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Title:	A NOVEL APPROACH TO GENERATE TEST CASES FOR COMPOSITION & SELECTION OF WEB SERVICES BASED ON MUTATION TESTING
Author:	ASHOK KUMAR. P.S, KAARTHICK .B, GOPAL KRISHNA. C
Abstract:	Now a day�s Web Service has become a significant part of the web. The importance of Web Services is to support interoperable and Application � to � Application interaction over a network with proper URI, so that Web Services provide high value to online business transactions. Testing (Verification & Validation) is a critical activity in software product design. Rigorous software testing is not possible so different software testing techniques are invoked before releasing the product. Based on Prim�s algorithm we created all possible test cases from directed weighted graph. Mutation testing is a structural testing method; it generates software tests and evaluating the quality of software testing by fault insertion in original code. A case study has been presented here in order to create the efficacy of our test approach in mutation analysis.
Keywords:	Mutants, web service, testing, URI, SRS
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Full Text

Title:	TOWARDS A NEW ALGORITHM MORE EFFICIENT FOR UPDATING FIREWALL POLICIES
Author:	A. KARTIT, Z. KARTIT, M. EL MARRAKI
Abstract:	Firewall is one of the most widely utilized component on any network architecture, since that a deployment is a very important step to turn the initial policy to a target policy. This policy requires automated tools in order to create a suitable environment for configuring or deploying safely a policy target. Most researchers are interested in detection of conflicts or the problem of optimization of policies firewall while few of them have proposed deployment strategies for two important types of edition policies. We have already proposed a correct algorithm for the deployment type I [0]. In this work we study one of these strategies that falls within the type II edition policies. We show that the proposed solution of type II edition [1] is not fully correct and lead to security vulnerabilities, and then we offer a few corrections and improvements for this type of editing.
Keywords:	Security Policy (SP), Firewall Policy Management (FPM), Security Vulnerabilities (SV), Network Security (NS)
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

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Title:	A MULTI-ASPECT RULE BASED MODEL FOR WEB SERVICES OFFLINE COMPOSABILITY
Author:	HAJAR OMRANA, FATIMA ZAHRA BELOUADHA, OUNSA ROUDIES
Abstract:	Composition is still one of the most challenging key design goals of Web services technology. While they are designed to be aggregated and work with each other, most of existing Web services are developed independently and uses different standards. Detecting all the incompatibilities of Web services composability before processing the composition would increase the efficiency and correctness of this latter considerably. In this direction, we propose a multi-aspect Web services composability model, aligned with WSDL 2.0, SAWSDL and WS-Policy 1.5 standards, which addresses a set of functional, non-functional, contextual, data structure and technical composability rules to check whether to or more web services operations can concretely interact with each other.
Keywords:	Web Services Composability , Dynamic Composition, WSDL 2.0, SAWSDL, WS-Policy
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	CORRECTION POSITION OF COORDINATES FROM DATA GPS LOGGER IN GOOGLE MAPS BY USING LAGRANGE INTERPOLATION METHOD
Author:	NGAKAN MADE SATRYA WIBAWA, I MADE SUKARSA, I KETUT ADI PURNAWAN
Abstract:	Development of navigation technologies increase rapidly. People need a GPS to indicate a location or street. The accuracy of the GPS position is often less precise. This problem is used as a discussion of issues in the design of GIS to fix the GPS coordinates to the coordinates of the path using interpolation polinom lagrange method. This study uses PL/SQL to MySQL engine to perform the calculations haversine formula and interpolation polinom lagrange. Coordinates improvements value obtained from the results of these calculations.
Keywords:	GPS, GIS, PL/SQL, Correction Coordinate, Interpolation Polinom Lagrange
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	COMPARATIVE STUDY OF DATA MINING MODEL FOR CREDIT CARD APPLICATION SCORING IN BANK
Author:	EVARISTUS DIDIK MADYATMADJA, MEDIANA ARYUNI
Abstract:	The growth of credit card application needs to be balanced with the anticipation of bad credit risk because it does not use security collateral as warranty. The usage of credit scoring can be used to help the credit risk analysis in determining the applicant's eligibility. Data mining has been proven as a valuable tool for credit scoring. The aim of this research is to design a data mining model for credit scoring in bank in order to support and improve the performance of the credit analyst job. The proposed model applies classification using Na◆ve Bayes and ID3 algorithm. The accuracy of Na◆ve Bayes classifier is 82% and ID3 is 76%. So we can conclude that Na◆ve Bayes classifier has better accuracy than ID3 classifier.
Keywords:	Credit Scoring, Data Mining, Credit Card, Bank, Na◆ve Bayes, ID3, Classification
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	MULTI-LEVEL TRUST ARCHITECTURE FOR MOBILE ADHOC NETWORKS BASED ON CONTEXT-AWARE
Author:	A.RAJESH, DR. N. MOHAN KUMAR
Abstract:	Mobile ad hoc networks (MANETs) are not favorable to centralized trust architecture and literature review provides several security framework and solutions for trust management. However, there is no unified architecture for MANET to exploit deployed security models based on trust. This study presents compelling trust architecture in which a trust based security model is superimposed with three trust models such as a low-level trust model, a medium-level trust model, and a high-level trust model based on context-aware security. The low-level trust model meets the necessary security requirements using direct observations. The medium-level trust model ensures medium security level using direct observations and recommendation messages. The high-level trust model provides a highly secured system with high complexity and computational cost. The proposed work is formulated based on the application context to determine the trust-level in geographic routing protocol. The proposed trust is fully distributed and application context dependent and dynamic in nature. The proposed multi-level trust model is integrated with Position based Opportunistic Routing (POR) Protocol that selects the trusted next hop in the routing path. The correctness of the proposed scheme is analyzed using network simulator (NS-2). Proposed work increases packet deliver ratio and throughput significantly.
Keywords:	Mobile Ad Hoc Networks, Geographical Routing, Trust Management, Context-aware Trust, Trust based Security
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	INVESTIGATION OF SUPPORT VECTOR MACHINE CLASSIFIER FOR OPINION MINING
Author:	K.SARASWATHI, Dr. A.TAMILARASI

