# The suitability of Technology, Organization and Environment (TOE) and Socio Technical System (STS) for assessing IT Hardware Support Services (ITHS) Model.

# The suitability of Technology, Organization and Environment (TOE) and Socio Technical System (STS) for assessing IT Hardware Support Services (ITHS) Model.

**Azham bin Ahmad[1] Zainuddin bin Othman[1] Dr. Ruzaini Abdullah Arshah[2] Dr. Adzhar Kamaludin[2]**

[1]Faculty of Computing Network, UC TATI, Kemaman, Terengganu.
[2]Faculty of Computing (FKOM), College of Computing and Applied Sciences. Universiti Malaysia Pahang, Pekan, Pahang.

azham@uctati.edu.my, ruzaini@ump.edu.my, adzhar@ump.edu.my, zainudin@uctati.edu.my

**Abstract**: IT support services are the crucial part in daily business operation services in any organization. Special attention is needed, especially in managing users or client satisfaction when using the IT services to address the user's problem or request IT hardware issues. Service quality (SQ) dimension is used to measure the effectiveness in delivering IT service support hardware to users. To strengthen the elements of the ITHS (IT Hardware Support Services), information system theories (IS) are used to harmonize the IT environment especially on the service support related to the IT hardware component. Two such theories taken from the IS environment are:Technology, Organization and Environment (TOE) and Social Technical System (STS). In this model, discussion is on the suitability of the above theories to assess ITHS, ability to achieve the service quality that reflect back to the users, client, and organization in achieving the service performance based on the SERVQUAL dimension.

## 1. Introduction

Services are becoming prominently important, especially to provide value to customers and for competitive advantage. Hence, the quality of service as perceived by customers is utmost important and continuous quality improvement is one of the priorities for organizations. An IT outfit exists (either internal or external to the organisation) to generate and provide IT services. Those services provided to a group of customers of that IT organization, a group that demands quality services for value and timely delivery with quality. Quality is an output for the products or services to be quantified by the customers, both from internal and external services. Quality is achieved when a specified standard of performance set by the services meets the minimum requirements, agreed specification and time. An example of a quality computer system is a basic computer system from Dell and HP. Each one of them has the specific design standards to satisfy and quality, especially for its customers, is delivered once these standards are met. Quality reflects quality of service (QoS). These

are the descriptions of the services' overall performance. For instance, in today's IT infrastructure services (ITIS), providing the IP network becomes very important. It is also an important factor to support the growing Internet of Things (IoT) not only for voice and video streaming over the Internet.

Again, the concept of service differs in different IT areas of the organization, such as marketing, operations management, software engineering and information systems. However, studies of IT services identify the effectiveness of communication and trust between the parties as a critical factor affecting the quality of service. Jia and Reich [1] define "IT Service Climate" as a shared mutual perception of IT employees, practices and behaviours in the workplace that support the provision of IT services to business customers. It shows that the climate of services is related to customer satisfaction and quality of service [2]. Service and quality characteristics in IT services are negotiated or consulted between service providers and customers, and specified by means of a service level agreement (SLA)[3]. The theories and IT Framework towards the ITHS model elements will be further challenged from the perspectives of people, process and technology to give further depth to the ITHS model.

## 2. Information Technology (IT) Framework

The value of a service comes from what it authorises somebody to try and what the service is created for. Thus, the worth or value of a service is decided by the client or users and not the service supplier or the IT technician services. To know service quality in Information Technology (IT) services, Information Technology service management (ITSM) is responsible for the management and maintenance of IT systems and has an essential role in supporting and satisfying business necessities and to inspire IT service quality. It additionally effects the IT service quality and making it worth to the purchasers or users. Many IT frameworks are designed to manage, measure, and align IT objectives with the organizations' objectives. The framework is also to guarantee a significant portion of business operations is generated by information and technology.

A Framework may be a standard, a repository, a method or a model. Standards and repositories have version numbers. A standard is constructed from a set of requirements, while the repository is defined by a set of recommendations. A method is a set of steps while a model is a set of tools. Standards and repositories can use one or more methods or models.

