Journal of Applied Informatics and Computing (JAIC)
Vol.8, No.1, July 2024, pp. 186~193
e-ISSN: 2548-6861

Computational Analysis of IT Governance Audit Using COBIT 4.1 Framework: A Customer Perspective

Vera Wati [1]*, Siska Febriani [2], Eka Yulia Sari [3]*****
* Sistem Informasi Kota Cerdas, Universitas Tunas Pembangunan Surakarta
** Informatika, Institut Teknologi Bisnis dan Kesehatan Bhakti Putra Bangsa
*** Informatika, Universitas Sarjanawiyata Tamansiswa
vera.w@lecture.utp,ac,id [1], siska17feb@gmail.com [2], eka.sari@ustjogja.ac.id [3]

Article Info

Article history:

Received 2024-07-03
Revised 2024-07-08
Accepted 2024-07-10

Keyword:

Customer Perspective,
Balance Scorecard,
COBIT 4.1,
Maturity Level.

ABSTRACT

A company's performance can be measured by the number and satisfaction of customers, which helps in maintaining customer relationships. Indicators such as customer satisfaction, perception of service, and loyalty can be derived from the Customer Perspective of the Balance Scorecard (BSC). Conducting an IT governance audit is essential to understand how customers perceive a service. The use of the COBIT 4.1 Framework for IT governance audits is recognized for its detailed process, both for business and governance purposes, to avoid vulnerabilities and threats, thereby increasing customer satisfaction. Effective IT governance plays a crucial role in enhancing customer satisfaction and achieving organizational success. This research aims to analyze IT governance audits from a customer perspective using the COBIT 4.1 framework, with a focus on aligning IT strategy with business goals to meet customer expectations. The research method involves key processes in PO8 (Manage Quality) and PO10 (Manage Project) to determine quality standards and influential budgets. Integration with computational techniques for data analysis and IT audit algorithms is carried out to build strong IT governance practices. The computational audit results show maturity levels of 2.59 for PO8 and 3.02 for PO10, indicating areas needing improvement in product quality management and project execution to better meet customer needs. These findings underscore the importance of integrating computational insights to optimize IT governance frameworks and improve organizational performance, especially in customer retention through enhanced project quality management.

I. INTRODUCTION

Audit of corporate governance of information technology (IT) are applied on the company or agency, of course, to improve the process of information technology to run good [1]. The times demand this developing technology, application of IT should be done because the demands of information delivery are expected to be quickly carried with a high degree of accuracy [2]. These claims are important for the sake of the continuity of the economy for the Government, communities, or businesses [3][4]. Performance measurement needs to be cared for, that is, for the sake of maintaining the balance of the financial and non-financial side, internal and external, long term or short term i.e. with score card called the Balance Scorecard (BSC) [5][6][7]. View of the BSC includes 4 of the financial perspective i.e. perspective, customer, internal business, and learning [8][9].

The performance of a company can be measured with some component, for example, a large number of customers, and customer satisfaction so that the company can maintain a relationship, these indicators can be obtained from the customer perspective [10][11]. Customer perspective is

closely related to customer services performed by the company [12][13][14][15]. An organization engaged in management will definitely implement information technology governance to support the desired achievements. One of the efforts made to win business is to attract new customers by providing licensed services. Of course, this requires reliable computing. Customer perspective is indeed be leading indicator of an increase in management philosophy because if customers are satisfied [16][17]. Of course, customers won't like the delay in work on the request.

Evaluation of the standard framework COBIT 4.1 is the most complete guide to best practices for the IT management [18][19] because the process has a pretty good detail on the internet [20][21][22]. COBIT 4.1 mapping can be applied to consulting company DPLK's business goal to focus and objectives it wants maintained, thus leading to an efficient IT management process by touching the goal process and avoiding activity vulnerabilities and threats [23][24][25]. Business goals on COBIT 4.1 have a surface of 17 linking business goals with customized company goals and 28 IT for implementations of IT are applied to the company [23][26][27]. There is a perfect picture of the 34 domain process IT on COBIT 4.1 that covers how to manage, control, and measure every process [28]. The maturity Level Model on COBIT 4.1 is used as a tool to measure the level of reliability of the company's position on the application of IT [20][23][29], the level is divided into six Levels of Maturity that is 0 (Non-existent), 1 (Initial/Ad Hoc), 2 (Repeatable but Intuitive), 3 (Defined Process), 4 (Managed and Measurable), 5 (Optimized) [30][31]. In this case, if the company wants to achieve Good Corporate Governance (GCG) then IT's role from the customer perspective is very important, as management guidelines apply COBIT 4.1 Framework to evaluate the company's IT management framework.

