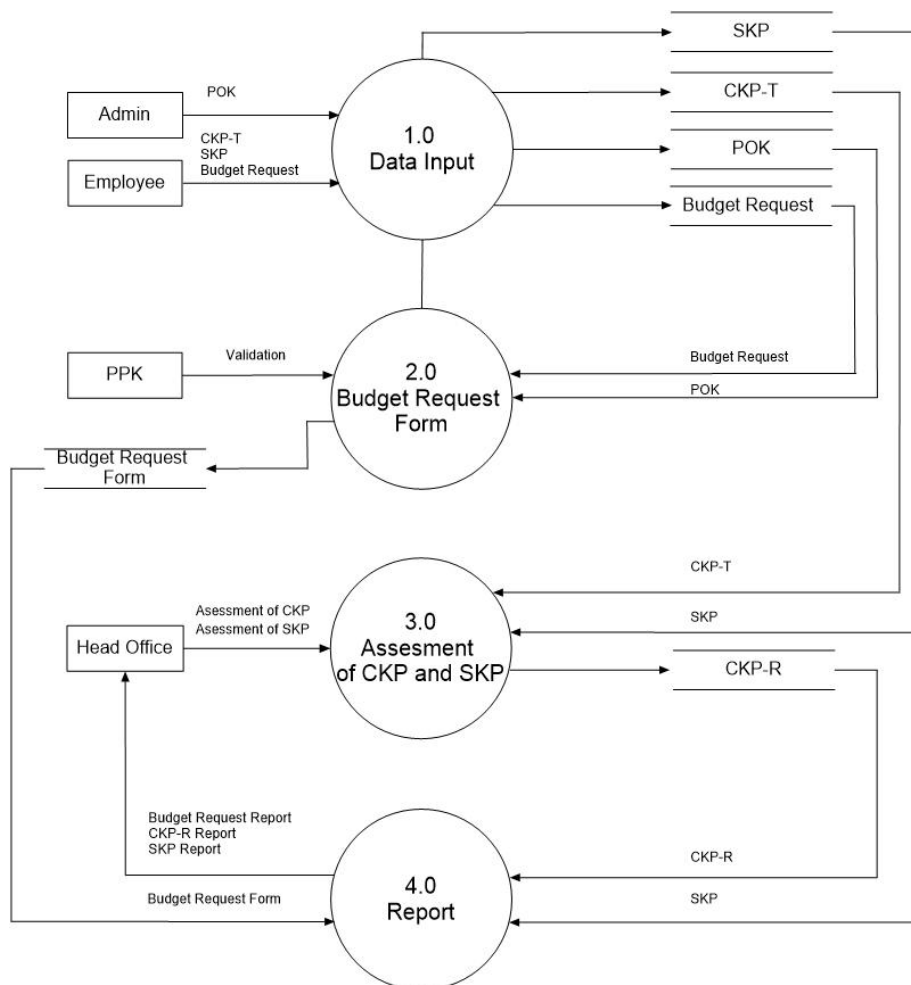

Figure 3. Diagram of input, process, and output

Figure 4 and Figure 5 illustrate the implemented design of the business process monitoring system. The system has a feature to create a budget request form, performance form, and employee performance targets

form. This system can also monitor the process of submitting the future and the used budget request forms and indicators of achievement of employee performance assessments and targets. Furthermore, through this system, the decision making officer (in Indonesian known as PPK) can verify the budget request form based on the budget request before submitting it to the treasurer (the one who will make a receipt from the budget for the disbursement process). In the process of evaluating employee achievement and performance targets, the system can monitor the presentation of targets and the realization of employee achievements and performance.
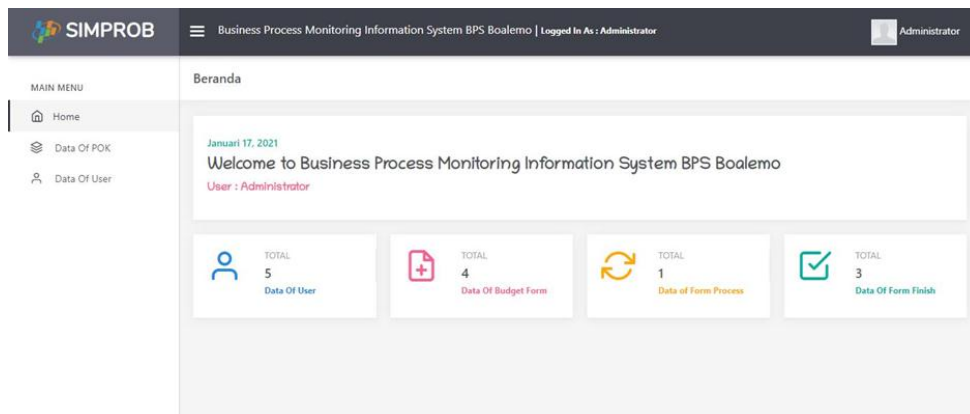