In order to sustain and improve business, an organization must be able to guarantee the stability and performance of the information technology (IT) service quality. Many IT organizations have begun to use frameworks and measurement to monitor, evaluate and restructure their organizations based on the mission, vision and business nature. Examples of popular frameworks are Capability Maturity Model (CMMI), Control Objectives for Information and Related Technology (COBIT) and Information Technology Infrastructure Library (ITIL). Examples of measurements include, percentage of incidents resolved by first line support, average time to resolve incidents, percentage of releases on time, and percentage of IT staff turnover [4]

Definition from [5] in term of services is, acts performed by one entity for another, including the provision of resources that another entity will use. IT services are services provided by an IT service provider to one or more customers and are based on the use of IT to support or enable business processes [6]. The IT service is complex due to the number of equipment used such as the hardware, the operating system software, the application software, and the telecommunications network equipment. Continuous developments need to be managed to exploit new technology. Many large companies that have internal IT services used the IT framework to govern their internal IT services that serve the other departments such as marketing, human resource and finance [7] in accordance with the organization business environment, vison and mission of the company. IT governance represents a structural relationship between different processes and mechanisms through effective and efficient use of IT strategy and resources that can be controlled to achieve the goals and objectives of an

organization. IT governance has been defined as "the decision rights and accountability framework for encouraging desirable behaviours in the use of IT" [8]–[10]

In reference to [11], IT governance encompasses developing the IT strategic plan, assessing the nature and organizational impact of new technologies, developing the IT skill base, aligning IT direction and resources, safeguarding the interests of internal and external IT stakeholders as well as taking into account the quality of relationships between stakeholders.

A number of IT frameworks are developed with the intention to increase IT efficiency, reduce IT costs and increase the control of IT investments both in private and public sectors agencies. Among these, the most popular models are ITIL, COBIT and ISO17799 standard which can provide guidance and tools for better IT governance [12]. Nevertheless, there are numbers of IT frameworks in the organization such as COSO, CMMI, PMBOK, Six Sigma, MOF, TOGAF, PDCA, COSO and Val IT are using. IT standards such as ISO 20000, ISO 27001, ISO 27002, ISO 9000 and BS 10012. These frameworks propose predefined areas of domains and method and processes for a variety of IT Governance firms' related activities, best practices, support and advice on how to implement these frameworks [13]. Table 1 below describe the purpose of the IT Frameworks.

Table 1: IT frameworks and purpose (Source: Developed for this research)

| **IT Framework** | **Purpose** |
|---|---|
| ITIL V3 (Information Technology Infrastructure Library) | Improving support systems in the area of information technology (IT). A technology utilization system for optimal management of technology and communication and for the establishment of best practices and the advancement of the IT service quality standard that customers should demand and provide. Used as a quality management framework for the objectives: quality assurance, standard of management, performance, cost reduction and knowledge flow effectiveness, SLAs and business process control. [14]–[16] |
| COBIT 5 (Control Objectives for Information and Related Technologies) | To track whether the information metric system is readily mature or accurate. COBIT provides management support for optimization of IT resources, including applications, information, infrastructure and personnel. It also offers a systematic structure that helps businesses achieve their objectives to handle IT businesses..[17]–[19] |
| CMMI SVC | Designed and used exclusively for IT services and products. To boost service efficiency and customer satisfaction and to track various processes introduced for customer service delivery. [16], [20], [21] |
| TOGAF (The Open Group Architecture Framework | To provide methods and tools to promote the growth of architecture companies and to enable them to embrace, build, use and manage the architecture of companies. Freely available by any entity that wishes to build an architecture for use in the business. [22], [23] |
| COSO (Committee of Sponsoring Organizations of the Treadway Commission | Help organizations plan and carry out internal control in the light of the many changes in their business and operating environments. Dedicated to the development, quality control and fault prevention of systems and guidelines for customer risk management. A reference can also be found to other systems and standards. [13], [24], [25] |
| PMBOK (Project | It aims to be a subset of expertise known as good practice in the project management community. It allows companies to standardize practices with |

| IT Framework | Purpose |
|---|---|
| Management Body of Knowledge) | other departments; people in development manage projects in the same way as those in distribution. It also helps project managers to work with a standardized system across companies. [13], [26], [27] |
| Six Sigma | Tool to improve operational excellence in manufacturing and other enterprises.[28]. In order to emphasize customer satisfaction, an ongoing improved culture, the search for root causes and full involvement of employees. [29] |
| VAL IT (Value IT investment) | Ensuring that organizations achieve the optimal value from IT-enabled enterprise investments with known and acceptable risk at reasonable cost, and provide guidance, processes and supporting practices to help the board and managers comprehend and carry out their role in this investment. [30]. It also provides methods to measure and optimize the realization of business value of investments in IT, in order to achieve certain mechanisms. [31] |
| PDCA (Plan Do Check Act) | Continuous search for improved methods. The PDCA cycles are more than a tool; they are a concept of continuous processes of improvement that integrated in the culture of the company. ISO 9001 manifestation. [32] A systematic series of steps to learn and know in order to improve a product or process continuously. [33] |