Abstract:	Complicated text understanding technology which extracts opinion, and sentiment analysis is called opinion mining. Building systems to collect/examine opinions about a product in blog posts, comments, and reviews/tweets is sentiment analysis. Product reviews are the focus of existing work on review mining and summarization. This study focuses on movie reviews, investigating opinion classification of online movie reviews based on opinion/corpus words used regularly in reviewed documents.
Keywords:	Opinion Mining, Classification Accuracy, Sentiment analysis, Movie reviews, Support Vector Machine, Bagging
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	A ROBUST METHOD FOR DIGITAL IMAGES WATERMARKING BASED ON COMBINATION OF SVD, DWT AND DCT USING OPTIMAL BLOCK
Author:	MOHAMED RADOUANE, TARIK BOUJIHA, ROCHDI MESSOUSSI, RAJA TOUAHNI
Abstract:	With the growth of the Internet, development of digital media technologies and computer network, the change and the protection of copyright have become very important. To protect multimedia data against illegal recording and retransmission, the integration of a signal (digital signature, watermark) has become an obligation without modifying quality of the original image, the goal of this operation is to identify the owner and protect his intellectual property. Digital watermarking has been proposed as a solution to solving the copyright problem by introducing invisible data (watermark) into original image. In this paper, we propose a robust method for digital images watermarking. This method is achieved by searching the optimal block that can be used to insert the watermark in original image by modifying the singular value decomposition (SVD) in DWT (discrete wavelet transform) combined with DCT (Discrete Cosine Transform) . The experimental results show that this imperceptible method combines the advantage of three transformations to ensure robustness against most attacks.
Keywords:	Watermarking, DWT, SVD, DCT, Entropy
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	FUZZY VAULT FUSION BASED MULTIMODAL BIOMETRIC HUMAN RECOGNITION SYSTEM WITH FINGERPRINT AND EAR
Author:	R.VINOTHKANNA, Dr.AMITABH WAHI
Abstract:	Human Recognition is one of the admired tasks over the world for recognizing a person using biometrics by determining physical or behavioral characteristics of that person. In our existing work, we have already worked out a multimodal biometric recognition system with fingerprint, palm print and hand vein. For getting more accurate recognition of our biometric system, in this work, we use ear as one of the modalities with the fingerprint. In order to improve the clear visible of input image databases, pre-processing of images is initially done. After the pre-processing of these images only, the features from the fingerprint and ear modalities are extracted clearly for the further processes. In the fingerprint images, the minutiae features are extracted directly and from the ear, the shape features are extracted using Active Appearance Model (AAM). Then, a grouped feature vector point is gained using chaff points and these two extracted feature points. After acquiring the grouped feature vector points, the secret key points are attached with the grouped feature vector points to formulate the fuzzy vault. Finally, test person�s grouped vector is matched up to the fuzzy vault data base to the accurate recognition of the correct person. Our proposed work is effectively evaluated in Matlab with the evaluation metrics FAR, FFR, GAR and Accuracy by changing the secret key size at every time. The results of our proposed work facilitate very better values for the recognition of persons with the fingerprint and ear modalities. Moreover, our existing work is also compared with our proposed work for proving that our proposed work is good. In addition to this, other existing work papers are also taken for our comparison work, which clearly proves that our proposed work outperforms other techniques by providing very much better recognition accuracy.
Keywords:	Recognition, Multimodal biometric system, Minutiae Extraction, Bifurcation, Ridges, Active Appearance Model, Chaff points, Fuzzy Vault
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

| Title: | EMPLOYING DATA MINING ON HIGHLY SECURED PRIVATE CLOUDS FOR IMPLEMENTING A SECURITY-AS-A-SERVICE FRAMEWORK |
| Author: | G. Thippa Reddy, K. Sudheer, K Rajesh, K. Lakshmanna |

Abstract:	Cloud computing is rapidly gaining popularity. However, like any new system, cloud computing is facing some significant challenges. The most significant challenge faced by cloud adopters is related to legal compliance, security controls, privacy and trust. This paper proposes a novel security management framework by employing data mining to detect, contain and prevent attacks on cloud computing systems. Given that the security frameworks and related controls on cloud computing are still evolving, this research may prove to be a useful piece of contribution in enhancing the theoretical foundation established by existing studies.
Keywords:	Cloud Computing, Data Mining, Security-as-a-service, OPNET, Positivism and the Interpretivism
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	A MULTI-AGENT BASED DISTRIBUTED INTRUSION PREVENTION SYSTEM AGAINST DDOS FLOODING ATTACKS
Author:	A. SAIDI, A. KARTIT, M. EL MARRAKI
Abstract:	Denial of service (DoS) attacks is a simple and very annoying type of intrusions. This kind of attacks attempts to make unreachable at least a service of equipment like it can stagnate the whole of a network. To launch a DoS attack, we have, nowadays, often tools to succeed. Some of these tools try to send a compromised network load to corrupt their targets by flooding it with SYN, UDP or ICMP packets [1], [2]. Our paper describes the conception of a multi-agent-based intrusion prevention system (IPS) that can apprehend these flooding attempts in a distributed way.
Keywords:	DoS Attacks, Intrusion Prevention, Multi-agent System, Distributed System
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	FORECASTING EARNINGS PER SHARE FOR COMPANIES IN IT SECTOR USING MARKOV PROCESS MODEL
Author:	M.P. RAJAKUMAR , V. SHANTHI
Abstract:	Investors rely growth on earnings per share (EPS) which is the net income less dividends on preferred stock divided by the number of outstanding share for measuring the financial soundness of a company as it represents the profitability of a common stock. Many investors select stocks on the basis of earnings forecast, cost of capital and the particular company�s profitability compared to other companies. As this seems to be the base for any development phase, market analysts spend ample time in evaluating and refining EPS estimates. In this work Markov process model is applied for forecasting the subsequent quarter EPS for companies in information technology (IT) sector. Two models namely two state basic model and extended state interval model with time independent transition probability matrices are applied to analyze and predict the EPS for subsequent quarter of HCL infosystem, Reliance, Infosys and Wipro. The EPS data obtained from Bombay stock exchange (BSE) are used to test the proposed prediction model. The experimental results declare that two companies� show optimistic sign of success, one company strikes a balance and the other company provides state of loss. The outcome of the prediction process is consistent in the real situation.
Keywords:	Markov process model, earnings per share, forecasting, IT sectors
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

