Leveraging COBIT 2019 to Implement IT Governance in SME Context: A Case Study of Higher Education in Campus A

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***Abstract*—Achieving business and Information Technology (IT) alignment has become the aspiration of most organizations nowadays. Small and Medium Enterprises (SMEs) are not exempt as they also thrive to survive in a competitive market using IT. However, implementing all IT control and management components will be excessive, with a lack of justifiable cost-benefit for SMEs. A tailored governance system based on the specificities of SMEs is necessitated to help the organization to focus on its main objectives and strategies. By leveraging COBIT 2019 design toolkit, the researchers support Campus A in establishing healthy governance and IT management. Both qualitative and quantitative approaches are applied to select relevant governance/ management objectives. The toolkit has been designed with a semi-automated quantitative approach in which users will get scoring for each objective based on the associated value inputted for each design factor. Through a series of discussions with the management team, it concludes the governance design and recommends several improvements to increase its capability level, from the current level of 1.05 (initial stage) to the desired level of 2.33 (repeatable stage). Then, since the toolkit is practical to use, it is also rigid by design with its predefined and protected formula. To some extent, the resulting score or importance level of certain governance/management objectives is questionable and lacks justification. Flags or indicators to 'should-have' governance/management objectives, regardless of the organization's size and type, will be useful to prevent the omission of essential objectives.**

***Index Terms*—COBIT 2019, IT Alignment, Small and Medium Enterprise (SME), Higher Education**

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I. Introduction

INFORMATION Technology (IT) is pivotal for most organizations, regardless of their industry and size. Small and Medium Enterprises (SMEs) have invested significantly in their IT infrastructure to sustain a highly competitive market. It has become a key resource and integral part of organizational life to improve its business processes [1]. Nevertheless, aligning IT with business goals is not always a clear-cut task. Profoundly different from large companies, SMEs tend to have limited resources and a lack of IT governance, increasing the risks of IT project failure and cost overrun [2]. Furthermore, constraints in resources, budget, and time also result in low-risk awareness and the ability to apply risk mitigation [3].

With limitations of internal resources, SMEs rely heavily on outsourcing partners to adopt IT/Information System (IS) [4]. While it seems to be an appealing solution, engagement with external parties opens up other risks and causes negative consequences, especially at the vendor's risk due to conflicting interests between client and vendor [5, 6]. Therefore, implementing IT governance is essential for SMEs to manage risks and help the organization to achieve better business-IT alignment.

Studies of IT governance in the context of SMEs are still uncommon, although they underpin more than 90% of global economics [8]. Only 13 studies have been identified during 2008–2015 [9]. Between 2016–2018, 19 new studies have been identified, indicating increasing interest in this topic [8]. Various guidelines and frameworks for IT control and management have also been developed in recent years, such as COSO, ISO, ITIL, CMM, and others [10]. One of

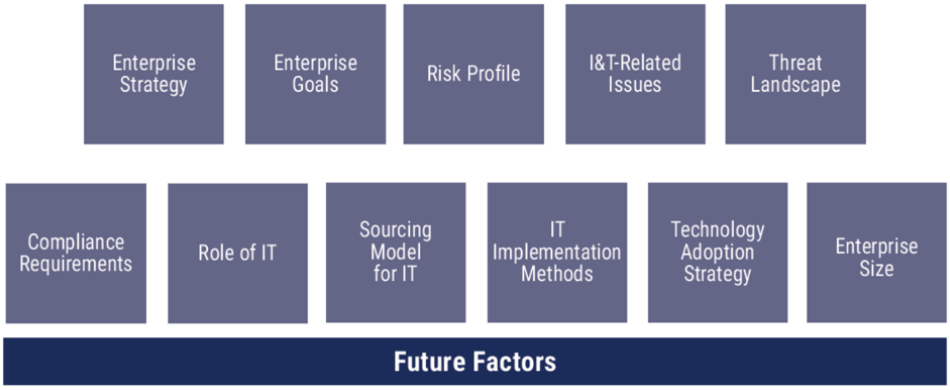

Fig. 1. Design factors in COBIT 2019 [7].

the foremost frameworks that cover all activities for IT governance is COBIT. However, these frameworks with plentiful processes and best practices are more suitable for large-scale organizations than SMEs. They are perceived as too complicated, costly, unattainable, and intimidating for SMEs [11, 12].

Implementing all governance components will be excessive, with a lack of justifiable cost-benefit for SMEs. Instead, according to COBIT 2019 framework, a governance system should be dynamic and tailorable accordingly to the company's IT and strategic objectives. COBIT 2019 frameworks, with their 7 governance and management components and 40 objectives, can be customized and prioritized [13].