From table 1 above, the majority of the IT frameworks are designed to assist the IT department run organizational business on a daily basis. Tools, system, procedures, methods are used to observe or monitor various processes executed for service delivery especially to users and customers with the aim to improve the IT service department performance and customer satisfaction. The IT Framework helps to reduce costs and improve IT service delivery. However, not all of the IT frameworks are suitable to use; depending on the purpose, capacity and demand of the organization e.g. PDCA, which is designed for controlling and continuous of processes and products[34] and VAL IT which is designed as guidelines for Board of Directors and executives members to the organization [31]. Some IT frameworks are used only by large business and are not suitable for small business. For this research studies, only three IT Frameworks are selected for research intensification purpose. The IT frameworks selected are COBIT 5, ITIL and CMMI SVC based on the harmonization and adaptation to the IT support environment reflected in the IT support service, in accordance with the service quality element, of the selected component of each IT frame process. The IT hardware services (ITHS) do not reflect all the framework component processes.

Table 2: Selected Framework (ITIL, COBIT 5, CMMI SVC). (Source: Develop for this research)

| | ITIL | COBIT 5 | CMMI SVC |
|---|---|---|---|
| FOCUS | IT service management and operations. | IT governance and Control. | Software development, process improvement. |
| TARGET | IT service | All organizations. | Software Development Organization. |
| | Set of cookbooks providing best | Hierarchy of control objectives organised in | Detailed guidelines on process areas, goals and |

| | **ITIL** | **COBIT 5** | **CMMI SVC** |
|---|---|---|---|
| DOCUMENTATION | practice guidelines. | four domains. | practices |
| PROCESS IMPROVEMENT | An early edition of ITIL CMM is available. | Fragile on process improvement as it is essentially a control. | Framework is devoted to development improvement. |
| PROCESS | SERVICE MANAGEMENT:<br>- Service Support.<br>- Service Desk.<br>- Incident Management.<br>- Problem Management.<br>- Change Management<br>- Release Management<br>- Configuration Management<br>- Service Delivery<br>- Service Level Management | DELIVERY AND SUPPORT:<br>- Define and manage service levels.<br>- Manage third-party services.<br>- Manage performance and capacity.<br>- Ensure continuous service.<br>- Educate and train users.<br>- Assist and advice customers.<br>- Manage the configuration.<br>- Manage problems & incidents.<br>- Manage data.<br>- Manage facilities.<br>- Manage operations. | DEFINED:<br>- Incident Resolution and Prevention. |

From Table 2 above, only processes that related to the incidents within the IT hardware system application are selected. The issues have been discussed in [35]. All processes are linked to the information about the IM (incident management) process and is associated with the IT Frameworks selected (ITIL, CMMI-SVC and COBIT 5). This paper extend the work in [36], for each process and element, the work processes are similar, but given a distinctive name instead. The "similarities" part or processes can be merged into one element. This ITHS element is taken up from each of the three IT Framework (ITIL, COBIT 5, and CMMI SVC) uses. To measure the efficiency of the ITHS element, the SQ dimension is used. The SQ consists of five dimensions; as discussed in [36].

## 3.0 Information System theory (IS)

A category of description comes from the phenomenon and interaction of variables used to describe or forecast. In Greek theories means "contemplation." [37] A theory is a common rule based on a

propositional or decision-making relationship. Information on theories are commonly used in IT research provides a fundamental policy-enhancing environment for IT organizations, expanding the potential to produce successful and competitive businesses, adding business value and providing customers with valuable products and services. In the field of IT research several new theories have been developed, some of them to help clarify and use technology.

In information system (IS) perspective, several theories are involved with different kinds of research perspective, environment, and suitability of the work process. The significant information systems theories include the following; firstly, the structure models explain the influence over time of technological change on organizational design. The Adaptive Theory of Structure (AST) is based on the Gidden Theory of Structure. To study the interface between organizations and information systems, DeSanctis and Poole have adapted Gidden's theory. AST disagree with the technology-centred view and emphasizes social aspects as discussed in [38].

Second, the model of DeLone and Mclean is considered to be a comprehensive IS evaluation model, based on the review and integration of 180 studies. This study introduced a comprehensive classification leading to the success of six key information systems categories. Categories include system quality, quality of information, use, user satisfaction, impact on people and organizations as discussed in [39][40].

Third, the Diffusion of Innovation Theory (DIT), which has been modified and used in many different disciplines and technologies. Methodologically and empirically mature technique, it explains the rate innovation is communicated over time and in a particular social system through specific channels. Discussed in [41].