Title:	GOVERNANCE AUDIT OF APPLICATION PROCUREMENT USING COBIT FRAMEWORK
Author:	GUSTI AYU THERESIA KRISANTHI, I MADE SUKARSA, I PUTU AGUNG BAYUPATI
Abstract:	The audit of information system is conducted to check the level of readiness of the organization in managing Information Technology (IT) governance. Measurement of level of maturity in procurement of application in one of the universities in Indonesia using framework COBIT 4.1 toward several IT processes related with procurement applications process by mapping the identification of business goals, information technology goals and information technology process COBIT 4.1. Best practice is given using ITIL V3 standard which is obtained by mapping IT process of COBIT 4.1. Results of audit that has been conducted show the current maturity level index is in 2.85 which means in 3-defined of maturity level with the readiness level of expectation at the level of 5-optimized. This shows the readiness gap, thus, needs to be given improvement strategies that contain the steps to achieve the expected level of maturity.

Keywords:	Audit of Information System, IT Governance, COBIT, Maturity Level, ITIL
Source:	

Title:	ENERGY EFFICIENT INTRUSION DETECTION SYSTEM FOR WIRELESS SENSOR NETWORK USING NEURAL NETWORK
Author:	SYEDA GAUHAR FATIMA,Dr.SYED ABDUL SATTAR, Dr.K ANITHA SHEELA
Abstract:	In wireless sensor network (WSN), the existing intrusion detection techniques rarely consider energy consumption for judging the node state. Also there is need for increased detection rate. Hence in this paper, we propose an energy efficient intrusion detection system for WSN. Initially the nodes deployed in the network are analyzed for malicious activity based on their residual energy. If the energy consumption of a node is greater than a predicted threshold, it is considered as malicious and the packets emerging from these nodes are said to be abnormal. The abnormal packets are passed through the Back Propagation Network (BPN) to analyze the data misinterpretation. In case, the output of BPN is found to be abnormal, then the attack detection is confirmed and attack type is estimated. By simulation results, we show that the proposed technique is more energy efficient.
Keywords:	WSN, Intrusion Detection, Wnergy Efficient, Neural Network
Source:	

Title:	A NOVEL APPROACH FOR MITIGATION OF HARMONICS AND INTERHARMONICS IN VARIABLE FREQUENCY DRIVES
Author:	PROF.VIJAYAKUMAR.A, DR.MAHENDRA BABU. T.K
Abstract:	Interharmonics are non-integer multiples of the fundamental frequency that causes several undesirable effects. Variable frequency drives are main sources of interharmonics. Also interharmonics are generated when the inverter load is unbalanced or the inverter is operating in overmodulation. In this study, adjustable speed drive employing diode bridge rectifier and voltage source inverter with load unbalance is considered. Propogation of interharmonics in the supply side due to load unbalance is analysed and a novel method for mitiating interharmonics is proposed. The proposed method employs an active filter in supply side which is simulated using PSIM . With the proposed active filter the compensation effectiveness is significantly improved and allows the elimination of passive filters thereby reducing cost and space required.
Keywords:	Interharmonics, Power Quality, Adjustable Speed Drive, Active Filter, Interharmonics Mitigation
Source:	

Title:	MAPPING THE RESEARCH PRODUCTIVITY OF BANARAS HINDU UNIVERSITY: A SCIENTOMETRIC STUDY
Author:	R. BALASUBRAMANI, R. PARAMESWARAN
Abstract:	The study presents the growth and the contribution of research carried out by the scientists of Banaras Hindu University (BHU). The pattern of communications of authors and scattering of their research output in different journals, analysis the strong and weak areas of university research. The data for the study was taken from the Web of Science online database published by Institute for Scientific information (ISI). The study shows that there was a gradual growth of publications during 2000 - 2011. The annual average research output of BHU was 578 records and the research output of the scientists is fairly collaborative. �Current Science� is one of the most preferred journals of the authors of BHU. The Institute of Technology leads in publications productivity with 1482 (21.3%) articles. The authors of BHU have been collaborated with the foreign authors for their research work.
Keywords:	Scientometrics Analysis, Scientometrics Study, Bibliometircs, Research Productivey, Banaras Hindu University, Scientfic Research-University.
Source:	

sensor networks. We emphasize the main motivation behind the development of each routing protocol category and clarify the operation of different protocols in detail related to energy issues, with emphasis on their advantages and disadvantages. Moreover, the current multipath routing approach is broadly used in wireless sensor networks in order to improve network performance such as load balancing, reliability, fault tolerance, bandwidth aggregation and QoS Improvement. Therefore, in this paper we highlight the notion of the multipath routing approach and its essential challenges, additionally the basic motivations for utilizing this technique in wireless sensor networks. In addition, we contrast and review the state-of-the-art multipath routing protocols that based on energy aware method, fault tolerance and QoS multipath routing. At the end of this paper, a characterized comparison has been forwarded on these methods based on the analysis outcome.

Keywords:	Wireless Sensor Networks, Routing Protocols, Energy Efficiency, Fault Tolerance, Qos, Multipath Routing
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

 Full Text

Title:	A STUDY OF TSUNAMI MODEL FOR PROPAGATION OF OCEANIC WAVES
Author:	E.SYED MOHAMED, S.RAJASEKARAN

Abstract:	The enormous destruction of tsunami and the increased risk of their frequent occurrences enhance the need for the use of more sturdy and accurate models that predict the spread of catastrophic oceanic waves accurately. This paper tries to study this phenomenon that shows a considerable amount of uncertainty. To model the spread of tsunami waves, the initial wave can be considered as a continuous two dimensional closed curve. Each point in its parametric representation on the curve will act as a point source which expands as a small ellipse. The parameters of each ellipse depend on many factors such as the energy focusing effect, travel path of the waves, coastal configuration, offshore bathymetry and the time step. Using Huygens� wavelet principle, the envelope of these ellipses describes the new perimeter. Further, overlapping and traversing of the wave front are detached and efficiently clipped out

Keywords:	Huygens� Wavelet, Tsunami Propagation, Simulation, Curvature, Convex
Source:	Journal of Theoretical and Applied Information Technology January 2014 -- Vol. 59. No. 2 -- 2014

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Title:	FAST AND SECURE HANDOVER AUTHENTCATION SCHEME IN MOBILE WiMAX
Author:	H. F. ZMEZM, S.J. HASHIM, ADUWATI SALI

Abstract:	Handover is one of the essential elements that can affect the Quality of Service (QoS) and capacity of Mobile Broadband Networks. The next generation of broadband wireless networks including the IEEE802.16e standard, allow users to roam seamlessly and securely over the network. Unfortunately the current design suffers from lengthy delay between breaking of previous connection and making of next connection. This delay might not be tolerated by some of the real-time applications such as VoIP and video streaming. Therefore the need for fast and secure handover design becomes an urging necessity. This paper proposes a new handover mechanism enables fast and secure handover with minimum delay suitable for real-time applications. It should be pointed that this proposed handover protocol guarantees a forward and backward secrecy. We conducted our research using ns-2 simulation tool.

