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A Proposed Model of IT Governance within Cloud Computing and Data Management in Higher Education

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Abstract— *The organization strategic design is able to be synced and supported through accurate and proper governance implementation. IT Governance reflected as a success key for organizations, including higher education's institutions. In supporting the sustainability and the organization stride, IT governance for the higher education organization needs regular assessment to maintain the dynamic technological and business circumstances. Recently, we see technology management in IT services is experiencing transformations phase to service management. Cloud computing (CC) which viewed as an IT transformation, is introducing the enhanced IT innovation system that works at a management budget throughout the concept of IT services. Despite its benefits, CC has not commonly embraced due to many factors, in particular, associated with the transfer of business data and its security. This makes one of today's organizations problems, especially concerning how cloud technology influenced data management. However, IT governance eventually will proceed to switch forward to CC technology. Organizations such higher educations will need to overcome these matters and afford to develop policies related to the cloud to manage the capabilities brought by CC and meet their conditions. Based on above conditions, this paper tries to proposed IT governance with CC and the data management model framework which formed based on primary aspects in governance processes with its COBIT 5 instructions and also data management with its principle for data assets managing.*

Keywords— COBIT 5 Framework, Data Management, Higher Education, IT Governance, ISO/IEC 38500.

I. INTRODUCTION

IT governance provides perceptibility and IT mechanism; consequently, the attempts performed in institutions governance made their operational processes risks decreased, gain more commitment to compliance procedure and give additional preservation of invested value. Although information technology has merits, it has contributed to the consequences of its presence. Various forms of IT risk emerging along with the advancement in the perspective of Information, Communications and technology, which also lead to organizations like higher education's institutions, require more directing and readjusting on its governance in IT with different concept. According to [1] IT Governance is needed by institutions like higher education to generate a process of disseminating knowledge in more interactive and dynamic learning activities, transparencies in their operational governance of institutional activities, and evaluation-based performance improvement assessment, then data and information security which is associated to intellectual rights. Nowadays, along with vast technology development, cloud with its technology has the capability to offers another way for its clients to manage their resources vigorously, which gains a quite common focus. Besides being very interested in using the cloud within data management with its capabilities; which almost all higher education institution has, regrettably some of them remain entirely unacquainted within the cloud then the further data management significance variables. Cloud computing must be introduced as a matter of urgency as many scientific study and research currently address cloud computing technologies. Previous investigations done by [5] conclude in their paper which undoubtedly presents the divergence between the competencies needed for conventional IT outsourcing associated with the services of cloud technology. Also, centered on the experiments to hundreds of Australian institutions [6], the organization's addition to cloud alternatives was proposed. The examination aims to underline the significance of IT governance in the improvement of the IT scheme and to highlighting the influence in the business field. Emphasizing on the following phase of the IT governance and its passages to adopt cloud technology within data management has become this project objective.

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II. IT GOVERNANCE AND CORPORATE GOVERNANCE

The idea of IT governance [17] and corporate governance [18] are considered well familiar among us. The general definitions of "governance," pointing out to the drill of how an organization makes sure its strategic policies are established supervised and implemented [19]. Implementing good corporate governance which linked in a strategic way to performance measures allows organizations at first to focus on the fundamental effort who promote their activities, and secondly to ensure strategic objectives line up by business purpose. Corporate governance encompasses many essentials areas, one of which is IT governance. IT governance, as an essential feature of business strategy and as a corporate governance constituent, is by necessity, the cornerstone for every organization. Many terms found in literature that suggested to employing IT governance. However, our paper tries to observe the interpretation of IT governance offered by [3], which says that it represents the "organizational capacity of the Board, the Executives and Management of IT in the application and construction of IT strategy." It also concerns the series of practices, customs, policies, laws, and an institution that prejudices the management, administration or supervision of an institution [7], and integrates IT approaches and organization in performs [8].