Moreover, a study on the implementation of COBIT 2019 is still limited due to its novelty. COBIT framework, in general, is often seen as a product by practitioners and lacks theoretical claims [14]. COBIT 2019 is developed to address its predecessor's limitations: its complexities and difficulties in applying in practices and lack of guidance on 'how' rather than just 'what' [15, 16]. One of the major improvements in COBIT 2019 is the design factor concept, allowing to build off a best-fit tailored governance system [17]. Each organization has its distinct nature, which differentiates it from other organizations in certain criteria. There are 11 criteria, collectively known as design factors, including future factors, which are the plausible additional factors in the future, as shown in Fig. 1. Thus, the research aims to demonstrate the use of these design factors and the challenges encountered in building the best-fit governance system in the SME context.

There is no universal definition of SMEs that is accepted by all countries. Each country has criteria, such as the number of employees, total assets, and others [18]. Since COBIT 2019 is a globally used and recognized framework, the researchers refer to the definition of SMEs by International Finance Corporate (IFC) - World Bank. SMEs are enterprises that employ less than 300 persons and have annual sales/assets not exceeding US$15 million [19]. Meanwhile, in COBIT 2019, the enterprise size as one of the design factors for IT governance is determined solely based on the number of full-time employees. For example, enterprises with 50 to 250 full-time employees will be categorized as small and medium enterprises [7].

The researchers use a higher education case study (Campus A). The number of internal employees at Campus A is 224, with total annual sales/revenue from study fees around IDR40–50 billion (US$3 million). Therefore, the researchers can categorize Campus A as a medium-sized business. This organization has no dedicated internal IT person and heavily depends on external vendors to maintain their application and infrastructure. Moreover, the organization aspires to renew its core learning system and new student intake application. However, without a proper governance and management environment, achieving these goals and managing vendor performance effectively with sufficient risk management are both difficult.

The research aims to explore the following research questions:

1) RQ1: Using COBIT 2019 design toolkit, which domain and objectives are necessary for a best-fit governance system at Campus A? Are they at a desired capability maturity level? What recommendations are needed?
2) RQ2: What theoretical concepts have been discussed regarding IT Governance in SMEs? Are design factors in COBIT 2019 able to accommodate these concepts sufficiently?
3) RQ3: What challenges are encountered while using COBIT 2019 design toolkit?

II. Research Method

To answer the research questions, the researchers apply the structured approach from the Design Science Research Methodology (DSRM) of IS research [20]. With its focus on developing certain artifacts to improve the efficacy of IS, DSRM can accommodate various processes and is mostly outcome based [21]. The artifact of the research is a tailored governance system, and it is applied in a case study. Although a case study as a research method is criticized for the lack of reliability and a rigorous scientific approach, it allows the researchers to examine a particular area more holistically and in depth through empirical and real-life cases [22]. To obtain reliable and accurate information, the researchers have approached the key management team using a collaborative workshop format. Both participants of the workshop and the facilitator are working together to assess the facilitation artifact, which is a focus of interest and evaluation [23].

A. Steps in Research

1) Identify the Objectives of the Proposed Solution: The main objective of the research is to help the organization (Campus A) to achieve a better capability maturity level for its tailored IT governance system. The researchers use theoretical concepts on SMEs' issues and other study disciplines, such as IT project management, IS security, IT operations, and others, to design its governance and formulate recommendations for Campus A.

2) Design and Development: The researchers arranged a two-week workshop with the key management team in Campus A. It composes of representatives from the rector office, General Affair head, and several lecturers who assisted in IT operations to perform data collection and analysis.

3) Data Collection: The researchers use a combination of qualitative and quantitative approaches. The qualitative approach is based on a series of interviews, observations, and document examination. At first, the researchers conduct a preliminary interview to gain a high-level understanding of the IT infrastructure, its general overview (number of employees and outsourcings), and its mission and visions and to obtain policy and procedures related to IT operations. Afterward, a series of workshop sessions are carried out to put the importance level of each design factor using COBIT 2019 in the MS Excel toolkit in a quantitative manner, with a value between 0-no relevance and 4-maximum relevance.

4) Data Analysis: The case study of an organization aims to reveal significant facts underlying the organization from its initial state. Recommendations are then provided as improvements [24]. The researchers use the Capability Maturity Model Integration (CMMI), ranging from 0 to 5, to measure the collected data. It can indicate whether a process has been properly implemented and performed. CMMI allows a quality assessment for the initial and target state, shows improvements needed, and provides a basis for benchmarking [25]. The following are the steps for data analysis. First, with the predefined formula or matrix calculation in the design toolkit, the importance level for each design factor will result in a score for each objective to indicate which one to focus on and its suggested capability maturity level. Second, the organization will have a preliminary scope of governance system and proceed with the refinement process. Relevant key stakeholders will be engaged to adjust the result of a preprogrammed calculation based on justifications for competing/conflicting priorities or specificities of the organization and to set an agreed target capability level. Third, in the end, the researchers conclude the governance design by prioritizing governance/management objectives for Campus A and reveal the gap between the existing and expected situation by showing the average capability level of initial and target states.