Keywords:	EAP-Authentication, Hard Handover, Mobile WiMAX, NS-2
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GOVERNANCE AUDIT OF APPLICATION PROCUREMENT USING COBIT FRAMEWORK

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ABSTRACT

The audit of information system is conducted to check the level of readiness of the organization in managing Information Technology (IT) governance. Measurement of level of maturity in procurement of application in one of the universities in Indonesia using framework COBIT 4.1 toward several IT processes related with procurement applications process by mapping the identification of business goals, information technology goals and information technology process COBIT 4.1. Best practice is given using ITIL V3 standard which is obtained by mapping IT process of COBIT 4.1. Results of audit that has been conducted show the current maturity level index is in 2.85 which means in 3-defined of maturity level with the readiness level of expectation at the level of 5-optimized. This shows the readiness gap, thus, needs to be given improvement strategies that contain the steps to achieve the expected level of maturity.

Keywords: *Audit of Information System, IT Governance, COBIT, Maturity Level, ITIL*

1. INTRODUCTION

Governance of information technology (IT) is a process of planning to implement the use of information technology by directing and controlling a corporate by providing a structure that links processes, resources and information of information technology for strategy and corporate objectives [1]. To obtain the good information technology governance, thus, the company needs a framework that can fulfill the needs for facilities and infrastructure in information technology gradually in each year.

Audit procurement governance application in this university is focused on the application of procurement processes and procedures that could affect toward quality of the applications which is held or developed. Testing can be done through the proper value of internal and external control, so that the deviations that occur can be known in advance and can be fixed according to best practice guidance in the application of procurement governance.

IT has become critical in all aspects in University. It has become benefit as a strategic instrument for universities and other educational institutions [2]. Auditing is very important to increase the performance of academic information system. Academic information system audit model development using COBIT allows higher education to measure its full performance [3].

Control Objectives for Information and related Technology (COBIT) is one of the standards in IT governance that is developed to assist the corporate in control of the business needs that includes all information technology activities and an emphasis on what should be accomplished and effectively controlled [4]. The Information Technology Infrastructure Library (ITIL) is a framework for IT service management technology services to create high-quality information [1].

COBIT 4.1 framework is used as guidance in the implementation of management control processes and procedures in achieving good governance. Governance condition currently is known by measuring in accordance with the COBIT 4.1 standards. If the condition of the current maturity of the organization still has not reached the level of maturity of the maximum, thus, the expected maturity of the targets is set by the organization. The difference between current conditions and the maturity expected then if found a gap in the level of maturity, which is used as a reference in determining the suggestions of improvement by adding the use of ITIL V3 framework order to have better governance.

COBIT and ITIL framework provide an effective way in understanding the needs and priorities of the IT governance by completing each other if it is applicable. COBIT roles in the performance measurement process through IT process maturity measurement, by measuring the

level of current maturity and the improvement of the future process by setting the target of maturity achievement toward great improvement [5]. ITIL describes whatever the key success factors in the performance of the service to improve satisfaction of the user [5]. ITIL support best practices of IT management and focus more on methods and define the process flow have to be done. As of the both framework can be combined to apply in the organization.

In recent years various groups have developed world-wide known IT Governance best practices and frameworks to assist management in measuring the maturity of IT. Contemporary IT Governance frameworks are COBIT, ISO 27000, ITIL, IT BSC (IT Balanced Scorecard) [6].

2. METHODOLOGY

2.1. General Overview of The Audit Process

This research meant to perform audit for the application procurement governance in the university, to measure the current maturity, also to fix the maturity gap. This is an improvement effort for the IT governance in the university.

Procurement governance application audit in this university assess how governance of maturity level of application procurement services in this university today with the audit process using COBIT 4.1 framework.

COBIT framework was used as a tool to audit because the management guidelines of COBIT 4.1 provide information to control, measure and organize certain IT processes [2]. ITIL provides the definition of the best practice on how to plan, design, and implementing the ability of effective service management. ITIL is based on 5 foundations which is the focus of customer, service life cycle, process concept, continuous improvement, communication [7].

Application procurement (software) is an activity to obtain an application (software) required by university academic community by making or buying, which the process starts with planning needs until the completion of all activities to obtain application (software).

COBIT 4.1 IT process is related with the procurement business process application is used as a reference for the preparation of a questionnaire distributed surround university. The questionnaire results are used as source of data to measure how the maturity level of the current application of procurement services and determine the expected maturity targets. Maturity gap as a reference to

provide recommendations steps based on ITIL V3 as improvement of existing governance.

2.2. Stage of Audit Process

Stages of the audit process using COBIT 4.1 framework consists of several stages. Audit process steps are gradually shown in Figure 1.
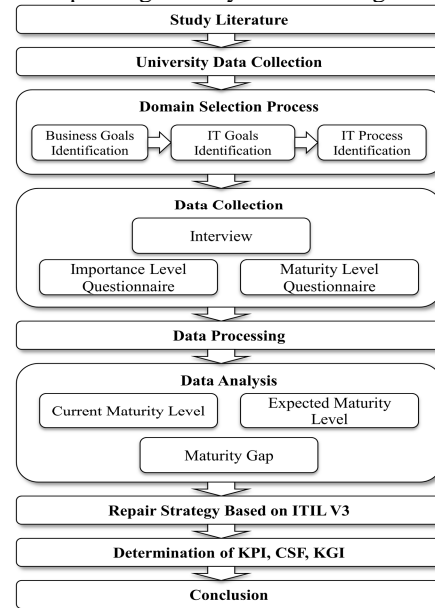
Figure 1: Stage of Audit Process

Stages conducted which are includes the selection IT process on the COBIT 4.1, as well as data collection which is consists of interviews, observations and questionnaires, processing questionnaires, data analysis include the current maturity and the expected maturity level, strategy improvements based on COBIT 4.1 and best practices of ITIL V3 framework with COBIT 4.1 mapping and final conclusions.