Figure 4. Login page

Figure 5. Admin home page

In the system testing process, white box testing was carried out by testing one of the source codes in making the request form. The selected file was the implementation of the transaction part of the supporting business process monitoring information system. Figure 6 shows the Flow graph on the white box test of the request data process file. Figure 6, is followed by a measurement of cyclomatic complexity which measures a quantitative measure of the logic complexity of a program, as in Table 1. The results of this measurement can determine whether a program is a simple or complex program based on the logic applied to the program.
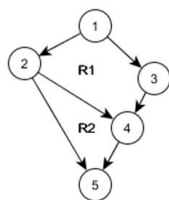

Figure 6. Flow graph

Table 1. Cyclomatic complexity

V(G)=E-N+2	E=the number of arcs in the flow graph is 6
=6-5+2	N=Number of vertices in flow graph 5
=3	

Table 2. Independent path flow graph notation

Basic Flow	Independent Path
Path 1	1-2-5
Path 2	1-2-4-5
Path 3	1-3-4-5

Number 3 the results of the calculation of cyclomatic complexity, shows the number of independent paths from the basis of path testing, which means that it shows the number of tests that must be run to ensure that all statements in the program are executed at least once (all statements have been tested) as in Table 2.

According to the performance measurement results that used the self-assessment method to measure the performance NIK and importance of NIK found on quadrant II, the lack of monitoring of the business process and the inflexible template will decrease the performance of the business process. In this measurement, questionnaires were distributed to 19 respondents who are the staff of Statistics Indonesia (BPS) of Boalemo. Based on the questionnaires, the value of the performance measurement obtained in the NIK performance is 3.3, and the value of NIK importance is 3.4. After this system was implemented and self-assessment was carried out using performance matrix tools, the variables in the system were considered important by respondents and were following what they had perceived. As a result, the level of satisfaction was relatively higher. The variables included in this system must be maintained since all these variables make the system superior in the organization.

To ascertain the quality of the software made on whether the system is as hoped system usability scale (SUS) measurement was used. The software is deemed to have a good quality if it is above the score >=70. The samples in this method are not many [31]. The questionnaire shows that out of the average score of 19 respondents (the staff of BPS Boalemo), who underwent a recording process and filled the questionnaire, 84 for the SUS were acquired. It is considered A-grade (80-90). The SUS score graphic of score 84 is shown in Figure 7. The results show that the quality of the system is very good.
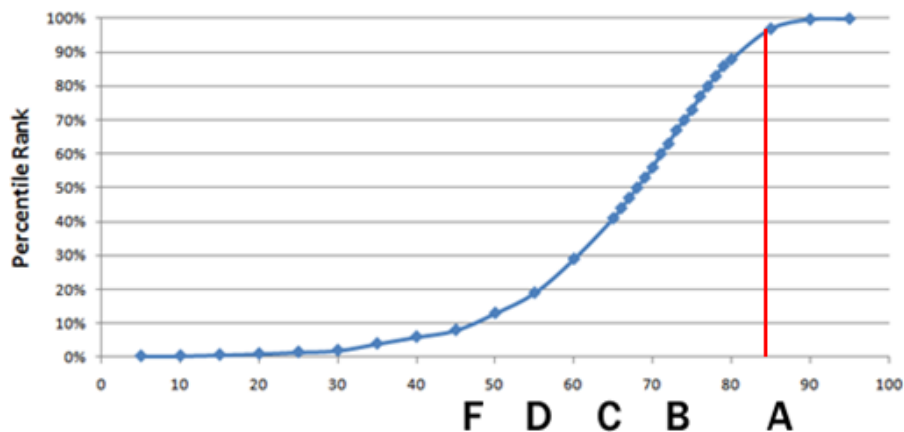

Figure 7. Graph of SUS score results

The system makes the monitoring of the organizational business process easier and more effective. Moreover, this system can monitor and control the IT capability decisions to confirm the delivery of value to key stakeholders in an organization. It is expected that the system can improve the performance of the organizational business process.

4.   CONCLUSION

Central to the advancement of and support towards the organizational business process are the roles of IT. Close attention of organizational leaders to the roles of IT is proven by system development and monitoring process to the IT field that belongs to the organization. This is because IT stores all data related to the business process and the continuity of organizational activities.