Considering to the advanced use of technology, a critical IT dependence needs to focus specifically on IT governance, and the needs to take the risks of business transparent and conserve the shareholder value [9]. IT governance also acknowledged as an applicable design to resolve IT changes and issues developed. The IT governance mechanism will lean on its properties and organization's needs. IT governance performs as an anticipation to facilitate performance in the IT utilization to an accountability framework including the making of decision process [10]. The organization possessed the right and sufficient capacity and structure following above IT governance definitions to implement effective governance that aligns IT with its institution's strategy. Institutions governance will be affected when current technology requires to get introduced to the existing system.

The institution of higher education considered as a unique non-profit organization that needs a periodic examination to change the governance framework of IT as the reflection of the expanding industry situation and technology. A higher education's institution also has a distinct IT infrastructure; it has unique apps that differ from other organizations, like educational and technology-related systems [11]. In Indonesia for an example, IT is to be used for promoting the continuation of management processes to enable the higher educations (universities) "Tri Dharma" (teaching, research, and community-based services) to get appropriately carried out. It is necessarily for university to be a pattern for the completion of Good University Governance as Indonesia's highest educational organization. It represents several factors why higher education with principles in it so important. The IT governance mechanism of an organization will, however, depend on its characteristics and requirements [14]. In this case, the organization executives can be assisted by utilizing COBIT 5 with the ISO/IEC 38500 to encourage their legal responsibilities, laws, and conduct alongside of the applications by contributes its essential values.

2.1 COBIT 5

COBIT 5 which stands for the Control Objectives for Information and Technology related is "*a comprehensive framework that helps enterprise leaders to create optimal value from information and technology by maintaining balance amongst realizing benefits and optimizing risk levels and resource use*"[12]. With offering necessary structure and tools to convey value, risk reductions, and optimizing opportunities COBIT 5 foundations are on its process reference model, which describes in detail many governance and the processes of management which familiar to every institution. Such pattern is offering IT organizational and company executives a broadly acknowledged field. The involvement of this operating model is a basic and crucial stage in good governance and presents a structure for IT parameter and monitoring. [13]. In short, it supports organizations to bear maximum IT values by balancing the applications of advantages and optimizing the levels of risk and resources utilizations. COBIT 5 is universal and beneficial for organizations of any dimensions [17].

COBIT 5 splits the process of IT governance into two primary method areas, First one is Governance areas; it covers another five processes where evaluation, direct, and monitoring (EDM) practices defined in every process. The second areas is management, includes four fields, sequential with the plan, build, run, and monitor (PBRM) area of responsibility, and provides end-to-end IT coverage. The dimension of processes is covered in their field, respectively. While the predominance of procedures involve "planning," implementing," and "monitoring" practices in or through the mechanism (e.g., quality, security) they are positioned in the domain that is usually equipped with the most well-suited field of operation when considering IT incorporate stage [18].

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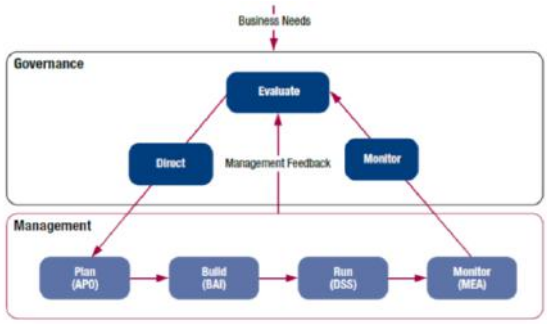

Fig.1: Governance and Management Key of COBIT 5

The suggested model is well-developed, integrated model, but not the only feasible model of the method. Due to their particular scenario, each company must identify its method selection. good governance most significant and critical parts measures is to include an operational structure and the universal language for all IT projects components of the corporation. The framework provided also ensures the measurement and monitoring of IT performance, IT security, communication with service providers, and integration of good management practices.