3. AUDIT DESIGN

3.1. Mapping Business Goals, IT Goals and IT Process

COBIT defines as business objectives related to information technology activities that generally exist in a company. To identify business goals by analyzing the business goals and objectives of the procurement application in the university which is later mapped in the COBIT 4.1, by aligning goals and objectives in accordance with the business goals of COBIT 4.1.

There are 28 goals and 17 information technology business goals of mapping information technology and business objectives based on COBIT 4.1 standards. Identification of previous

business goals results obtained are used as reference to get the relationship with IT goals. COBIT framework also maps the relationship between IT goals with COBIT IT process. Every IT goals can be composed of several related IT process, and vice versa [4].

It was based on the identification that has been made in the business and IT goals and there is found some related information technology processes. The results of IT process of the mapping between IT goals to IT based on COBIT 4.1 process is as shown in Table 1 [4].

Table 1: IT Process

IT Process		
Plan and Organize (PO)	PO2	Define the Information Architecture
	PO3	Determine Technological Direction
	PO6	Communicate Management Aims and Direction
	PO8	Manage Quality
	PO10	Manage Projects
Acquire and Implement (AI)	AI1	Identify Automated Solutions
	AI2	Acquire and Maintain Application Software
	AI5	Procure IT Resource
	AI7	Install and Accredit Solutions and Changes
Deliver, Service and Support (DS)	DS3	Manage Performance and Capacity
	DS4	Ensure Continuous Service
	DS7	Educate and Train Users
	DS8	Manage Service Desk and Incidents
	DS11	Manage Data
	DS13	Manage Operations

Results of identification produces 15 IT process that has been linked to the application of the procurement process in this university.

3.2. Questionnaire Draft of Importance Level

Questionnaire of Importance level of IT process aims to obtain the opinion of the respondents to determine the importance level of each IT process which also represents a process that has a high degree of risk. This questionnaire was developed from the results of the identification IT process on standard COBIT 4.1. Questionnaires of importance level of IT processes is distributed in the top management of each business unit in the university which is considered more aware of the IT processes related to the applications procurement in the university. This questionnaire has 5 levels of calculations, namely not applicable, not sure, not important, somewhat important and very important [8].

3.3. Questionnaire Draft of Maturity Levels

The questionnaire was designed to determine the maturity level of governance procurement applications recently, by analyzing responses from the respondents. Preparation of the questionnaire is based on IT process result of COBIT 4.1 of questionnaires of maturity levels. Questionnaire to measure the maturity level of governance is composed of several statements, which statements are made based on COBIT 4.1 maturity models from level 0 (non - existent) - level 5 (optimized) for each IT process.

The first thing that needs to be done to create a questionnaire that is by taking a statement of maturity models for each level. Each statement in maturity level, broken down into a single sentence and is adapted with object audit namely application of procurement in the university, then which is included in the audit questionnaire form based on COBIT standards [9][10]. Design questionnaire of maturity level for PO2 namely defining the Information Architecture at level 1 can be seen in Table 2 and Table 3 [4].

Table 2: Level 1 Maturity Statement of PO2

Level 1 Initial/*Ad hoc* - Management recognizes the need for information architecture in application development in the respective work units. At the level of management has developed several components of the architecture in order to improve the quality of information. Defining the complete and accurate data are clear and driven by software application offered by vendors compared with the information obtained. Defining the complete and accurate data are clear and driven by software application offered by vendors compared with the information obtained.

Table 3: Maturity Level Questionnaire Result of PO2

No	Statement
1	Management recognizes the need for information architecture in application development in the respective work units.
2	At the level of management has developed several components of the architecture in order to improve the quality of information.
3	Defining the complete and accurate data are clear and driven by software application offered by vendors compared with the information obtained.
4	Defining the complete and accurate data are clear and driven by software application offered by vendors compared with the information obtained.

Statements for the questionnaire obtained needs standards of assessment answers for each statement. There are 4 answers available with assessment standards set by COBIT and each answer has a value of its own opinion that does not agree with the value 0, doubt with the value 0.33, agrees with the value 0.66 and strongly agree with the value 1 [9][10].

Questionnaire is distributed to 75 respondents around university. Selected respondents were respondents representing a RACI (Responsible, Accountable, Consulted and Informed) chart on the data processing. Questionnaires will be given to the respondent in accordance with IT processes related with respondents based on the RACI chart.

3.4. Calculation of Important Level

Data processing to calculate the important level of the IT process is done by using one of the methods measure the concentration mode, which calculates the amount of data that most often appear in the data group [11]. Thus, the important level will be seen from the number of the dominant answer for every IT process. Quantity of answers to the most crucial value is predominantly considered to represent the important level of each COBIT IT processes can be applied later. Besides the important level as well as to describe the level of businesses risk faced that is related to the performance of information technology owned.

3.5. Calculation of Maturity Level

The maturity model allows management of a company to evaluate and determine the location of their internal control spectrum, especially with the worry of the senior manager about IT management and what needed to be done in the future to reach a satisfying level of management and control over IT function [12].

Administration of the data to determine the maturity level is conducted by the following calculation steps [9][10] :

a. Calculating the value and the compliance level of each level

The compliance level of each level (A) obtained from the division of compliance value per level (C) with a number of statements (B) per level. While the compliance values are obtained from the total value of the opinion that the results given by the respondents to the IT process. Where i is the level of maturity

$$A_i = \frac{\sum C_i}{B_i} \qquad (1)$$

b. To normalize the level of compliance

Normalization (D) is conducted by dividing the value of each level of compliance with the total value of compliance.

$$D_i = \frac{A_i}{\sum_{i=0}^{5} A} \qquad (2)$$

c. Calculating the value of the level of maturity

The final step is to calculate the contribution (E) of each level and then sum them together, thus, we get the maturity value (F).

$$E_i = i * D_i \qquad (3)$$
$$F = \sum_{i=0}^{5} E \qquad (4)$$

Results of calculating the value of the maturity level is maturity index to obtain the level of maturity in accordance with Table 4.