Fourth, the Knowledge-Based Theory builds upon and extends the resource-based theory of the firm initially promoted by Penrose and expanded by others. It discusses the facets to knowledge integration (efficiency, scope and flexibility) and the four primary mechanisms by which knowledge is coordinated (rules and directives, sequencing, routines and group problem solving and decision making). "Distribution is the process through which innovation is transmitted over time via a channel in a social system." An innovation is an idea or an element that the individual perceives as new.

Fifth, Goodhue and Thompson argued that the technology must be exploited and well adapted to the task it supports in order for an information system to have a positive influence on individual performance. Task-Tech Fit (TTF)[42] provides a robust theoretical basis for a number of problems relating to IT impact on individual performance, including recognition of users' impact on performance. The TTF is an extension of two social psychology models: Theory of Reasoned Action (TRA), which implies the conduct of a person is determined by behavioral intentions, where certain intentions are focused on the behavior of the person and contain the performance of the person and second, the technology acceptance model (TAM) [43], influencing the decision of a person to use modern technology: perceived ease of use and perceived utility. While, the task fit from the TTF is the extent to which technology helps a person to carry out his tasks. Task technology fit is used to provide a user with the instrument for evaluation aimed at organizational assessment of management decision-making exploitation of information systems.

Sixth is the model of Technological Acceptance (TAM) which is also an adjustment of reasoned action theory. TAM theorizes that user perceptions of utility and ease of use as the important drivers for acceptance or adoption of technology. The original TAM is now known as TAM2 [44]. Since then, Davis especially recommends the use of TAM in future research of additional external variables. TAM2 is used to explore the acceptance of end-users for the use of a variety of IT systems. In a number of fields, for example, decision science, management science, TAM2 was used to describe and forecast technology usage. Informatics and information systems management. TAM2 was also used to measure acceptance of technology across a number of different areas culture. as it clearly explores and addresses the role of end users, when the new technology started.

Seventh, UTAUT seeks to clarify user plans for IS utilization and user behavior by means of the unified theory of acceptance and technology use. The four key components (performance expectation, effort expectation, social influence and conditions facilitating) are mainly influenced by user behavior.

UTAUT[45] offers managers a useful means to measure the chance of success of new technology startups and helps them to identify those who accept them by proposing interventions for groups of users who may be less likely to use contemporary systems and to take advantage of them.

Lastly, The Nolan Stage Theory[46], which described a set of concepts for understanding the absorption of IT in business organizations. It focuses on the premise that almost all of the organization's computer expenditures form an S-shaped curve over time, following a common model of learning and experience curves. In view of the fact that organizational learning is to a certain extent, the official transfer of recorded knowledge and, in part, the non-official accumulation of experiential knowledge, the theory suggests that each knowledge organization sequentially crosses four stages of learning: initiation, contagion, control and integration.

This research paper will look at three angle perspectives i.e., of people, process and the technology. People who work within the organization environment, starting from the manager that manage the department, the IT engineer and IT technician who solve the IT hardware issues daily and lastly, the end users or client that request or log the incident. Process involves the workflow process starting from the incident, until the issues are resolved. The process involved the level of users; IT parts availability and vendor requirement time. The technology used to solve issues or incident request from users. Tool kits, level of experiences and expertise on how to use the technology to fix the IT component system.

Two theories from the Technology and Environment Organization (TOE) and Socio Technical System (STS) are adopted into this research. The TOE framework introduced by [47], aims to identify generic factors that explain and predict the probability of innovation and the adoption of technology.

The TOE framework provides researchers with an understanding of the impact or effects of organizational changes or innovations within three key areas, namely technology, organization and environment. Trist urbanized the STS[48] delivering a framework for modelling and analyzing complex systems.

STS comprise of humans applying technology to perform work through a process within a social structure (organization) to achieve a defined objective [49]. The mechanism can become dense due to dynamic interaction between the people themselves, between people and technology, and between people and the environment. STS is one that considers requirements spanning hardware, software, personal, and community aspects. It applies an understanding of the social structures, roles and rights (the social sciences) to inform the design of systems that involve communities of people and technology.