5) Demonstration: After concluding the governance design, the researchers hold another workshop session to socialize the recommendations required for selected processes and components of each objective according to COBIT 2019, such as policies and procedures, processes, services, infrastructure, and others.

6) Evaluation: The research findings are presented to the management team to obtain their feedback on whether the processes and proposed recommendations are feasible to be implemented and identify what adjustments are needed.

7) Communication: The results of this IT governance evaluation are documented in a report and communicated to the respective management team.

III. Results and Discussion

The case study discusses the assessment performed to establish IT governance and set up an IT division in one of the higher education institutions in Indonesia. Due to its confidentiality, the researchers refer to this institution as 'Campus A'.

A. Context of Campus A

Founded in the 1980s, Campus A started as a Nursing Academy and gradually offered various courses mainly focusing on healthcare education. After 30 years of continuously providing excellent education, the campus officially became a university in 2013

with 17 study programs, ranging from diploma to postgraduate degrees. There are 43 applications used, from its campus and each study program web profile, e-learning, and third-party applications to its main administrative systems, such as new student intake and academic system to support students' learning journey and its internal operations. The development and maintenance of these applications are mainly outsourced to a sole third party and recently in concern due to difficulty in contacting this party.

In the meantime, there is no dedicated IT team to support its IT operations. Troubleshooting or service requests related to peripheral devices are handled by the General Affair division or Computer Science lecturers. In addition, an adequate IT infrastructure has become more important due to the increasing number of IT users, either internal (employee) or external (student) users, and to digitize the lecturing process. By 2038, the number of students is expected to be doubled. Thus, IT governance is required to facilitate a better IT operation by ensuring the adequacy of sufficient resources and balancing dependencies with vendors.

B. Designing the Tailored IT Governance

To tailor the best fit for the governance system, the researchers have conducted interviews with the key management team on the importance level of each design factor in COBIT 2019. The importance level of governance and management objectives ranges from 1 (low) to 5 (high). It is an indication of the influence or contribution of a specific design towards the objective achievement as compared to a baseline (standard) situation (level 3).

The researchers guide the team to put the importance level based on its organizational objectives and goals and to address its key challenges. The absence of an IT organization and limited resources have become the main issues in building a healthy governance system. The issues also lead to an absence of policies and procedures that cause inconsistent IT operation and security. It increases the higher risk of information security issues and business continuity in Campus A. These issues also contribute to the importance level of each design factor, as summarized as follows.

- 1st Design Factor – Enterprise Strategy
  In the pursuit of doubled student intakes and revenue, the team expects that IT systems and infrastructure will help the organization to grow with stable IT service. Therefore, the growth and client service/stability have a higher level of importance compared to innovation and cost leadership value. Table I shows the design factor of enterprise strategy.

TABLE I
DESIGN FACTOR OF ENTERPRISE STRATEGY.

Value	Importance (1-5)	Baseline
Growth/acquisition	4	3
Innovation/differentiation	3	3
Cost leadership	2	3
Client service/stability	4	3

TABLE II
DESIGN FACTOR OF ENTERPRISE GOALS.

Value	Importance (1-5)	Baseline
EG01—Portfolio of competitive products and services	2	3
EG02—Managed business risk	2	3
EG03—Compliance with external laws and regulations	2	3
EG04—Quality of financial information	3	3
EG05—Customer-oriented service culture	2	3
EG06—Business-service continuity and availability	3	3
EG07—Quality of management information	3	3
EG08—Optimization of internal business process functionality	2	3
EG09—Optimization of business process costs	2	3
EG10—Staff's skills, motivation, and productivity	4	3
EG11—Compliance with internal policies	2	3
EG12—Managed digital transformation programs	4	3
EG13—Product and business innovation	3	3

- 2nd Design Factor – Enterprise Goals
  By realizing enterprise goals, the organization can also acquire the desired enterprise strategies [13]. As shown in Table II, Enterprise goals (EG10 and EG12) have a higher importance in realizing the expected growth and stability strategies than the other values. The employees' skills, motivation, and productivity are considered critical internal factors and the main goal of establishing an IT organization. The managed digital transformation programs are also required to ensure that the in-used applications are not overlapping and are web-based and properly managed to achieve the growth strategy.

- 3rd Design Factor – IT Risk Category
  Apart from the absence of an internal IT organization with appropriate skills and behavior, another major issue is related to third-party/supplier incidents. Campus A relies heavily on other parties to maintain and develop its applications. The lack of adequate contractual agreements, insufficient project and program life

TABLE III
DESIGN FACTOR OF IT RISK CATEGORY.