This research will be directed at integrating computational techniques for data analysis and algorithmic auditing with the COBIT 4.1 framework, so as to find out how mature a company is, which emphasizes Business IT on the Customer Perspective in creating agility to respond to IT business needs. The process taken in PO8 about Manage Quality and PO10 Manage Project in determining the standard quality and budget the effect on the customer perspective. This restriction was taken as it will maximize the customer perspective to retain customers and increase the products, services, and implementation to conform to the quality management, and project management that can improve business processes in the the company.

Research utilizing the domain on COBIT has been done, such as the study by [32] applying the domain side of the perspective of customers and produce still needs to improve. Stakeholders are indeed very helpful to optimize the management of information on any transactions that occur, the statement is rendered in the study [18]. COBIT is able to be utilized for regulatory change and involves a large project production team at Turkiye Finans IT research [33]. In addition, the mapping of COBIT is also able to prevent the productivity paradox in the process and the purpose of IT [23]. Integrating COBIT concepts done in research [34] with other frameworks can also be done for technology management and information technology services from a business perspective.

The influence of perspective customers is indeed very influential on the sustainability of governance IT companies, researchers [35] pay attention to perspective customers with Balance Scorecard (BSC) for it governance at universities. Asia IT service management from the perspective of customers' important concern to improve the governance and management of the modelling of good service, the study by utilized [36] in the implementation by Critical Success Factors. To improve customer service companies can exploit the resources of knowledge [10] and total quality management dimensions of performance results on the company [37]. Aligning the business activities of the organization with the resources IT needs to do indeed, this statement is emphasized in the study [38]. In addition, the importance of building project level management control system will have an impact on the performance of the project from the behavior of the team that will have an effect on the level of service from the customer perspective. The influence of perspective customers is indeed very influential on the sustainability of governance IT companies, researchers [35] pay attention to perspective customers with Balance Score Card (BSC) for governance at universities. Asia IT service management from the perspective of customers important concern to improve the governance and management of the modelling of good service, the study by utilized [36] in the implementation of Critical success factors. To improve customer service companies can exploit the resources of knowledge [10] and total quality management dimensions of performance results on the company [37]. Aligning the business activities of the organization with the resources IT needs to do indeed, this statement is emphasized in the study [38]. In addition, the importance of building a project-level management control system will have an impact on the performance of the project from the behavior of the team and will affect the level of service from the customer perspective.

This research will be directed to the IT governance audit with the implementation of COBIT 4.1 governance emphasized at Framework quality and manage projects with case studies on the company. The results of the evaluation from computational are expected to touch on the Customer's Perspective on the company's domain in the game after the agility in business change responds to changes accompanied by increasing technology needs.