Table 4: Maturity Level Assessment Criteria

Maturity Index	Maturity Level
0 – 0,50	0 – Non-Existent
0,51 – 1,50	1 – Initial/ad hoc
1,51 – 2,50	2 – Repeatable But Intuitive
2,51 – 3,50	3 – Defined Process
3,51 – 4,50	4 – Managed and Measurable
4,51 – 5,00	5 – Optimized

Proper level is determined based on the COBIT framework which provides capability grouping of the company in managing the IT processes from zero (Non-Existent) to five level (optimized) [13].

3.6. Mapping COBIT 4.1 and ITIL V3

COBIT and ITIL are two approaches in IT Governance and governance of information technology services that complete each other, which the relevance of ITIL can be mapped to COBIT area in general. COBIT set an objective problem that must be achieved by an organization in providing IT services, while ITIL is a best practice that provides ways of IT managing to achieve organizational objectives. In the use of COBIT as the control standard IT management, it can be implemented in an effort to increase the level of IT maturity of company.

ITIL V3 comprises of five volumes namely Service Strategy (SS), Service Design (SD), Service Transition (ST), Service Operation (SO) and Continual Service Improvement (CSI). The mapping process is taken by mapping COBIT 4.1 and ITIL V3 published by Information Technology Governance Institute (ITGI). Mapping processes of COBIT 4.1 and ITIL V3 as shown in Table 5 [14].

Table 5: Mapping COBIT 4.1 and ITIL V3

COBIT 4.1 Process	ITIL V3 Process
PO2 - Define the Information Architecture	SD 3.6 - Design Aspects
PO3 - Determine Technological Direction	SD 3.6.3 - Designing Technology Architectures
AI2 - Acquire and Maintain Application Software	SD 3.6.1 - Designing service solutions SD 5.3 - Application Management
AI5 - Procure IT Resource	SD 4.7.5.3 - Establishing New Suppliers and Contracts
AI7 - Install and Accredit Solutions and Changes	ST 4.4 - Release and deployment management ST 4.4.5.2 - Preparation For Build, Test and Deployment
DS4 - Ensure Continuous Service	SD 4.5 - IT service continuity management SO 4.6.8 - IT Service Continuity Management
DS7 - Educate and Train Users	SO 5.14 - Improvement of Operational Activities
DS11 - Manage Data	SD 5.2 - Data and Information Management SO 5.2.3 - Backup and Restore

At the mapping of ITIL V3 towards COBIT, ITIL V3 processes have various types of coverage, where ITIL processes covering COBIT process thoroughly, partially and no area covered.

4. RESULT AND ANALYSIS

4.1. Data Processing of Importance Level

Recapitulation questionnaire results of the level of maturity more clearly shown in graphical form as shown in Figure 2.
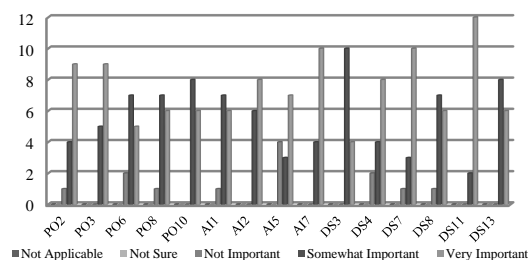
Figure 2: Importance Level Chart

From the graph above, it can be seen that there are eight IT processes. They are in very important level based on the results of questionnaires with respondents of top management of each unit of work at the university. Eighth IT processes, which later will be applied to look for the level of maturity.

4.2. Maturity Level Data Processing

Maturity model is one of the methods of information technology processes measurement through mapping each process towards maturity

status. The maturity level represents the IT process maturity in an university that shown in the form of value. Maturity level calculation is conducted by calculating the compliance of each level, and then normalized to the level of compliance is obtained, and finally calculate the value of contribution. Maturity value obtained from the value of the contribution of each level is summed. The results of calculations on PO2 define the information architecture towards a respondent, as shown in Table 6.

Table 6: Maturity Level Calculation of PO2

(i)	(A)	(B)	(C)	(D)	(E)
0	0	2	0	0	0
1	0.50	4	1.98	0.16	0.16
2	0.66	3	1.98	0.22	0.44
3	0.66	6	3.96	0.22	0.66
4	0.62	9	5.61	0.21	0.83
5	0.57	7	3.96	0.19	0.94
Total	**3.004**			**1**	**3.03**

Where (i) is the level of maturity, (A) is the level of compliance, the total (A) is the total level of compliance at all levels, (B) is the number of representations of questionnaires, the total value of compliance is (C), (D) is the normalization of the level of compliance, (E) is the contribution level and the total of the value of (E) is the maturity value.

Calculation of questionnaire for all IT processes performed on all respondents can be seen in Table 7. Results of the maturity index is the average value of each respondents overall IT each process.

Table 7: Maturity Level Data Processing

IT Process	Maturity Index
PO2 Define the Information Architecture	2.86
PO3 Determine Technological Direction	2.79
AI2 Acquire and Maintain Application Software	2.83
AI5 Procure IT Resource	2.75
AI7 Install and Accredit Solutions and Changes	2.71
DS4 Ensure Continuous Service	2.83
DS7 Educate and Train Users	2.74
DS11 Manage Data	3.09
Average maturity level	**2.85**

From the table above it can be seen the current average of maturity level index currently is 2.85, so it is in 3 – defined of maturity level.

4.3. Maturity Analysis of Current and Target

Processing of data obtained from the average over the entire IT process has current maturity level in maturity level 3 - defined. In general, it is meant that there's already a standard procedure for the application procurement process in the university which was documented. This procedure is communicated through seminars and trainings. Application procurement procedures are well defined, but the implementation still given to each individual in the work unit, so that the deviations may not be known. In general, these procedures have not been perfect yet; however it is just a formality on existing practices.

Targets or expectations of IT process maturity are the conditions of process maturity level that are expected and used as a reference in the IT governance model in the university. IT process maturity target is determined by looking at the internal environment procurement applications in the university such as vision and mission, goals and objectives. So of these things can be determined that in order to support the achievement of at least the expected level of maturity that is at maturity level 5 or optimized standard which is also the maximum maturity level.