REFERENCES

[1]   V. Sambamurthy and R. W. Zmud, "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies," *MIS Quarterly*, vol. 23, no. 2, pp. 261-290, 1999, doi: 10.2307/249754.
[2]   L. Mueller, M. Magee, P. Marounek, and A. Phillipson, "IBM IT Governance Approach Business Performance through IT Execution, "*IBM Corp*, Redbooks. ibm. com/redbooks, 2008.
[3]   S. De Haes and W. Van Grembergen, "IT Governance and Its Mechanisms," *Information Systems Control Journal*, vol. 1, pp. 1-7, 2004.
[4]   N. A. Qassimi and L. Rusu, "IT Governance in a Public Organization in a Developing Country: A Case Study of a Governmental Organization, "*Procedia Computer Science*, vol. 64, pp. 450-456, 2015, doi: 10.1016/j.procs.2015.08.541.
[5]   P. H. Bermejo, A. O. Tonelli, and A. L. Zambalde, "Developing IT Governance in Brazilian Public Organizations", *International Business Research*, vol. 7, no. 3, pp. 101-114, 2014, doi: 10.5539/ibr.v7n3p101.
[6]   C. Juiz., C. Guerrero, and I. Lera, "Implementing Good Governance Principles for the Public Sector in Information Technology Governance Frameworks," *Open Journal of Accounting*, vol. 3, no. 1, pp. 9-27, 2014, doi: 10.4236/ojacct.2014.31003.
[7]   E. N. Nfuka, L. Rusu, P. Johannesson and B. Mutagahywa, "The State of IT Governance in Organizations from the Public Sector in a Developing Country," *2009 42nd Hawaii International Conference on System Sciences*, 2009, pp. 1-12, doi: 10.1109/HICSS.2009.456.
[8]   S. M. B. Barrera, K. Kim, H. Yoon, and J. Hwang, "IT Governance Effectiveness and Its Influence on Innovation Product and Process, "*Conference: Portland International Conference for Management of Engineering and Technology at Hawaai*, 2018, pp. 1-10, doi: 10.23919/PICMET.2018.8481752.
[9]   A. Ghildyal and E. Chang, "IT Governance, IT/Business Alignment and Organization Performance for Public Sectors," *Journal of Economics, Business and Management,* vol. 5, no. 6, pp. 255-260, 2017, doi: 10.18178/JOEBM.2017.5.6.522.
[10]   M. A. J. Sabegh and S. M. Motlagh, "The Role and Relevance of IT Governance and IT Capability in Business - IT Alignment in Medium and Large Companies, "*Business and Management Review*, vol. 2, no. 6, pp. 16-23, 2012.
[11]   A. Ullah and R. Lai, "A Systematic Review of Business and Information Technology Alignment, "*ACM Transactions on Management Information Systems*, vol. 4, no. 1, pp. 1-30, 2018, doi: 10.1145/2445560.2445564.
[12]   L. N. Amali, M. R. Katili, S. Suhada, and L. Hadjaratie, "The Measurement of Maturity Level of Information Technology Service Based on COBIT 5 Framework," *Telkomnika, Telecommunication, Computing, Electronics and Control*, vol. 18, no. 1, pp. 133-139, 2020, doi: 10.12928/telkomnika.v18i1.10582.
[13]   M. Sibanda and D. Ramrathan, "Influence of Information Technology n Organization Strategy, "*Foundations of Management*, vol. 9, no. 1, pp. 191-202, 2017, doi: 10.1515/fman-2017-0015.
[14]   A. Gunasekaran, N. Subramanian, and T. Papadopoulos, "Information Technology for Competitive Advantage within Logistics and Supply Chains: A Review, "*Transportation Research Part*, vol 99, pp. 14-33, 2017, doi: 10.1016/j.tre.2016.12.008.
[15]   J. Montilva, J. Barrios, I. Besembel, and W. Montilva, "A Business Process Model for IT Management Based on Enterprise Architecture," *CLEI Electronic Journal*, vol. 17, no 2, 2014, doi: 10.19153/cleiej.17.2.3.
[16]   D. Lipaj and V. Davidavičienė, "Influence of Information Systems on Business Performance, "*Mokslas–Lietuvos Ateitis Science–Future of Lithuania*, vol. 5, no. 1, pp. 38-45, 2013, doi: 10.3846/mla.2013.06.
[17]   M. Dumas, M. La Rosa, J. Mendling, and H. A. Reijers, "Introduction to Business Process Management, "*Fundamentals of Business Process Management, Springer-Verlag Berlin Heidelberg*, pp. 1-31, 2013, doi: 10.1007/978-3-642-33143-5_1.
[18]   W. Luo and Y. A. Tung, "A Framework for Selecting Business Process Modeling Methods, "*Industrial Management & Data Systems*, vol. 99, no. 7, 312-319, 1999, doi: 10.1108/02635579910262535.
[19]   M. Fischer, F. IMgrund, C. Janiesch, and A. Winkelmann, "Strategy Archetypes for Digital Transformation: Defining Meta Objectives Using Business Process Management, "*Information & Management*, vol. 57, pp. 1-13, 2020, doi: 10.1016/j.im.2019.103262.
[20]   J. Vom Brocke and M. Rosemann, "Business Process Management, in Wiley Encyclopedia of Management," *Management Information Systems,* vol. 7, pp. 1-16, 2014, doi: 10.1002/9781118785317.weom070213.
[21]   T. C. Redman, "The impact of Poor Data Quality on the Typical Enterprise," *Communications of the ACM*, vol. 41, no.2, pp. 79-82, 1998, doi: 10.1145/269012.269025.
[22]   F. Rahimi, C. Moller, and L. Hvam, "Alignment Between Business Process Governance and IT Governance," *In 20th Americas Conference on Information Systems, AMCIS 2014 Association for Information Systems*, pp. 1-12, 2014.
[23]   A. Tiwana and B. Konsynski, "Complementarities Between Organizational IT Architecture and Governance Structure," *Information Systems Research*, vol. 21, no. 2, pp. 288-304, 2010, doi: 10.1287/isre.1080.0206.
[24]   H. M. Alzoubi and N. A. Khafajy, "The Impact of Business Process Management on Business Performance Superiority," *4International Journal of Business and Management Review*, vol. 3, no. 2, pp. 17-34, 2015.
[25]   T. Ahmad and A. V. Looy, "Business Process Management and Digital Innovations: A Systematic Literature Review," *Sustainability*, vol. 12, no. 6827, pp. 2-29, 2020, doi: 10.3390/su12176827.
[26]   R. S. Pressman and B. R. Maxim, "Software Engineering: A Practitioner's Approach," Boston: McGraw Hill Education, 2015.