II. METHODS

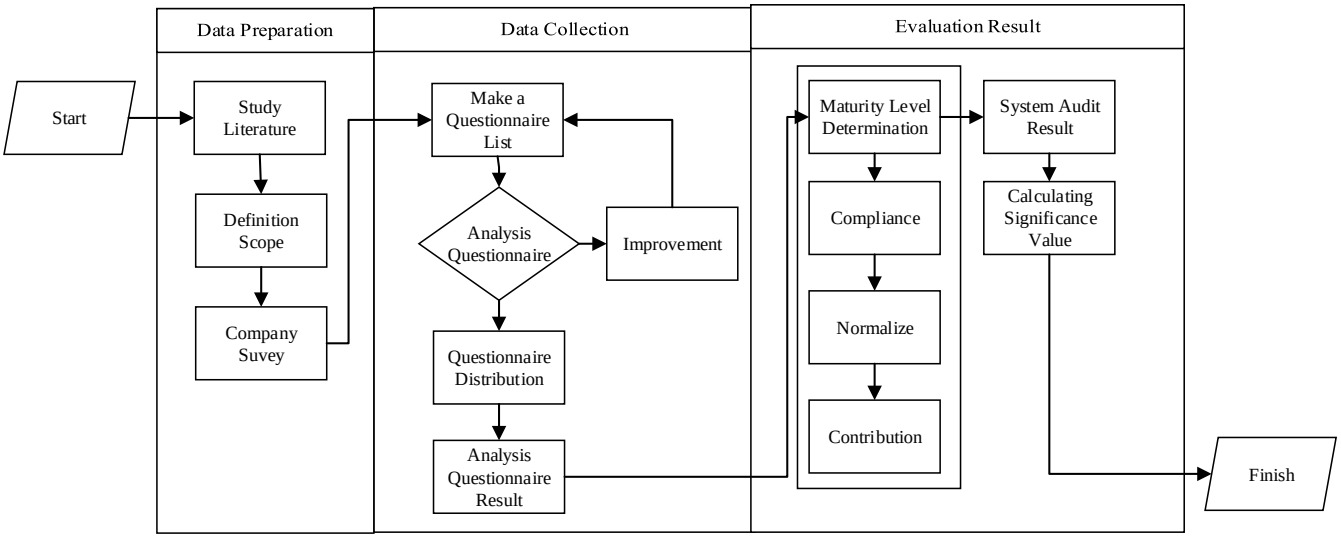

Figure. 1. Research Methodology

This step describes the completion of research that started with Data Preparation and Data Collecting to produce evaluation results, the method can be seen in Figure 1.

A. Data Preparation

TABLE 1.
RELATIONS BSC AND COBIT 4.1 FRAMEWORK

Balance Scorecard (BSC)	Business Goals	IT Goals	Process
Customer Perspective	Create agility in responding to changing business requirements.	Deliver projects on time and on budget, meeting quality standards	PO 08 Manage Quality
			PO 010 Manage Projects.

A survey of companies by looking at the qualifications of the companies already implementing IT within its business process, so that the selected PT. XYZ Consulting company specializes in the insurance and retirement services division located in Jakarta. These companies were selected because they typically demonstrate significant efforts in improving quality management and project management, which in turn is expected to increase customer satisfaction, implementing best practices to increase customer satisfaction, customer retention, and customer loyalty. The survey is expected to provide insight into how effective IT implementation can impact customer satisfaction in the sector. So it is necessary to carry out computational auditing, to determine the maturity level of the company.

B. Data Collection

Create a questionnaire with the list include statements that are guided by COBIT 4.1 Framework on Business Customer Perspective Goals and IT Goals Deliver projects on time and on budget, meeting quality standards. The researchers analyzed the content of the questionnaire so that change does not occur again. Thus generating some appropriate level of questions relating to the process and PO8 and PO10.

PO8 which focuses on Quality Management, aims to ensure that the IT services provided by the company meet the expected quality standards and meet customer needs. Then, PO10 relates to IT Project Management which includes planning, implementation and monitoring of projects to ensure project objectives are achieved. The questionnaire created is based on five levels of maturity starting from level 0 Non-Existent, level 1 Initial/Ad Hoc, level 2 Repetable but Intuitive, level 3 Define, level 4 to Manage and Measurable, and level 5 Optimized.

At level 0 Non-Existent, statements referring to the planning process are assessed as non-existent or no methodological efforts for the system development cycle. At this level 0, there is a question of whether the organization agrees if it has not realized the importance or has not started implementing the program, until the quality review stage. The next question at level 1 Initial/Ad Hoc, this level includes whether the organization is starting to have the necessary management awareness and management to make informed assessments on service quality, even though project creation is still in the early stages and there is often no consistency in its development.

At level 2 Repeatable but Intuitive provides questions that focus on quality management processes that have been implemented at level 1 and can be repeated, but their application in the organization still depends on individual knowledge or expertise. This level 2 confirms the organization, regarding questions regarding whether the organization is currently oriented towards projects and processes to improve the quality of management, rather than the management of organizational processes at large. Next, in level 3 Defined, questions are asked regarding whether the organization has started to have clear guidelines and documentation that support implementing and managing processes on projects to maintain quality. The question at the Define level is whether quality satisfaction surveys for customers have been planned and carried out occasionally so that the basic quality expectations of the project being carried out can be defined. Level 4 Manage and Measurable, questions at the level of organizational readiness that are more consistent in measuring the performance and effectiveness of project work more systematically. The indicators in this question confirm whether the company has managed and measured quality management by involving third parties, whether satisfaction surveys have been carried out consistently, and whether the information technology management built has a reliable knowledge base. Furthermore, at the 5th Optimized level, the questions created related to the processes occurring in the company have been fully optimized, and there is continuous improvement in the data analysis process to evaluate the quality management of the projects created. The creation of these questions is adjusted to the maturity level of each level, which refers to the organization's evolutionary journey in managing and improving the project quality management process starting from nothing, the initial stage until reaching the optimal level.