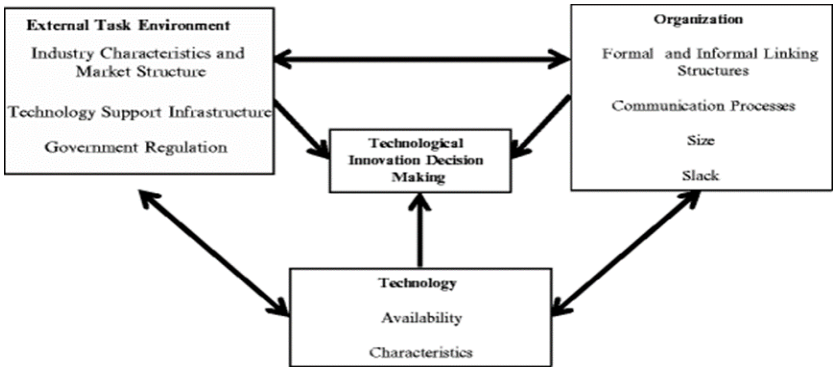


Figure 1: Technology organization environment framework. Adopted from [50]

From Figure 1 above, the TOE framework, adopted from [50], consist of three domains namely external task environment, organization and the technology.

First, the external task environment combines elements such as market structure and technology support infrastructure available for adopting new technologies and government regulations. These elements interact with each other to influence technological adoption decisions. For this research, under the external task environment domain, the only the element selected is the technology support infrastructure. On the ITHS, technology support infrastructure consists of IT infrastructure, technology readiness, user satisfaction and internal employees. The government regulation and industry characteristic are not selected on this research purpose as the research purpose is to investigate the service quality on the IT support services that bring service satisfaction to users and IT staff in delivering the IT support services in daily routine IT jobs especially on IT hardware.

The second domain consist of organization. The element from the organization consists of communication, process and size selected. Communication include the top management commitment, communication between users and IT staff and sizes of the organization. Formal and informal linking structures are not selected for this research purpose. The research purpose looks on how the communication between users and staff to deliver the IT support services according to the users' request on the IT hardware services on service quality.

While for the third domain, the technology domain. The research looks at availability and the characteristic of the technology. Availability involves the IT infrastructure (management), IT expertise (human), organizational IT (standard IT services include the internal (IT tools, IT infrastructure) and external (vendors' expertise). While, characteristic element excludes on the technology domain not use on the ITHS model. Table 3 below illustrate the relationship between the TOE, ITHS and the evaluated criteria.

Table 3: TOE theory to support the process from the ITHS element (Information Technology Hardware System. (Develop for this research purpose).

| TOE (Technology, Organization, Environment | ITHS (IT Hardware Services) | Example of evaluative criteria. |
|---|---|---|
| Technology context:<br>Availability<br>- IT infrastructure.<br>Management<br>- IT expertise: Human IT<br>- Organizational IT:<br>Standard IT services.<br>- Internal: IT tools, IT infrastructure.<br>- External: Vendors expertise. | Efficiency | Materials and Personnel[51]. |
| Organization: Communication Process and Size.<br>- Top management commitment;<br>- Hierarchical organizational structure. (IT Department) | Operational Performance | Willingness to help customers and provide prompt service [52]. |

| | | |
|---|---|---|
| Environment: Technology Support Infrastructure.<br>- IT infrastructure; technology readiness<br>- User satisfaction : Internal employees | Service Performance | Caring, individualized attention the firm provides its customers. Knowledge and courtesy of employees and the ability to convey trust and confidence [53]. |

The theory TOE to support the ITHS elements displayed in Table 3 above. It must meet the ITHS criteria assessed under TOE (Technology, Domain, and Environment) three domains.

The second theory, Socio Technical System (STS) invented by Trist [48], carries a framework for modelling and analysing complex systems. STS comprise of humans applying technology to perform work through a process within a social structure (organisation) to achieve a defined objective [49]. The foundation of STSs is general systems theory, which describe what the disciplines of science devise in common, that they all refer to systems: sociologists perceive social systems, psychologist's cognitive systems, computer scientists' information systems and engineer's hardware systems. In general, in systems theory, no discipline has a monopoly on science. STS components consist of people, process, tools and organisational structure. The entire component reflects to the Leavitt's Diamond (1965) [54] .

A sociotechnical system (STS) is made up of complex interactions between social humans and technical systems [49]. STS theory highlights the importance of the united optimisation of social and technical subsystems in an organisation in order to elucidate complex issues [55], [56]. People work in organisations through the use of technological things (tools, devices, and techniques) to succeed in economic performance and job gratification. The suitability of the STS theory within the ITHS element is based on two components; social and technical environments, however not all subjects in STS are used in both environments.