The differences between the expected level of maturity and level of maturity are obtained when this gave rise to a gap. Maturity gap can be seen more clearly in the form of graphical diagram as shown in Figure 3.
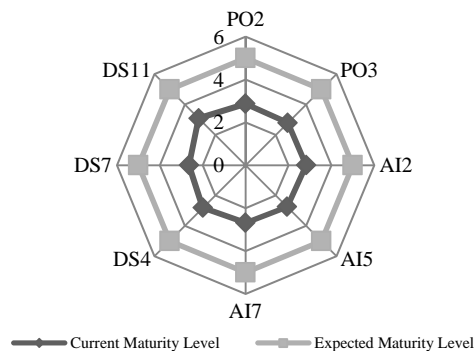

Figure 3: Maturity Level Chart

Of the results graph of maturity gap can be seen that all IT processes have maturity gap, it indicates that the entire process is in the applications procurement of IT in the university have not reached the expected level of maturity is the 5 (optimized) maturity level. To overcome the gaps that exist in the entire maturity of IT processes, it is necessary to do some steps to overcome the maturity gap.

4.4. Repair Strategies Based on COBIT 4.1 and ITIL V3

The steps in overcoming the differences (gaps) maturity levels of IT process are actions that need to be done on each IT process of applications procurement in the university who has the maturity level of current (current maturity level) below the expected level of maturity (expected maturity level). Remedial steps of application procurement governance towards the expected level of maturity is the maturity level 5 - optimized, from the lower level to the higher level of maturity respectively.

Recommendations to overcome the maturity gap are also provided in accordance with the guidelines of the ITIL framework mapping of IT processes of COBIT 4.1. ITIL V3 provides guidance from the perspective of the service provider to anticipate needs and improve outcomes through service strategy. ITIL supports IT management best practices and focuses more on methods and defines the process flow that must be done. Improvement strategies based on COBIT 4.1 is given as shown in Table 8.

Table 8: Repair Strategy Based on COBIT 4.1

PO2 Define the Information Architecture
a. Increase more complex data models can be applied to utilize the contents of the database.
b. It is necessary for the development of the information architecture equipment in accordance with its development in a sustainable manner.
PO3 Determine Technological Direction
a. It is necessary for the identification of deviations and maintenance of existing technology infrastructure.
b. It is necessary to be a reference in determining the best practice technical direction, such as by using the ITIL V3 framework.
AI2 Acquire and Maintain Application Software
a. It is necessary for classification of applications required in each work unit and the application will be developed in accordance with the work function.
b. It is necessary for skilled human resources in the implementation, maintenance and acquisition of software applications efficiently in each unit.
AI5 Procure IT Resource
a. It is necessary to be a standard IT policy for the acquisition of IT resources that are used extensively on all work units.
b. It is necessary to establish a good relationship with suppliers on an ongoing basis and the importance of proper communication acquisition strategy and contract management of the entire IT function.
AI7 Install and Accredit Solutions and Changes
a. It is necessary for standardization of formulation installation procedures that meet both environmental testing.
b. It is necessary to be an evaluation of the standards of users need and measurement to ensure the satisfactory quality of applications.

DS4 Ensure Continuous Service
a. It is necessary to be set of mature versioning standard enforced on application to the entire application in the university, and are consistently applied.
b. It is necessary to assess toward the achievement of IT services and continuous at each stage (assessment of the goals and objectives).

DS7 Educate and Train Users
a. Has the responsibility and clear ownership of the process that was set out in the training and education in work units.
b. It is necessary to understand each individual that through education and training the use of applications is important component for employees' career in each work unit.

DS11 Manage Data
a. It is necessary to have a high level of responsibility on the ownership and management of the data clearly communicated to each unit of work and management.
b. Maximize the use of advanced tools for automation of data management and training for data management staffs.

Mapping of ITIL V3 has done a miraculous result on ITIL processes corresponding to the IT processes in COBIT 4.1. ITIL processes are used to provide a reference point of view of improvement strategies based on ITIL V3 to reach maturity expected. Improvement strategies based on ITIL V3 is given as shown in Table 9 [15][16][17].

Table 9: Repair Strategy Based on ITIL V3

Current Maturity	Expected Maturity
PO2 - SD 3.6 Design Aspect	
The awareness of the importance of information architecture in development and procurement of application in the university.	The existence of the value or warranty (warranty) of the IT services provided for users.
There is already the identification of IT services.	There is management system such as service portfolio.
PO3 - SD 3.6.3 Designing Technology Architectures	
Technology infrastructure planning, implementation cannot be applied consistently.	There is management of IT infrastructure architecture which consists of the management architecture and architectural products.
Planning direction of technology infrastructure is in line with the strategy planning and communicated.	The existence of a centralized IT infrastructure with top-down design, implementation bottom up and unify both approaches.
Selection of vendors selected by understanding the long-term planning and technology development application plan consistently.	IT can manage costs, and lead the business in the use of technology.

AI2 - SD 3.6.1 Designing service solutions and SD 5.3 Application Management	
Acquisition and maintenance of software applications has been well understood and clear, and has been aligned with the IT and business strategies.	The implementation of the SDLC approach (Service Development Lifecycle) in application management.
There has been a documented process consistently across different applications and different working units.	The concept of a mature application framework.
There is already a maintenance plan that has been scheduled and coordinated the work units.	Ensure the content SAC (Service Acceptance Criteria) was established and desired achievement has been planned in the initial design.
	Supplementing with the assessment to ensure that the IT services can be operated effectively to meet agreed targets.
AI5 - SD 4.7.5.3 Establishing New Suppliers and Contracts	
There is already the establishment of IT procurement policies and procedures which are documented and communicated to the work units	Assessment of the pre-contract risk and the methods of the Business Impact Analysis (BIA) to assess the impact on various fields.
Supplier of IT resource management mechanism is integrated in project organization, depends on the existence of a contract management perspective.	There is management of SCD supplier (Supplier and Contract Database)
AI7 - ST 4.4 Release and deployment management and ST 4.4.5.2 Preparation For Build, Test and Deployment	
There are already formal methodologies in installation, migration, conversion and acceptance as well as appropriate in its place.	There is management of the installation for each new application, for example by Big bang approach or phased approach. The existence of the application deployment method gradually into the work units
Training, testing and transition have been determined yet based on individual decisions	Determining existence of training programs, the determination of the number of people who require training and how to provide education.
Quality of the system often lead to new levels of problems of post-implementation issues	There is corresponding simulation and related training and education programs.