When creating questionnaires through manual PO10 regarding Manage Projects, it is also differentiated based on maturity level. Level 0 with Non-Existent, researchers confirm through questions that include whether there are project management techniques used in the organization and whether the organization has not considered the business impact related to project failure on the company's development. Level 1 at the Ad Hoc stage, questions confirm whether the project has been carried out with an approach even though there is no consistency, such as projects are often carried out without in-depth planning, management is more dependent on individuals and it is difficult to complete projects on budget and on time. Level 2 Repeatable, are questions that confirm the organization's readiness to face the project, whether there are basic project management practices that are starting to be repeated as stated in the informal procedures for carrying out project management. Questions at this level are questions that start to approach the procurement of project documentation but are not always complete or do not fully comply with standards. At Define level 3, this level of the protection management process is well defined and documented. So the questions are made to ensure that the organization has a defined and documented methodology for project management, based on the planning, implementation, and closing stages of project implementation. The questions at Manage and Measurable level 4 are related to organizations that have started managing and measuring project performance systematically, to having regular reviews of project performance, and knowing whether there are measures of project success. In the final stage, level 5 Optimized is a question that confirms that protection management has been implemented optimally with continuous improvement regularly, both in terms of the tools used, learning, and optimizing feedback loops on project performance.

A questionnaire containing questions that have been adjusted to the Maturity Level in the PO8 and PO10 processes will be circulated to organizations in the company. This assessment involved 5 respondents involved, especially those who were related to and responsible for customer service. This assessment can involve the IT manager, head of IT, project management team, customer service staff, and quality supervisors as an internal audit team in the company. They have a role that is closely related to quality and project management, so if a computational audit assessment can be carried out it will have an impact on customer satisfaction with the services offered. After the questionnaire already been filled then further process the awarding of grades in accordance with the maturity level to level of approval is based on the values do not agree, agree, agree and strongly agree. The process of granting the weighting is described in the stage of maturity level determination.

C. Evaluation Result

TABLE II.
ILLUSTRATION OF CALCULATION LEVEL APPROVAL

Maturity Level	Statement	Level of Approval				Value
	Ad Hoc	SD	D	A	SA	
1	Initial a		✓			0,33
1	Initial b			✓		0,66
1	Initial c				✓	1
Sum						**1,99**

Information Initial from Table 2:

Initial a: There is a management awareness of the need for a QMS (Quality Management System)
Initial b: The QMS (Quality Management System) is driven by individuals where it takes place
Intial c: Management makes informal judgments on quality.

Maturity level determination using a matrix of attributes documented in COBIT 4.1 Management Guidelines deliver value at every process [39][40][41]. Based on the level of agreement on the question of the weighting value given as follows: Strongly Disagree (SD): 0; Disagree (D): 0.33; Agree (A): 0.66; Strongly Agree (SA): 1. Results of the questionnaire contents of 5 respondents carried out calculations with average, then processed the value searched

for its fulfillment. For the compliance stage, the value of the fulfillment by summing all the results of the questionnaire for each level. Illustrations in Table 2. The value is the value of 1.99 amount resulting from the sum of the values of each statement. The divide by the number of statements for the value fulfillment, e.g. 3.32:5 = 0.66 in the illustration Table 3

TABLE III.
ILLUSTRATION OF CALCULATION OF THE COMPLIANCE VALUE

Maturity Level	Sum of statements Compliance Value (A)	Statement Totally (B)	Compliance Value (C= A:B)
0	0	2	0,00
1	1,99	4	0,50
2	3,32	5	0,66
3	1,99	4	0,50
4	2,31	6	0,39
5	3,32	6	0,55
SUM ∑C			**2,59**

The result of the normalization value compliance division is then divided by the total Compliance Value i.e. the total results of all maturity levels. For example == 2,59/0.66 0.26, illustrated look at Table 4.

TABLE IV.
ILLUSTRATION OF CALCULATION THE NORMALIZED COMPLIANCE VALUE

Maturity Level	Sum of statements Compliance Value (D)	Normalized Compliance Values (D=C/∑C)
0	0,00	0,00
1	0,50	0,19
2	0,66	0,26
3	0,50	0,19
4	0,39	0,15
5	0,55	0,21
SUM ∑C	**2,59**	1

TABLE V.
ILLUSTRATION OF CALCULATION THE NORMALIZED COMPLIANCE VALUE

Maturity Level (F)	Normalized Compliance Values (E)	Contribution (E*F)
0	0,00	0,00
1	0,19	0,19
2	0,26	0,51
3	0,19	0,58
4	0,15	0,59
5	0,21	1,07
SUM	1	**2,94**

The value of the contribution resulting from the Division of the normalization results multiplied by the maturity level. If you have already obtained a value in each level of maturity and then aggregated, then the result is the value of the maturity level in the company. Suppose 0.26 * 2 = 0.51 illustrations found in Table 5. Then the result is the maturity value of 2.94, where the next step of the audit system was based on the expected target outcome for the company.