Table 4: STS Theory to support the process from the ITHS element (Information Technology Hardware System. (Developed for this research purpose)

| **STS (Socio Technical System)** | **ITHS element (IT Hardware Services)** | **Example of evaluative criteria.** |
|---|---|---|
| **Social system**: Structure Organization, people who manage the organization | Operational Performance | Willingness to help customers and provide prompt service [51]. |
| ***Social***: People: Employees and knowledge, skills, attitudes, values and requirement they produce to the workplace.<br><br>***Technical***: The processes, tasks, and technology needed to transform inputs to outputs. | Service Performance | Caring, individualised attention the firm provides its customers. Knowledge and courtesy of employees and the ability to convey trust and confidence [52]. |
| **Technical system**: IT Facilities, Hardware and Toolkits. Characteristic: | Efficiency | Materials and |

| | | |
|---|---|---|
| Interaction (Hardware, Software and Toolkit) | | Personnel [53]. |

In Table 4 above, for the social system section, the framework of an organization consists of individuals and entities who run or oversee the IT service department. The expertise and management skills required in order to maintain an efficient IT control within an entity represent the organizational success of the ITHS. Hamed [57] reflects the fact that human infrastructure elements are the IT staff who provide the technological component, including the task process and technologies needed to turn pieces into unit or sections (the human machine process), expertise, dedication, principles and standards.

The technological infrastructure represents the services available such as computer equipment, hardware, software and toolkit. It represents the productivity of work based on quality products or workers that do the job that are required.

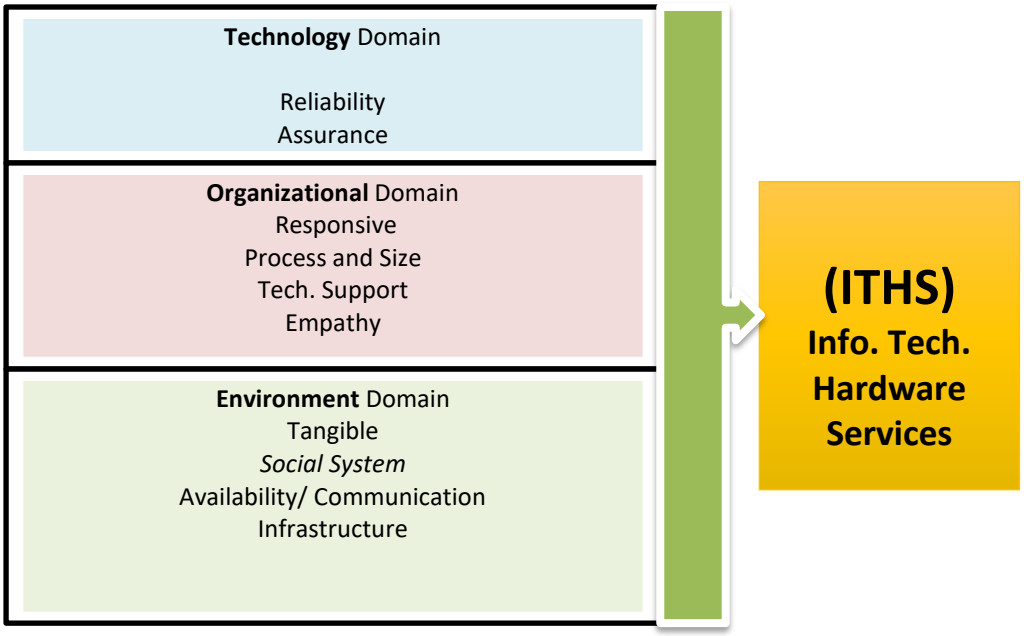


Figure 2: TOE and STS domain categories the SERVQUAL in ITHS element. (Source: Developed for this research).

From Figure 2 above, there are two conceptual theories (TOE and STS) to support the ITHS elements. The reliability of IT services is part of the technology domain, including maintenance on time in ensuring the reliability in operating the hardware 24x7 days. All these are dependent on the level and service type and the user requirement needs. i.e. the first time the service is required whether hardware failure, upgrade, or substitution of component parts. The guarantee ensures that the service is in the right direction to provide services, knowledge, and courtesy of the IT staff and to give confidence and trust to users. The technical system reflects part of the STS theory that IT tools and knowledge supplied by the facilities of the IT Department. Software, hardware and toolkit, which transform users into the entire service.

The organization consist of the responsive and empathy element from the SERVQUAL. Willingness to help customers and provide prompt service based on the users' request is reflected to the performance of the services handled by the IT department through the IT technician or representative to handle the IT issues request from users. Empathy, paying attention and understand the user's problem. It brings the true quality services and reflects back to the ITHS. The service

continues to grow and users will be more likely to demand the services repeatedly. The process will effectively enhance the efficiency of ITHS using the tools of the dashboards (software) to transform inputs into outputs, depending on the organizational structures and environmental groups.