Risk Scenario Category	Impact (1-5)	Likelihood (1-5)	Risk Rating	Baseline
IT investment decision making, portfolio definition & maintenance	4	4	16	9
Program & projects life cycle management	4	4	16	9
IT cost & oversight	2	2	4	9
IT expertise, skills, & behavior	5	5	25	9
Enterprise/IT architecture	3	3	9	9
IT operational infrastructure incidents	4	4	16	9
Unauthorized actions	3	3	9	9
Software adoption/usage problems	4	4	16	9
Hardware incidents	3	3	9	9
Software failures	4	4	16	9
Logical attacks (hacking, malware, and others)	2	2	4	9
Third-party/supplier incidents	5	5	25	9
Noncompliance	2	2	4	9
Geopolitical issues	2	2	4	9
Industrial action	1	2	2	9
Acts of nature	2	2	4	9
Technology-based innovation	3	2	6	9
Environment	2	1	2	9
Data & information management	5	5	25	9

TABLE IV
DESIGN FACTOR OF IT-RELATED ISSUES.

IT-Related Issue	Importance (1-3)	Baseline
Frustration between business departments (i.e., the IT customer) and the IT department because of failed initiatives or a perception of low contribution to business value	3	2
Significant IT-related incidents, such as data loss, security breaches, project failure and application errors, linked to IT	3	2
Service delivery problems by the IT outsourcer(s)	3	2
Failures to meet IT-related regulatory or contractual requirements	3	2
Insufficient IT resources, staff with inadequate skills, or staff's burnout/dissatisfaction	3	2
IT-enabled changes or projects frequently failing to meet business needs and delivered late or over budget	3	2
Regular issues with data quality and integration of data across various sources	3	2
Inability to exploit new technologies or innovate using I&T	3	2

TABLE V
DESIGN FACTOR OF THREAD LANDSCAPE.

Value	Importance (100%)	Baseline
High	30%	33%
Normal	70%	67%

cycle management, and service level agreements amplify vendor-related problems. Then, these issues also result in recurring software problems and software adoption problems. Table III shows the results.

- 4th Design Factor – IT-Related Issues
  Out of 20 IT-related issues listed in COBIT 2019, 8 risks listed in Table IV are considered serious. Those risks have a higher importance level than the baseline value. These risks have eventually materialized and resulted in several major IT issues. Lack of user involvement during project design and testing has caused discrepancies in user expectations, leading to frustration between business users and the IT department due to project failure. Inadequate after-live service by the outsources and lacking contractual agreement have also affected service delivery issues. These delivery issues are challenging for the internal team due to insufficient IT resources. Thus, these also cause data quality issues, missing opportunities to exploit IT, and others.

- 5th Design Factor – Threat Landscape
  Based on the discussion with the key management, Campus A is mainly operating under a normal threat environment. As shown in Table V, 70% of the threat landscape is estimated to be normal because organizations in the educational sector are not as highly regulated as the financial sector. IT also has not played a critical role in Campus A. Furthermore, there is no critical risk regarding its geopolitical situation. The geography, economics, demography, and political factors are quite conducive and do not entail certain risks.

- 6th Design Factor – Compliance Requirements
  Table VI depicts the compliance requirements for Campus A, which are estimated to be low. Campus A has a less stringent compliance requirement. There are no specific regulations from a government organization regarding IT operations in the educational sector. Although Campus A has implemented ISO 9001:2015 quality management for campus management, IT operations have not been a part of it. IT-related operations have also not been included in regular internal audits.

- 7th Design Factor – Role of IT
  As seen in Table VII, in the current phase, IT

TABLE VI
DESIGN FACTOR OF COMPLIANCE REQUIREMENT.

Value	Importance (100%)	Baseline
High	10%	0%
Normal	10%	100%
Low	80%	0%

TABLE VII
DESIGN FACTOR OF ROLE OF IT.

Value	Importance (1-5)	Baseline
Support	5	3
Factory	4	3
Turnaround	3	3
Strategic	3	3

TABLE VIII
DESIGN FACTOR OF SOURCING MODEL OF IT.

Components	Importance (100%)	Baseline
Outsourcing	80%	33%
Cloud	0%	33%
Insourced	20%	34%

is perceived as essential but not central for the operations of business services and processes. In case of disruption, other workaround and manual processes will be carried out for the continuity of business processes. However, IT is not yet seen as an innovation driver for education services. Therefore, IT operation in Campus A is of higher importance level for support and factory value.

- 8th Design Factor – Sourcing Model of IT
  With constraints in human resources, Campus A mainly relies on third parties to provide IT services, especially for the maintenance and development of its applications. Table VIII shows the selected sourcing model of the organization, which is predominantly outsourcing. The internal IT team, which consists of General Affair staff and several lecturers, handle several day-to-day tasks. These tasks include hardware troubleshooting, server operation, and service requests related to peripheral devices.