The results of the audit system that already obtained further done the file analysis and analyze information governance maturity. Level of expected recommendations based on the target company's improvement in achieving the level of maturity of the corporate governance of IT. The level compared with the results of the gap assessment of the maturity questionnaire is based [42][43]. Classic process Capability Maturity Model (CMM) (Figure 2) became the guideline for identifying content and quality risk if business process changes should occur [44].

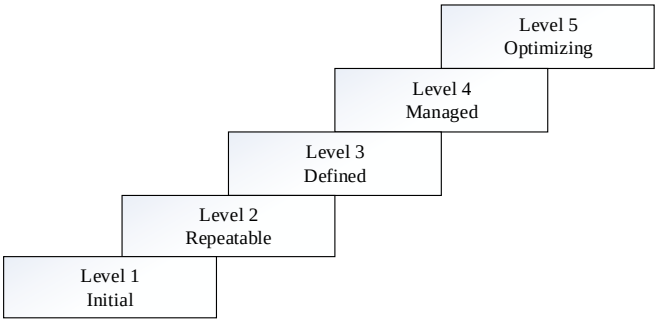

Figure 2. Characteristics of the Capability Maturity Model (CMM) Levels [45]

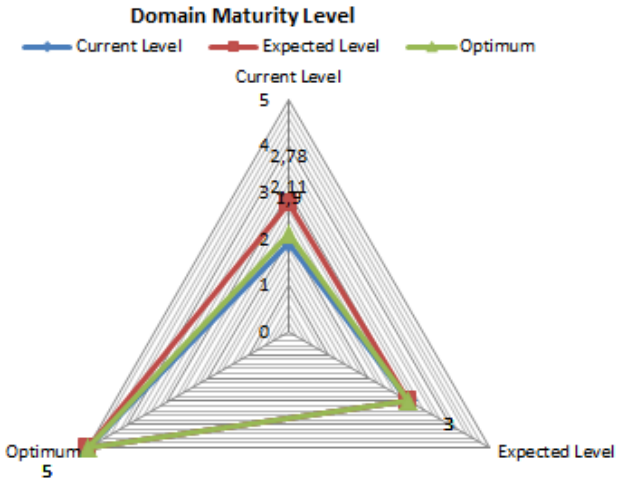

Figure 3. Illustration Domain Maturity Level (as-is and to-be based)

Refer to Figure 2 where level 1 (Initial) represents the process is poorly controlled, level 2 (Repeatable) processes the organization often reactive, level 3 (Defined) is organized on development methodology, level 4 (Managed) process controlled, level 5 (Optimizing) focus on process improvement. It will be a calculated value that will have a significant impact are good for PT. XYZ Consulting company. CMM level but should be offered up to suit the needs of business processes by Figure 2 fit the business process Mapping that occurs in Figure 3, which uses the concept research *as-is* current level by looking for issues that are not optimal According to request company, after it is done

by mapping the process of improvement *to-be* based on the expected level by the level goal [46]. This later searches for the value GAP.

III. Result And Discussion

In case studies of companies that are the object of research, researchers carry out calculations according to the steps in the research method. After the calculations have been carried out, the result is the maturity level of each process which has been generated from the calculations of the 5 selected respondents who have distributed questionnaires according to the questions on the Maturity Level. The depiction in Table 6 (PO8) and Table 7 (PO10) follows the results of the maturity level assessment.

Table VI.
Result of PO8 (Manage Quality) Maturity Quality

Maturity Level	Result Compliance	Result Normalize	Result Contribution
0	0,396	0,105	0,000
1	0,663	0,175	0,175
2	0,662	0,175	0,350
3	0,676	0,178	0,535
4	0,662	0,175	0,699
5	0,728	0,192	0,961
SUM	**3,79**		
Result Maturity Level			**2,59**

Table VII.
Result of PO10 (Manage Project) Maturity Quality

Maturity Level	Result Compliance	Result Normalize	Result Contribution
0	0,297	0,088	0,000
1	0,232	0,068	0,068
2	0,683	0,201	0,403
3	0,771	0,227	0,682
4	0,705	0,208	0,833
5	0,701	0,207	1,034
SUM	**3,39**		
Result Maturity Level			**3,02**

The results of the maturity on PO10 about manage project amounted to 3.02 has reached the value 3 by the company's expectation level i.e. level 3 (Defined). But both these processes will remain in the GAP between the calculations do is-to-be and be (found in Table 8), So the obtained graph is as follows in Figure 4.