DS4 - SD 4.5 IT service continuity management	
There is already accountability in the management of ongoing service to the application, but has not been clearly defined.	The existence of a mature standard setting versioning enforced on application to the entire application
Work unit has already had the initiative to follow the standards and receive training to handle a larger problem.	Presence in the life cycle management of ITSCM.
	There is management of the risk management framework based on ITIL V3
	The existence of the active service desk so it can be the key in communicating with staff and user (student).
DS7 - S0 5.14 Improvement of Operational Activities	
Training and education have been programmed and communicated.	The existence of automation manual tasks in work units.
Training and education of application procurement have been standardized and documented.	There are operational audits of all processes.
Training and education programs of the application procurement are already supported by budget, human resources and facilities.	The existence of incident and problem management so it has rich opportunities of operational improvement.
Not all deviations identified.	The existence of a consistent education and training and conducted regularly as well as the monitoring and measuring the performance of the results of training and education in order to know the result of training and education .
DS11 - SD 5.2Data and Information Management and SO 5.2.3 Backup and Restore	
Needs of the importance of data management in IT in all units, have to be understood and accepted.	There is process of data management in managing the data assets.
There is the establishment of data management responsibilities.	There is existence of a data administrator which played an active role.
Already, there are means of backup and restore.	There is existence of strategies for backup and restore data.

4.5. The order of Improvement of The IT Process

    Conditions of application of procurement governance maturity recently indicates the need of an improvement to achieve the maximum level of maturity. One way to implement the improvement of the governance strategy effectively and efficiently is to make improvements based on the IT processes that have the highest critical level.

    From the research that has been done it can be seen by the level of critical IT processes, as shown in Table 10.

Table 10: The Order of Improvement of the IT Process

No.		IT Process
1.	DS11	Manage Data
2.	AI7	Install and Accredit Solutions and Changes
3.	DS7	Educate and Train Users
4.	PO2	Define the Information Architecture
5.	PO3	Determine Technological Direction
6.	AI2	Acquire and Maintain Application Software
7.	DS4	Ensure Continuous Service
8.	AI5	Procure IT Resource

    Measuring the critical level of IT processes is obtained from the questionnaire were distributed in the top ranks of management in the university, by noticing the critical level of IT processes condition towards the application of procurement services.

4.6. Key Performance Indicators (KPI), Key Goal Indicators (KGI) and Critical Success Factors (CSF)

    Determination of KPI and CSF are needed to determine the direction to be given to the management, both general and specific, about what should be done. This includes the extent to which IT moves, a good indicator of performance, or factors that are created for success.

    Key Performance Indicators (KPI) is used to monitor the performance of each IT process, which is the major indication of the defining measurement of how well the IT process performance enabling objectives to be achieved. Critical Success Factor (CSF) contains a collection of activities that must be done to ensure the success of any process to achieve its objectives. Key Goal Indicators (KGI) is used to monitor the acquisition of IT process goals in order to determine whether the management of the IT process has achieved its business requirements. KGI is divided into 2 namely KGI to process (PKGI) and KGI for IT (ITKGI).

    Table 11 contains the form of KPI, CSF and risk for the ITIL V3 ST 4.4 release and deployment management process is the result of mapping the COBIT 4.1 AI7 Install and Accredit Solutions and Changes, which is based on ITIL V3 service transition and COBIT 4.1 acquire and implement [4][16].

Table 11: KPI, CSF and KGI

Key Performance Indicators
Customer or business perspective :
▪ Decrease in the number of problems on application procurement procedures and the use of post-implementation application.
▪ Increased satisfaction of the application performance in work unit and use by student.
Service providers perspective :
▪ Reduction of the use of human resources and costs in the application procurement and maintenance of applications.
▪ Minimize audit result difference with the facts that related to the application procurement.
Critical Success Factors
▪ The application resources and capabilities developed according to the target.
▪ Testing of the application design.
▪ Application capability has proven post-installation.
PKGI
▪ Reworking application post-installation.
▪ Lack of training for service desk.
▪ Application downtime of the work unit caused by inadequate testing.
ITKGI
▪ Percentage of the top management satisfaction towards data integrity of the new application system.
▪ Implementation of the application percentage that achieve the targeted goals.

KPI, CSF, PKGI and ITKGI is given in the IT processes that have critical levels in the organization. Thus, in the development of a model for the governance of IT processes, which is necessary to be done by setting the KPI, CSF, PKGI and ITKGI.

5. CONCLUSION

The conclusion obtained from the governance audit process of procurement applications include planning, the selection of the domain consists of the identification of business goals, IT goals and IT processes, data collection, data calculation, data analysis and improvement strategies. There are 15 IT processes COBIT4.1 are aligned with the goals and objectives of the applications procurement business and 8 process were considered to have very high level of importance by respondents, including PO2, PO3, AI2, AI5, AI7, DS4, DS7 and DS11.

The research that had been done has attain the purpose of the research which can measure the procurement governance current maturity level which is on maturity levels of IT processes in the application of procurement in the university was average maturity level 3 - defined and the expected level of maturity is the maturity level 5 - optimized, which is the standard expected level of maturity.

Remedial strategies are given to overcome the maturity gap based on COBIT 4.1 and ITIL V3 for procurement governance applications at the university. Process for improvement strategy according to ITIL is based on the mapping is being done by one-way mapping from COBIT towards ITIL and is irreversible.

6. FUTURE DIRECTION

This study is expected to be a reference in performing governance managing of the application procurement in a university so it can achieve the maximum maturity level which at the level 5 - optimized. Audit that has been done still refers to just a few IT process, it will be better if on the future it developed by referring to all the standardized domain in COBIT 4.1 and with the improved matter in a university, the framework that being used currently as an improvement strategy are COBIT 4.1 and ITIL V3 so that on the future, the research can use more than just 2 frameworks as comparison.

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