The environment element from the TOE theory is related are to the tangible part to the SERVQUAL. Tangibles defined as aspects of a service that can be "felt" without the service being purchased. For example, the ITHS uses high-tech toolkit systems to fix the computer component in order to give its prospective client or users a perception of high-quality services. On the social part, the communication between users and technician creates the increase in trust and confidence in the users and in turn final job gratification.

## 4.0 Conclusion and future work

This paper proposed the TOE and STS theory to support the ITHS model elements. Both theories cover all elements on the ITHS model as discussed. It is to ensure the services quality dimension match within the theories applied to the ITHS model. Both theories cover the people, process and the technology that govern IT frameworks (ITIL, COBIT 5 and CMMI-SVC). Information systems theories are critical for individuals, organizations and society. Research on information systems has been expanded to include many diverse perspectives including how technology is adopted, used and perceived by organizations and individuals. Nevertheless, the paper describes the relationship between IS theories, IT framework and the ITHS model elements. Output of the quality services is significantly related to the organization objective and profitability. The ITHS model was proposed for the assessment of the actual IT hardware service organizations. The key impact of this analysis is the emerging IT maturity model, in which three of the most popular and accepted frameworks have been taken into account and blended with TOE and STS theory. Work in the near future includes the authentication and validation of a model to support the ITHS model. The entire process continuum of the best-known IT frameworks may be a specific model of maturity, but an analysis of its advantages would be an extremely significant finding. This work is a step forward in the field of IT services that can be used in the IT governance environment, particularly in IT hardware support services.

## References

[1] R. Q. Jia and B. H. Reich, “IT service climate: A definition and research model,” 2005.
[2] P. B. Lowry and D. Wilson, “Creating agile organizations through IT: The influence of internal IT service perceptions on IT service quality and IT agility,” *J. Strateg. Inf. Syst.*, vol. 25, no. 3, pp. 211–226, 2016, doi: 10.1016/j.jsis.2016.05.002.
[3] A. Yazici, A. Mishra, and P. Kontogiorgis, “IT Service Management (ITSM) Education and Research: Global View,” *Int. J. Eng. Educ.*, 2015.
[4] S. Cronholm and N. Salomonson, “Measures that matters: Service quality in IT service management,” *Int. J. Qual. Serv. Sci.*, vol. 6, no. 1, pp. 60–76, 2014, doi: 10.1108/IJQSS-12-2012-0022.
[5] S. Alter, “Seeking synergies between four views of service in the is field,” 2008.
[6] D. Spath, W. Bauer, and C.-P. Praeg, “IT Service Quality Management,” in *Quality Management for IT Services*, 2011.
[7] A. Ghildyal and E. Chang, “IT Governance and Benefit Models: Literature Review and Proposal of a Novel Approach,” *Int. J. e-Education, e-Business, e-Management e-Learning*, 2017, doi: 10.17706/ijeeee.2017.7.2.123-131.
[8] L. Raymond, F. Bergeron, A.-M. Croteau, and S. Uwizeyemungu, “Determinants and outcomes of IT governance in manufacturing SMEs: A strategic IT management perspective,” *Int. J. Account. Inf. Syst.*, 2019, doi: 10.1016/j.accinf.2019.07.001.
[9] P. Weil and J. W. Ross, “IT Governance : How Top Performers Manage IT,” *Int. J. Eletronic Gov. Res.*, 2005, doi: 10.2139/ssrn.664612.
[10] M. Khouja, I. B. Rodriguez, Y. Ben Halima, and S. Moalla, “IT governance in higher