Table VIII.
Calculating Signification Value (GAP)

COBIT 4.1 List Process	Current Level *(as-is)*	Expected Level *(to-be)*	GAP
PO8	2,59 → 2	3	1
PO10	3,02 → 3	3	0

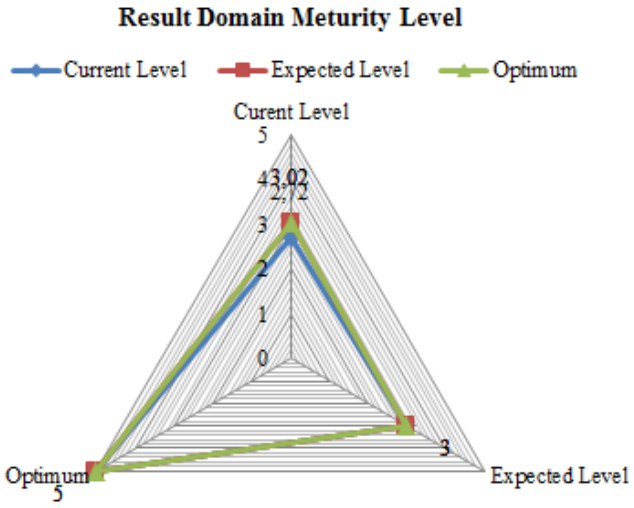

Figure 4. Result Domain Maturity Level (*as-is* and *to-be* based)

Based on Table 8 and Figure 4 the PO8 has a difference value gap of 1 while the PO10 process already meets the criteria. To produce several recommendations emphasized at PO8 Manage Quality to achieve the vision and mission of the company, this effort can be used as a reference in the improvement towards the consummation. PO8 recommendations are as follows:

1) The need for the optimization of the Quality Management System (QMS) to apply methodologies that require continued review of operations and projects in accordance with the customer's organization.
2) Apply a structural organization, procedures, processes, and resources with clearly as needed to fit the job desk.
3) Procurement training for workers ' levels of the organization.
4) Problem Analysis is done periodically by the management of IT to easily adapt to environmental change IT.
5) Quality to the customer satisfaction survey.

However, for the company in the case study object, the results from PO10 using computational calculations obtained a GAP of 0, so this result is if the data processing is good. The project management developed involves customers and is tailored to organizational goals that are not only centered on IT governance.

IV. Conclusion

The research conclusion resulted in the lowest level of maturity in PO8 Manage Quality with a score of 2.59 and Project Manage PO10 with 3.02 being a high level of maturity, where the expected level is level 3 (Defined). So optimizing IT governance in a company is needed to increase customer satisfaction. Efforts need to be made by utilizing computing with the Audit Framework 4.1 and quality improvement initiatives in Manage Quality and Manage Projects that are good and sustainable, so as to achieve

optimal maturity level values. It is necessary to emphasize quality and project management to retain customers in the long term, so that if there are problems they can be analyzed to improve solutions. These efforts are critical to maintaining competitiveness and meeting evolving customer demands.

REFERENCES

[1] S. Ramlaoui, A. Semma, and W. Dachry, "Achieving A Balance Between IT Governance And Agility," *Int. J. Comput. Sci. Issues*, vol. 12, no. 1, p. 89, 2015.

[2] M. M. Jha, R. M. F. Vilardell, and J. Narayan, "Scaling Agile Scrum Software Development: Providing Agility And Quality To Platform Development By Reducing Time To Market," in *2016 IEEE 11th international conference on global software engineering (ICGSE)*, 2016, pp. 84–88.

[3] D. Gibbs, "Sustainability Entrepreneurs, Ecopreneurs And The Development Of A Sustainable Economy.," *Greener Manag. Int.*, no. 55, 2009.

[4] J. C. Bertot, P. T. Jaeger, S. Munson, and T. Glaisyer, "Social Media Technology And Government Transparency," *Computer (Long. Beach. Calif).*, no. 11, pp. 53–59, 2010.

[5] R. S. Kaplan, "Conceptual Foundations Of The Balanced Scorecard," *Handbooks Manag. Account. Res.*, vol. 3, pp. 1253–1269, 2009.