[27] D. P. O. Godeiro, M. L. R. Dantas, M. D. S. Celestino, and D. C. Silva, "Application of Importance and Performance Matrix to Assess The Quality of Services Provided by Business Incubators," *Iberoamerican Journal of Entrepreneurship and Small Business*, vol. 7, no. 3, pp. 1-34, 2018, doi: 10.14211/regepe.v7i3.704.

[28] I. Sever, "Importance-Performance Analysis: A Valid Management Tool?," <u>*Tourism Management*</u>, <u>vol. 48</u>, pp. 43-53, 2015, doi: 10.1016/j.tourman.2014.10.022Get.

[29] A. Srinivasulu and A. Pushpa, "Disease Prediction in Big Data Healthcare Using Extended Convolutional Neural Network Techniques, "*International Journal of Advances in Applied Sciences (IJAAS)*, vol. 9, no. 2, pp. 85-92, 2020, doi: 10.11591/ijaas.v9.i2.pp85-92.

[30] C. A. R. Assad, "Using Business Intelligence Solutions for Forecasting in Marketing Researches," *International Journal of Informatics and Communication Technology (IJ-ICT)*, vol. 8, no. 2, pp. 102-110, 2019, doi: 10.11591/ijict.v8i2.pp102-110.

[31] J. R. Lewis, B. S. Utesch, and D. E. Maher, "Measuring Perceived Usability: The SUS, UMUX-LITE, and Alt Usability," *International Journal of Human-Computer Interaction,* vol. 31, no. 8, pp. 496-505, 2015, doi: 10.1080/10447318.2015.1064654.

BIOGRAPHIES OF AUTHORS

Lanto Ningrayati Amali received her Doctoral Degree in Information Technology from the Universiti Utara Malaysia in 2015. Her research interest includes IT Governance, System Planning, and Management Information System. She has published and presented her research both nationally and internationally in the field of IT Governance. She is currently a lecturer in the Faculty of Engineering at the Department of Informatics Engineering, Universitas Negeri Gorontalo in Indonesia

Muhammad Rifai Katili received his Doctoral Degree in Information Technology from the Universiti Utara Malaysia in 2018. He is a faculty member at the Informatics Engineering Department, Faculty of Engineering, Universitas Negeri Gorontalo in Indonesia. His research interest includes Knowledge Management, Information System, and IT Governance.

Sitti Suhada, holds a Master in Informatics Engineering from Universitas Hasanuddin, Indonesia. Her research interests are in the areas of Management Information Systems, Databases, and Data Mining. She is a faculty member at the Department of Informatics Engineering, Faculty of Engineering, Universitas Negeri Gorontalo, Indonesia.

Tri Alfandra Labuga is a student in the Faculty of Engineering at the Department of Informatics Engineering, Study Program of Information System, Universitas Negeri Gorontalo in Indonesia. Currently, he has completed his study program.