- 9th Design Factor – IT Implementation Methods
  As shown in Table IX, software development in Campus A mostly refers to the classic approach (Waterfall). However, there is no defined policy or procedure for the software development process. Phases of the requirement gathering process, design, development, and implementation are mainly handled by third parties. Internal users have partly involved in functionality testing prior to the implementation. The lack of defined policy and contractual agreement with third parties has resulted in lacking documentation.

TABLE IX
DESIGN FACTOR OF IT IMPLEMENTATION METHODS.

Value	Importance (100%)	Baseline
Agile	40%	15%
DevOps	0%	10%
Traditional	60%	75%

TABLE X
DESIGN FACTOR OF TECHNOLOGY ADOPTION STRATEGY.

Value	Importance (100%)	Baseline
First mover	10%	15%
Follower	55%	70%
Slow adopter	35%	15%

- 10th Design Factor – Technology Adoption Strategy
  The current state of IT operation in Campus A causes quick adoption of new technology to be yet possible. Typically, Campus A will wait for this new technology to be widely available and become mainstream and affordable. Therefore, the researchers classify technology adoption in Campus A as mostly follower and slow adopter. Table X illustrates the design factor of the technology adoption strategy.

The outputs of the mentioned design factor impact assessment using the predetermined formula in the COBIT 2019 design toolkit. It is resulted in 25 out of 40 objectives being selected as the suggested governance system. After discussing with key management and considering the specific context, the researchers adjust 12 objectives by adding and subtracting values, as shown in Table XI.

Due to the absence of IT organization and higher dependency on vendors, the researchers put more importance on Managed Human Resources (AP007) and several objectives regarding having proper documentation with vendors, i.e., Managed Requirement Definition (BAI02) and Testing (BAI07). Moreover, the other objectives that are deemed important are related to Deliver, Service, and Support (DSS) IT Daily Operations–DSS01, DSS02, DSS04, and DSS05. Specifically for Managed Operation (DSS01), it is rather questionable as its value is way below the expected importance

TABLE XI
THE ADJUSTED GOVERNANCE SYSTEM.

Design Factors	Refined Scope: Governance/ Management Objectives Score	Adjustment (between -100 and +100)	Concluded Scope: Governance/ Management Objectives Priority
APO07—Managed human resources	5	20	25
BAI02—Managed requirements definition	10	20	30
BAI03—Managed solutions identification & build	10	-20	-10
BAI07—Managed IT change acceptance and transitioning	10	20	30
BAI10—Managed configuration	5	-20	-15
DSS01—Managed operations	-40	70	30
DSS02—Managed service requests & incidents	25	20	45
DSS04—Managed continuity	20	20	40
DSS05—Managed security services	20	20	40
MEA01—Managed performance and conformance monitoring	20	-30	-10
MEA02—Managed system of internal control	10	-30	-20
MEA03—Managed compliance with external requirements	10	-30	-20

TABLE XII
THE CURRENT AND TARGET CAPABILITY LEVEL.

Design Factors	Concluded Scope: Governance/ Management Objectives Priority	Current Capability Level	Agreed Target Capability Level
EDM05—Ensured stakeholder engagement	5	1	1
APO03—Managed enterprise architecture	45	2	2
APO07—Managed human resources	25	1	2
APO08—Managed relationships	20	1	1
APO09—Managed service agreements	50	1	3
APO10—Managed vendors	25	1	2
APO11—Managed quality	85	1	4
BAI01—Managed programs	35	1	2
BAI02—Managed requirements definition	30	1	2
BAI04—Managed availability & capacity	65	1	3
BAI05—Managed organizational change	100	1	4
BAI06—Managed IT changes	75	1	4
BAI07—Managed IT change acceptance and transitioning	30	1	2
BAI08—Managed knowledge	45	1	2
BAI11—Managed projects	70	1	3
DSS01—Managed operations	30	1	2
DSS02—Managed service requests & incidents	45	1	2
DSS03—Managed problems	45	1	2
DSS04—Managed continuity	40	1	2
DSS05—Managed security services	40	1	2
DSS06—Managed business process controls	45	1	2
Average		1.05	2.33

level. The researchers have assigned a higher value to risk due to IT operational incidents and related issues. However, due to still adopting a traditional rather than agile approach, the predefined formula in the design toolkit has automatically subtracted the importance value.

Meanwhile, the other objectives – Managed Solutions Identification (BAI03) and Configuration (BAI10) are subtracted because vendors mainly perform these. Due to its nature of fewer employees, the current internal audit is not yet arranged to cover IT internal controls. So, the values of Management Performance and Conformance Monitoring (MEA01), Management System of Internal Control (MEA02), and Management Compliance with External Requirements (MEA03) are subtracted.