2.2 ISO 38500

ISO 38500 ISO 38500 seek to provide the directors including the owners, board memberships, managers, partners and executives with a packed of principles when assessing, instructing and controlling IT usage to comprehend and achieve its legal, regulatory and ethical obligations in organizations. The fundamentals range is to develop guidelines to confirm that IT use within their companies is efficient, adequate and suitable for any size of organization irrespective of the objectives, design or ownership [19].

I IT governance framework is considered a necessity; nevertheless, the framework itself not informing the way to pertain it; it merely guides its determined processes. The prominence of IT governance has risen to encourage the effectual output of the IT organization or to meet legal policies (ISO/IEC 38500, 2008) [17]. The popular frameworks of IT governance and standards give alternatives and instruments that can contribute to IT management.

Centered on the work proposed by [20][21][22], IT governance could be delivered through a different mixed from several structures, processes, and relational framework methods which could embraced by any organizations [22][23]. The proposed framework establishes a well-structured mechanism, making it easier to apply and implement a clear guideline similar as COBIT or the ITIL and ISO standards. Six principles of corporate IT governance are useable by most organizations entitled to the ideal performance which will support the decision making processes. Those six principles are Responsibility, Strategy, Acquisition, Performance, Conformance, and Human Behavior [43]. The IT governance directors are accountable for three functions international standard under ISO/IEC 38500, and those functions model demonstrated below.

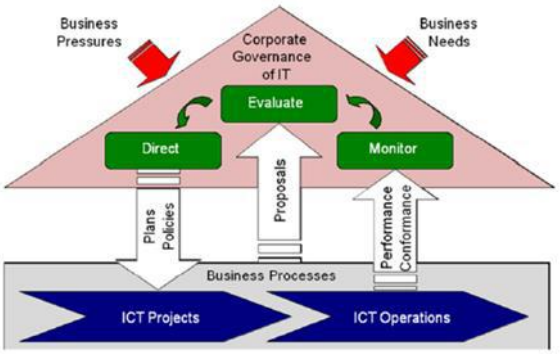

Fig.2: ISO 38500 Corporate Governance of IT Model

III. CLOUD COMPUTING (CC) AND BUSINESS TRANSFORMATION

During CC technology expansions, IT governance is treated into account. Without the utilizations of the CC facilities, the proper functions of an IT will not be accomplished anymore. CC, which mostly offers an innovative preference for organizations to preserve their infrastructure easily, yet also presents a risk, and the deficiency of a cloud governance strategy which is become our major attention. CC Governance is termed as the processes for controlling cloud-based service adoption and implementation, followed with recognized policies, audit procedures, and management policies [15]. However, cloud governance is beyond only management of policies and defining procedures to certify they have appropriately implemented. It is designed to support business strategy and provide value, security, and quality of service, irrespective of the location of data and services control.

Since it conveys an innovative computing idea, governance had to get supported, implemented and operated efficiently. In association to the conventional information system setting, attributable to its prevalent and various designs, and the virtual environment is more challenging to control. A fresh governance idea should have been developed to suit with and comply with cloud features. Therefore the organization must be prepared for efficient governance regarding cloud capabilities and constructions, in an attempt to implement efficient alternatives. An organizational design with the necessary abilities and knowledge is, therefore, necessary in the favor of proven IT governance. After evaluating the IT management structure suggested by [4][5] for instance,

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they analyzed that the existing organizational buildings must be given extra capacities to get the requirements of CC accomplished. They also suggested to incorporating cloud company policy capacities that would strategically integrate company goals with cloud/IT goals, proposed request, and relationship management expertise to facilitate business-IT interaction, and to preserve cloud problems in the various business sectors. Moreover, they have also recommended data security, IT network management, software acquisition, hazard and enforcement governance, contract management, etc. [5].