[6] H. Dincer, S. Yüksel, and L. Martinez, "Balanced Scorecard-Based Analysis About European Energy Investment Policies: A Hybrid Hesitant Fuzzy Decision-Making Approach With Quality Function Deployment," *Expert Syst. Appl.*, vol. 115, pp. 152–171, 2019.

[7] P. R. Niven, *Balanced scorecard: Step-By-Step For Government And Nonprofit Agencies*. John Wiley & Sons, 2011.

[8] H.-Y. Wu, Y.-K. Lin, and C.-H. Chang, "Performance Evaluation Of Extension Education Centers In Universities Based On The Balanced Scorecard," *Eval. Program Plann.*, vol. 34, no. 1, pp. 37–50, 2011.

[9] H.-Y. Wu, Y.-K. Lin, and C.-H. Chang, "Performance Evaluation Of Extension Education Centers In Universities Based On The Balanced Scorecard," *Eval. Program Plann.*, vol. 34, no. 1, pp. 37–50, Feb. 2011.

[10] S.-M. Tseng, "Knowledge Management Capability, Customer Relationship Management, And Service Quality," *J. Enterp. Inf. Manag.*, vol. 29, no. 2, pp. 202–221, Mar. 2016.

[11] R. Bhagwat and M. K. Sharma, "Performance Measurement Of Supply Chain Management: A Balanced Scorecard Approach," *Comput. Ind. Eng.*, vol. 53, no. 1, pp. 43–62, 2007.

[12] W. Ulaga, "Capturing value creation in business relationships: A customer perspective," *Ind. Mark. Manag.*, vol. 32, no. 8, pp. 677–693, 2003.

[13] N. Hill and J. Alexander, *The Handbook Of Customer Satisfaction And Loyalty Measurement*. Routledge, 2017.

[14] A. Graf and P. Maas, "Customer value from a customer perspective: a comprehensive review," *J. für Betriebswirtschaft*, vol. 58, no. 1, pp. 1–20, 2008.

[15] H. Oh, "Service quality, customer satisfaction, and customer value: A holistic perspective," *Int. J. Hosp. Manag.*, vol. 18, no. 1, pp. 67–82, 1999.

[16] P. Binsar Kristian, "Analysis of Customer Loyalty through Total Quality Service, Customer Relationship Management and Customer Satisfaction.," *Int. J. Eval. Res. Educ.*, vol. 3, no. 3, pp. 142–151, 2014.

[17] Y. Ramadonna, N. Nasf, and Z. Aziz, "The Effect Of Customer Relationship Management And Customer Value On Customer Satisfaction Of Services And Its Impact On Customer Loyaltyin Pt. BPR Rangkiang AUR," *MENARA Ekon.*, vol. 5, no. 1, 2019.

[18] N. Simbolon and D. Y. Hardiyanti, "Security Audit on Loan Debit Network Corporation System Using Cobit 5 and ISO 27001: 2013," in *Journal of Physics: Conference Series*, 2019, vol. 1196, no. 1, p. 12033.

[19] J. F. Andry and A. K. Setiawan, "IT Governance Evaluation Using Cobit 5 Framework On The National Library," *J. Sist. Inf.*, vol. 15, no. 1, pp. 10–17, 2019.

[20] N. Legowo and A. Firmansyah, "Maturity Level Evaluation of Information Technology Governance in Payment Gateway Service Company Using COBIT," in *Asian Conference on Intelligent Information and Database Systems*, 2019, pp. 49–61.

[21] B. Von Solms, "Information Security Governance: COBIT or ISO 17799 or both?," *Comput. Secur.*, vol. 24, no. 2, pp. 99–104, 2005.

[22] K. W. Hawkins, S. Alhajjaj, and S. S. Kelley, "Using Cobit To Secure Information Assets," *J. Gov. Financ. Manag.*, vol. 52, no. 2, p. 22, 2003.

[23] S. Mukaromah and A. B. Putra, "Maturity Level at University Academic Information System Linking it Goals and Business Goal Based on Cobit 4.1," in *MATEC Web of Conferences*, 2016, vol. 58, p. 3009.

[24] E. W. N. Bernroider and M. Ivanov, "IT Project Management Control And The Control Objectives For IT And Related Technology (Cobit) Framework," *Int. J. Proj. Manag.*, vol. 29, no. 3, pp. 325–336, 2011.

[25] K. Brand and H. Boonen, *IT governance based on CobiT® 4.1-A Management Guide*. Van Haren, 2007.