In the end, 21 out of 40 objectives (52.5%) are obtained as the priorities for Campus A (see Table XII). The focus is currently aiming to improve these domains. First, the Build, Acquire, and Implement (BAI) domain has eight selected objectives that mainly address project management, starting from the definition, acquisition to the implementation phase. Second, the DSS domain has six selected objectives that treat daily operations and IT services support. Third, Align, Plan, and Organize (APO) domain obtains six selected objectives that address IT strategy and supporting activities. Last, there is Evaluate, Direct, and Monitor (EDM) domain with one selected objective, which engages stakeholders to support the IT governance system.

C. Capability Level Assessment and Recommendations

After identifying the focus area for Campus A, the researchers proceed with a capability level assessment.

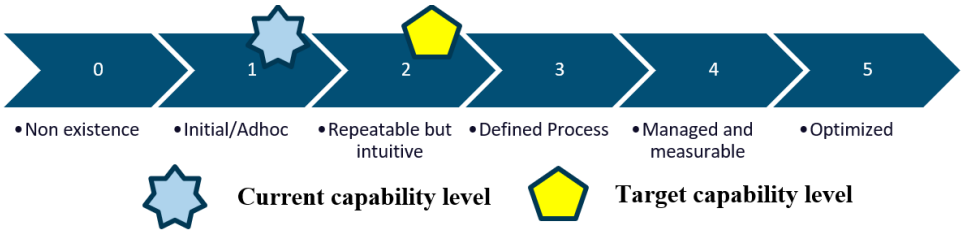

Fig. 2. Current and target capability level.

Based on the data and information gathered during the workshop, the implementation of IT governance and operations at Campus A is still in the early stage, wherein the monitoring and controlling processes are conducted on an ad hoc/situational basis. Meanwhile, the formal definition of duties and responsibilities, procedures, and documentation are still minimal. Therefore, it can be concluded that the current state of Campus A is still at level 1 – initial/ad hoc and its targeted level is at level 2 – repeatable but intuitive, as shown in Fig. 2 and Table XII.

The requirements of each capability level are as the following [26]:

- Level 0 – no activity improvement actions take place,
- Level 1 – the process is at the initial or ad hoc stage – not well organized with documentation of only 20%,
- Level 2 – the process is repeatable but still intuitive, with documentation reaching 40%,
- Level 3 – the process is typically well defined with documentation of at least 60%,
- Level 4 – the process is properly defined with regular quantitative measurement of its performance,
- Level 5 – good practices have been followed and automated.

After aligning the tailored governance system with the theoretical concepts, the researchers continue discussing recommendations to achieve the targeted capability level. Figure 3 is a set of key recommendations for the IT governance components in Campus A.

1) The organizational structure component is the most fundamental element, where the level of responsibility and accountability (Responsible/Accountable/Consulted/Informed (RACI)) is formalized for each IT management and operational process. At least, an IT organization consists of two or three personnel for IT operation, project, and security roles, and one personnel for Chief Information Officer (CIO) / Chief Technology Officer (CTO) position.
2) With dedicated personnel in an IT organization, the focus and quality of work expectantly can be further improved. The competencies and capabilities of each IT personnel are mapped to the competency framework for the digital era [27] and reviewed regularly. An action plan is to improve these competencies through training, knowledge sharing, rotation, and others.
3) Work procedures and guidelines as shown in Table XIII, based on organizational conditions and references to existing standards or frameworks, are developed to maintain consistency and standardize the implementation.
4) There are suggested activities for each tailored 21 governance/management objectives in COBIT 2019. During the workshop with key users, the researchers identify the relevant activities and their practicality to implement in daily operations.
5) Several infrastructure tools are suggested to be implemented considering cost efficiency and appropriateness, such as antimalware tools, email filtering tools, using HTTPS for a secure website, and implementing ISO 9001:2015 for the IT area.

D. Congruence between Theoretical Concepts of IT Governance in SMEs and COBIT 2019 Design Factors

Over the last three decades, the focus on IT governance has emerged significantly, especially in the context of risk management and value generation for organizations regardless the size [13]. It has been emphasized numerous times that IT value generation heavily depends on good IT Governance [28–30]. Nevertheless, research on IT governance in SMEs is still uncommon, although they underpin more than 90% of global economics [8].

According to the systematic literature review performed [9], several SME specificities are likely to influence how IT governance needs to be implemented.

1) Organizational process: more operational and reactive in nature with simpler processes in the organization.
2) Organizational structure: less hierarchy, centralized decision-making, and overlapping between ownership and management.