3.1 Cloud Computing

The NIST describes it as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" [2]. The cloud, besides offering efficiencies and reliabilities, also allows the customer to view data and apps in any approach and anytime or anywhere. Followed by the high emerged of new device and appliances every day, the demand for the cloud increased quickly. Cloud's facilities are transparent and straightforward, and can thus meet this increasing requirement [16]. The cloud have a model supports accessibility and it is covering five necessary characteristics (On-demand self-service, Ubiquitous network access, Resource pooling, Rapid elasticity, and Pay per use) [2], three service models (Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS))[41], and four deployment models (Public Cloud, Private Cloud, Community Cloud, Hybrid Cloud) [44].

Regardless of the basic feature of the above definition and the compromise between suggestion and requirements, some aspects should be accounted during the usage stage [24]. They are user profiling adaptability, individual use based on billing and metering, user-centric privacy, and SLA assurance. These criteria are described to distinguish the responsibility and perimeter on each level and to shorten the scheme and applications of an adapted architecture.

Governing cloud is not probably a new term for IT, but a clear definition has not yet been provided [25]. The definition offered by Microsoft is "*defining policies around managing the factors: availability, security, privacy, cloud services location and compliance and tracking for enforcing the running policies when the applications are running*" [26]. Cloud Governance primary focuses on provider/consumer interactions across various business models [27]. The corporate system should determine the method by which a proposition is completed and how it is going to spend. However, definition which arises indicates that the cloud is a profoundly evolving environment. Therefore it required some moment to categorizing its main features and depending on its domain methods areas [28].

3.2 Data Management

D Data management or so-called as data governance definition from IT Encyclopedia is "*the overall management of the availability, usability, integrity, and security of the data employed in an enterprise. Moreover, a good data governance program includes a governing body or council, a defined set of procedures, and a plan to execute those procedures*" [29]. The Association for Data Management (DAMA) refers it as top-level design and monitoring over data management, then also strengthen the definitions as: "*the exercise of authority, control and shared decision-making (planning, monitoring, and enforcement) over the management of data assets*" [31]. The literature might have various opinions on what drives these fields of governance. Nevertheless, data management undeniably essentials for both governance in corporate and IT governance, and it is being convinced with systematic analysis on a published paper [32]. Parts of cloud governance which regarded a crucial element are data governance [33]. With concerns to functions and accountability, the association among cloud performers or stakeholders necessary to get acknowledged [34]. Interoperability focused is nearly available in every current research report on cloud then data management despite accountability [30]. Decision making centered on cloud by organizations, likewise data store distribution and management, regulation, the audit procedures can be reinforced by the data management function [35]. To equip adequate decisions which the trust encouragement and self-assurance of cloud users, it will require effective data management with transparencies aspects and accountabilities as compulsories [36].

Five significant performers referenced by NIST's cloud computing composition are consumer, provider, auditor, carrier, and broker [2]. Thus every cloud performer has unique functions and duties in each cluster, so the data management program must describe precisely all cloud performer's parts and positions [37]. In outlining governance strategy for data which the organizations may select to transfer to a cloud provider will required Service-Level-Agreement (SLA) which contains protocols and rules assistance [38]. Meanwhile, data issues which influence the decision in switching to cloud and the data management applications for cloud services are includes in the technical background. As for the legal aspect, it defines

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the external and internal data laws and regulatory provisions that could impact the intention to embrace cloud technology [39], Inability to conform with the regulations, primarily related to private information will diminish the assurance of cloud providers and can severely harm the judgment from organizations management. Some prevalent positions in data management have recognized, such as the data management committee, cloud provider constituent, IT participant, and legal representative [40]. These functions must cooperate in developing data management forms. Collected after the analysis of relevant literature and review from the systematic literature, we encapsulate the affiliation concerning the Corporate/IT governance, CC, with data management in figure 3.