[26] I. T. ITGI, "Governance Institute," *About IT Gov. Framew. Inf. Syst. Audit Control Found. 4º Ed. Roll. Meadows ISACA*, 2007.

[27] I. G. I. ITGI, "COBIT 4.1," *Framew. Control Object. Manag. Guidel. Matur. Model*, 2007.

[28] H. F. Tipton and M. K. Nozaki, *Information Security Management Handbook*. CRC press, 2007.

[29] M. Simonsson, P. Johnson, and H. Wijkström, "Model-Based IT Governance Maturity Assessments with COBIT," in *ECIS*, 2007, pp. 1276–1287.

[30] M. Grundstein, "Assessing Enterprise's Knowledge Management Maturity Level," in *World Summit on Knowledge Society*, 2008, pp. 380–387.

[31] M. A. M. Stambul and R. Razali, "An Assessment Model Of Information Security Implementation Levels," in *Proceedings of the 2011 International Conference on Electrical Engineering and Informatics*, 2011, pp. 1–6.

[32] P. Hendry and A. J. Fernandes, "IT Governance at Financial Technology Company using COBIT 4.1 Framework And Balanced Scorecard Perspective," *Int. J. Open Inf. Technol.*, vol. 7, no. 6, 2019.

[33] N. Ozkan, A. Tarhan, and C. Kucuk, "Scrum at Scale in a COBIT Compliant Environment: The Case of Turkiye Finans IT," *Ozkhan, Tarhane Kucuk*, 2017.

[34] W. Sunthonwutinun and V. Chooprayoon, "A Proposed Model for Studying Information Technology Governance, Management, and Services of an Enterprise: An Integrated Framework of COBIT 5, ITIL® V3, and BSC," *Int. J. Comput. Theory Eng.*, vol. 8, no. 2, p. 140, 2016.

[35] N. Y. Wijayanti, W. Setiawan, and R. A. Sukamto, "Performance Assessment of IT Governance with Balanced Score Card and COBIT 4.1 of Universitas Pendidikan Indonesia," in *Journal of Physics: Conference Series*, 2017, vol. 812, no. 1, p. 12072.

[36] C. Montenegro, N. Nuñez, and A. Larco, "IT Outsourcing Improvement: Contractual Model of Governance and Management from Customer Perspective," in *World Conference on Information Systems and Technologies*, 2017, pp. 616–627.

[37] C. Jaca and E. Psomas, "Total Quality Management Practices And Performance Outcomes In Spanish Service Companies," *Total Qual. Manag. Bus. Excell.*, vol. 26, no. 9–10, pp. 958–970, Oct. 2015.

[38] G. Tapandjieva and A. Wegmann, "A Return on Our Experience of Using Services as a Unifying Concept for Business and IT Alignment in a University," 2019.

[39] B. Succar, "Building Information Modelling Maturity Matrix," in *Handbook Of Research On Building Information Modeling And Construction Informatics: Concepts And Technologies*, IGI Global, 2010, pp. 65–103.

[40] J. Mayer and L. L. Fagundes, "A Model To Assess The Maturity

Level Of The Risk Management Process In Information Security," in *2009 IFIP/IEEE International Symposium on Integrated Network Management-Workshops*, 2009, pp. 61–70.

[41] A. Amid and S. Moradi, "A Hybrid Evaluation Framework of CMM and COBIT for Improving the Software Development Quality," *J. Softw. Eng. Appl.*, vol. 6, no. 05, p. 280, 2013.

[42] M. C. Paulk, B. Curtis, M. B. Chrissis, and C. V Weber, "Capability Maturity Model, Version 1.1," *IEEE Softw.*, vol. 10, no. 4, pp. 18–27, 1993.

[43] J. Herbsleb, D. Zubrow, D. Goldenson, W. Hayes, and M. Paulk, "Software Quality And The Capability Maturity Model," *Commun. ACM*, vol. 40, no. 6, pp. 30–40, 1997.

[44] S. Akhlaghpour and L. Lapointe, "From Placebo to Panacea: Studying the Diffusion of IT Management Techniques with Ambiguous Efficiencies: The Case of Capability Maturity Model," *J. Assoc. Inf. Syst.*, vol. 19, no. 6, p. 4, 2018.

[45] A. Navigation, "File Analysis and Your Information Governance Maturity," no. Cmm, 2015.

[46] R. R. Gilchrist, *Managing for profit: the added value concept*. Routledge, 2018.