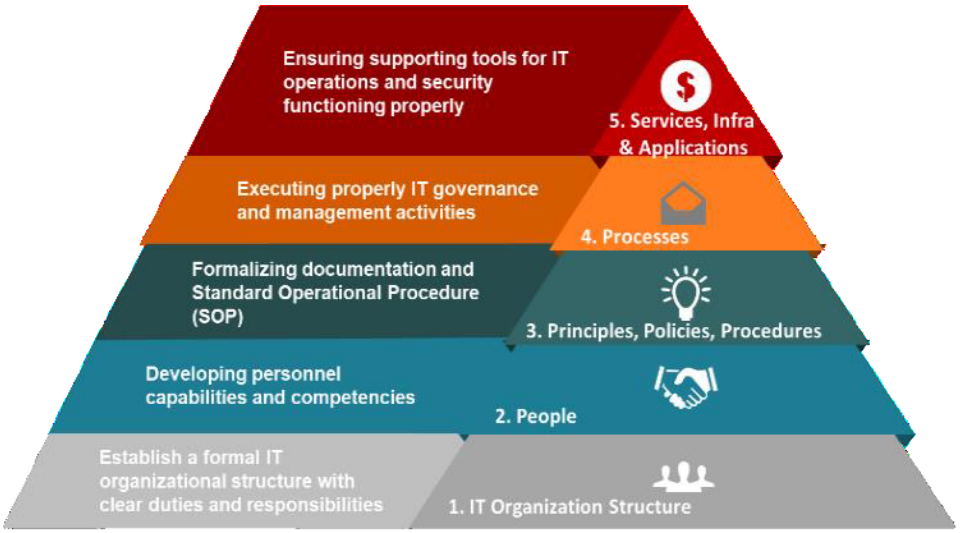

Fig. 3. Key recommendations.

3) Resources: no dedicated IT personnel, more generalist rather than specialist employee, constraints in financial resources, outsourcing option, and heavily reliant on few important parties. Typically, SMEs have no extra resources to counter pressure for change in an uncertain environment [31].
4) Organizational culture: absence of formalized procedures, informal culture, fast response, and ability to change quickly.
5) Organizational environment: tendency to be influenced by external factors and higher unit cost.

Another systematic literature review emphasizes the socio-technical aspects wherein IT governance works with relational mechanisms rather than formal procedures [8]. SMEs are also characterized as highly diverse. So, environmental factors, both internal and external, should be taken into consideration while applying IT governance. Facilitating tacit knowledge socialization and direct innovative actions will reduce the influence of these environmental factors surrounding an SME.

Due to the resource constraints mentioned, SMEs tend to depend heavily on outsourcing partners to adopt IT/IS [4]. Using a variety of theoretical concepts, such as Lemon Market Theory (LMT), Incomplete Contract Theory (ICT), Prospect Theory (PT), Organizational Trust Theory (OTT), and Organizational Control Theory (OCT), there are other specificities in SMEs in terms of IT project management and contract management involving third party vendors [2, 32].

- Asymmetric information and lack of project management skills lead to unclear scope and objectives, lack of adequate user involvement, and poor vendor controls.
- The tendency to keep IT costs as low as possible attracts more opportunistic vendors with poor or unobservable quality but at a lower attractive price.
- The unclear contractual agreement consists of mostly unspoken and unwritten expectations and unclear obligations of related parties.
- The issues mentioned above then result in project scope creep, failure to meet user expectations, lack of control over vendors, and changing project objectives.

With its guidance and associated design toolkit,

TABLE XIII
EXAMPLES OF SUGGESTED SOPS.

Domain	SOP	Best Practice/ Standard
APO03	Enterprise Architecture	TOGAF version 9.2, 2018
APO10	IT Project Tender and Acquisition	-
APO11	Quality Management	ISO 9000
BAI01	Project Management	PMBOK
BAI02	Software Development	PMBOK Part 1:5 - Project Scope Management
BAI04	Availability Management (SLA/OLA)	ISO/IEC 20000-1:2011(E) - Capacity Management
BAI05	Organizational Change Management	PROSCI® 3-Phase Change Management Process
BAI06	IT Change Management	ISO/IEC 20000-1:2011(E) - 9.2 Change Management PMBOK Guide Sixth Edition, 2017 - 4.6 Integrated Change Control

Design Factors:	Role of IT	IT Implementation Methods	Refined Scope: Governance/ Management Objectives Score
	1	1	
DSS01—Managed Operations	-5	-15	-40

Fig. 4. Scoring justification for DSS01.

COBIT 2019 has helped to identify critical areas for healthy governance in a more comprehensive way. The design factors can also cater to SMEs' specificities. The tendency to be more operational and reactive is accommodated in design factors of the role of IT, which are support and factory. Resource limitation is catered in design factors of generic IT-related issues, i.e., insufficient IT resources. Project management and contract management issues are also reflected in design factors of generic IT-related issues, i.e., service delivery failure by IT outsourcer(s) and failure to meet contractual requirements.

Meanwhile, fast response and the ability to change quickly, as indicated in literature [9], are not applicable in terms of technology adoption in Campus A. Instead, it is slow in adopting new technology due to its resource limitation. Dependency on the sole decision maker in SMEs is the common cause of slower IT adoption [33, 34]. SMEs also tend to be reactive and shorter rather than long-term and strategic plans in terms of technology adoption [35]. Besides organizational issues and vendor risks, as indicated in a literature review [8, 9], COBIT 2019 also highlights the tendency of SMEs to be lacking in information security awareness and the absence of business recovery plans and exposes SMEs to a higher risk.