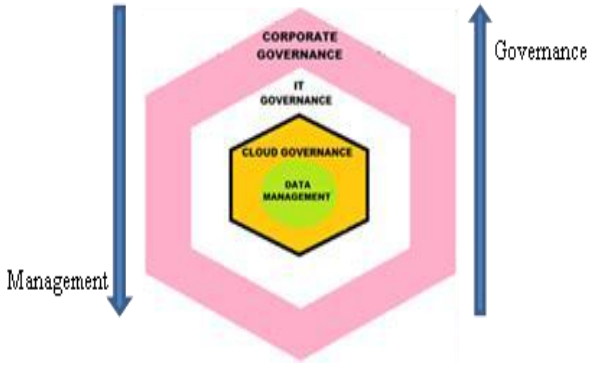

Fig.3: Corporate/IT governance, CC with data management affiliation

IV. PROPOSED IT GOVERNANCE WITH CC AND DATA MANAGEMENT

C Cloud computing get widely supported in the changing of the conventional IT governance and also the data management strategies [42]. IT governance is increasingly getting more crucial for organizations to adopt solution of CC and the data management to perform a new framework for cloud management, establishment, and controlling. The framework chosen should be flexible, practical, and be better reuse the recognized IT framework/standard management practice likewise COBIT and ISO / IEC 38500 series. COBIT 5 frameworks are providing direction on how to attain higher education benefits of IT modeling, property improvement, and hazard or danger optimization. The governance of CC and data should also allow for the service and the deployment models, which each requires security and concept in another level. The following proposed model of IT with CC and the data management (figure 4) show higher education's attempt could never be distinguished from its three main tasks; education and teach, research, and service to community in accomplishing the organization's purposes.

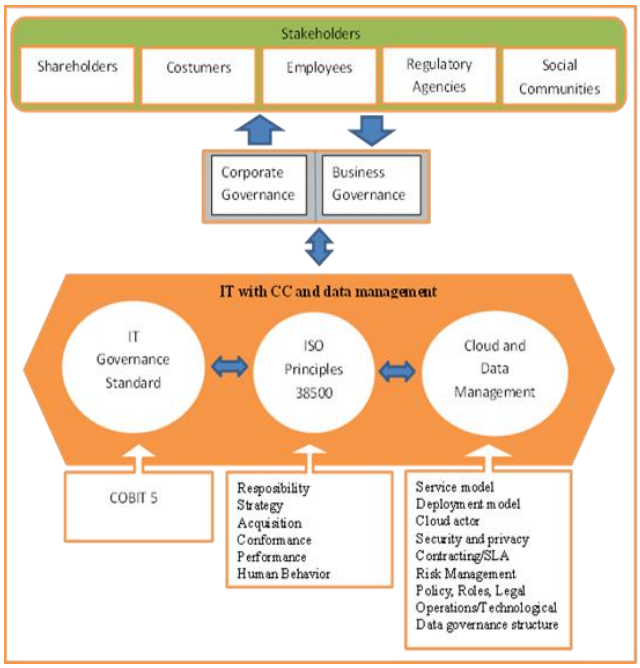

Fig. 4: proposed IT governance with CC and the data management

V. CONCLUSION

O Organizations especially higher educations are require holding a key to optimizing value from its investment in IT by having effective governance. Many elements still have to be reanalyzed and reconsidered. Within this paper, an outline description of the architecture of CC (deployment systems and operations model), data management, and the need in IT function also provided. We also deliberate the IT governance with cloud and the data management requirements, and then we illustrate the needs for IT governance with CC and the data management framework which would be the important condition for establishment, directing, and supervising IT governance with the purpose of organizations. The utilization of the main principles of the IT governance process will verify that all phase is consistent with the institution's stakeholder's requirements. CC and the data management framework adoption should influenced on the information technology function since it also offers cost-effective, quicker, more flexible resources and services IT direction and security. This suggested model shows how IT governance should be created along with the scheme of the governance corporate which then implies that IT governance is not merely become the commitment of the IT department, but becoming an essential component of institutions; therefore corporate governance conformity can be improved.

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