E. Challenges in Using COBIT 2019

COBIT 2019 is claimed to address limitations in COBIT 5 by having more prescriptive guidance and less complex to apply in practice [15]. Its design toolkit is quite practical to use. The users are required to merely enter the associated values to express the importance or relevance of each design factor.

The design guide of COBIT 2019 has also provided the mapping of each design factor value to prioritize objectives for governance and management [7]. For example, if a user or governance designer puts higher importance on growth/acquisition value for enterprise strategy design factor, the prioritized management objectives will be Managed Strategy - APO02, Managed Enterprise Architecture - APO03, Managed Portfolio - APO05, Management Programs - BAI01, Managed Organizational Change - BAI05, and Managed Projects - BAI11. The resulting score or importance of each objective for each design factor can be seen in the toolkit excel.

However, the mathematical formula and justification for the score/computation are questionable to some extent. The most apparent instance is the computation for DSS01 – Managed Operations. This domain is mainly related to executing, monitoring, and coordinating internal and outsourced IT services, such as ensuring proper control over IT infrastructure, environment, facilities, and others. It is argued that this domain is essential for almost every organization, regardless of its industry or size, as it relates to IT operations' availability and delivering the services as planned.

For Campus A, scoring for the importance level of DSS01 is minus 40, far below zero. Compared to large organizations, IT risks and issues for small organizations like Campus A are less complex with less impact and likelihood. IT role is also less crucial and strategic with a more classical approach (Waterfall) towards software development. In one of its examples, the design toolkit of COBIT 2019 seems to prioritize DSS01 for an organization using DevOps rather than Waterfall approach [7]. Figure 4 shows how the value of design factors, i.e., the role of IT as support and IT implementation method as Waterfall, have points reduced to minus 40.

Enterprise size has been included as the eleventh design factor. Though it does not impact the priority and target capability levels of governance and management objectives, this enterprise size factor determines whether to use the core COBIT guidance instead of the focus area guidance of SMEs. At the time of the research in Campus A, this focus area of SMEs has not yet been released.

Although comprehensive and extensive, COBIT 2019 remains rather rigid as its formula is predefined and restricted to change. The researchers have attempted several times with different values to minimize the scoring from the expected value or put an adjustment score in a provided column in the design toolkit. This adjustment is allowed by taking into consideration the organization's specific context. With its nature as

generic guidance, the design toolkit of COBIT 2019 is not intended to consider all specificities of every industry [7].

The resulting governance system using this (semi) automated design toolkit may bring another risk of dispensing essential governance/management objectives. Indeed, COBIT has suggested that the governance designer team should carefully reflect and consider all inputs before concluding or resolving the conflicting priority. However, SMEs typically tend to become discouraged from wading through objectives that are deemed not applicable or relevant to their organization due to its limitation [3]. Thus, it is suggested that it will be better if the design toolkit provides flags to a list of 'should-have' governance/management objectives, especially those related to confidentiality, integrity, and availability objectives, regardless of the industry type or size. This flag is an indicator to users and will help them to conclude the governance system.

IV. Conclusion

Based on the research, there are several conclusions. Firstly, the researchers have assisted Campus A in tailoring its governance systems using COBIT 2019 design toolkit. Around 21 out of 40 governance/-management objectives (52.5%) are selected as the priorities for the governance system at Campus A. These objectives are still at the initial stage, with a capability score of 1.03 out of a maximum of 5 points. Most processes are performed in an ad hoc manner and have not yet been properly organized or documented. By implementing the recommendations and practices for a better governance system, Campus A puts its targeted capability level to a repeatable stage in which the planning process and performance measurement will take place in a more organized manner.

Secondly, the research shows that the design factors in COBIT 2019 can sufficiently accommodate the specificities of SMEs as discussed in the literature review research, such as the tendency to be more operational and reactive, limitation in resources and capabilities, and lack of project management and contract management. These design factors have influenced the ways of tailoring governance systems to be more applicable to the SME context.

Thirdly, as the implication to technical practice, the researchers contend that although the design toolkit is practical to use, it may also omit essential objectives, which raise questions about its computation justification. Flags to a list of 'should-have' governance/management objectives, especially those related to confidentiality, integrity, and availability objectives, regardless of the industry type or size, will be useful to prevent SMEs from overlooking the necessary elements.

As the research limitations, the researchers discussed only one specific case. Hence, implementing more cases in the SME context using the COBIT 2019 design toolkit will give more insights into the validity and practicality of the framework. Moreover, the tailored governance system proposed for Campus A should also be reviewed regularly because its dynamic nature depends on strategic changes, risk landscape, and others. So, refinement to the governance system should also be applied whenever necessary.

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