education institutions: A systematic literature review," *Int. J. Hum. Cap. Inf. Technol. Prof.*, vol. 9, no. 2, pp. 52–67, 2018, doi: 10.4018/IJHCITP.2018040104.
[11] T. Sethibe, J. Campbell, and C. McDonald, "IT governance in public and private sector organizations: Examining the differences and defining future research directions," 2007.
[12] M. Nicho Robert and S. Khan, "IT Governance Measurement Tools and its Application in IT-Business Alignment," *J. Int. Technol. Inf. Manag.*, 2017.
[13] J. Ribeiro and R. U. I. GOMES, "IT Governance using COBIT implemented in a High Public Educational Institution – A Case Study 2 Information Technology Governance," *3rd Int. Conf. Eur. Comput. Conf.*, no. September, pp. 41–52, 2009.
[14] M. Talla, "An Implementation of ITIL Guidelines for IT Support Process in a Service Organization," *Int. J. Inf. Electron. Eng.*, no. November, 2013, doi: 10.7763/IJIEE.2013.V3.329.
[15] J. Aguiar, R. Pereira, J. B. Vasconcelos, and I. Bianchi, "An overlapless incident management maturity model for multi-framework assessment (ITIL, COBIT, CMMI-SVC)," *Interdiscip. J. Information, Knowledge, Manag.*, 2018, doi: 10.28945/4083.
[16] K. Melendez, A. Dávila, and M. Pessoa, "Information technology service management models applied to medium and small organizations: A systematic literature review," *Comput. Stand. Interfaces*, vol. 47, pp. 120–127, 2016, doi: 10.1016/j.csi.2015.10.001.
[17] D. Radovanovic and T. Radojević, "IT audit in accordance with Cobit standard," *... , 2010 Proc. ...*, no. May 2014, pp. 1137–1141, 2010, [Online]. Available: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5533627.
[18] S. De Haes, T. Huygh, A. Joshi, and W. Van Grembergen, "Adoption and Impact of IT Governance and Management Practices," *Int. J. It/bus. Alignment Gov.*, vol. 7, no. 1, pp. 50–72, 2016, doi: 10.4018/IJITBAG.2016010104.
[19] A. Féliz-Sánchez and J. A. Calvo-Manzano, "Comparison of models and standards for implementing IT service capacity management TT - Comparación de modelos y estándares para implementar la gestión de la capacidad de servicios de TI," *Rev. Fac. Ing. Univ. Antioquia*, no. 74, pp. 86–95, 2015, [Online]. Available: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0120-62302015000100008&lang=pt%5Cnhttp://www.scielo.org.co/pdf/rfiua/n74/n74a08.pdf.
[20] B. Trinkenreich and G. Santos, "Metrics to Support IT Service Maturity Models," *Proc. 17th Int. Conf. Enterp. Inf. Syst. (ICEIS 2015)*, pp. 1–8, 2015.
[21] K. Pourikas and P. Fitsilis, "Applying Capability Maturity Model for Maintenance Services: A Case Study," *1St Olympus Int. Conf. Supply Chain.*, p. 28, 2010.
[22] D. Proenca and J. Borbinha, "Enterprise architecture: A maturity model based on TOGAF ADM," 2017, doi: 10.1109/CBI.2017.38.
[23] I. H. A. Wahab and A. Arief, "An integrative framework of COBIT and TOGAF for designing IT governance in local government," 2016, doi: 10.1109/ICITACEE.2015.7437766.
[24] J. Gondohanindijo, "Vol.3, No.1 Februari 2017 TATA KELOLA TEKNOLOGI INFORMASI UNTUK MENILAI DAN MENINGKATKAN KINERJA PERUSAHAAN," vol. 3, no. 1, 2017.
[25] N. Tuan and D. N. Hung, "A theoretical model studying the Impact of Internal Control on Performance and Risks of Vietnam Commercial Banks," 2016.
[26] A. El Yamami, K. Mansouri, M. Qbadou, and E. H. Illoussamen, "A New Pattern for the Deployment of IT Governance Frameworks in Organizations," no. November, 2018, doi: 10.14419/ijet.v7i4.15427.
[27] STS Sauter, "Comparing PMBOK ® Guide 4 th Edition , PMBOK ® Guide 5 th Edition and ISO 21500," *Sts Sa*, 2013.
[28] V. Raja Sreedharan and R. Raju, "A systematic literature review of Lean Six Sigma in different industries," *International Journal of Lean Six Sigma*. 2016, doi: 10.1108/IJLSS-12-2015-0050.
[29] M. Jäntti and V. Hotti, "Defining the relationships between IT service management and IT

service governance," *Inf. Technol. Manag.*, vol. 17, no. 2, pp. 141–150, 2016, doi: 10.1007/s10799-015-0239-z.
[30] J. Thorp, "VALIT Framework," no. May, 2014.
[31] A. Poorebrahimi, F. Razavi, and F. S. Razavi, "Presenting VALIT Frameworks and Comparing between Them and Other Enterprise Architecture Framework," *Int. J. Adv. Netw. Appl.*, 2016.
[32] F. M. Vogt, S. Maderwald, H. Eggebrecht, F. Breuckmann, R. Kroeker, and J. Barkhausen, "1044 High spatial and temporal resolution MRA (TWIST) in acute aortic dissection," *J. Cardiovasc. Magn. Reson.*, vol. 10, no. S1, pp. 476–483, 2008, doi: 10.1186/1532-429x-10-s1-a169.
[33] A. Puvvala, V. Rai, and R. Patil, "A Metrics Analysis Framework for IT Service Management," *Proc. 34th Int. Conf. Syst. Dyn. Soc.*, 2016.
[34] P. M. Patel and V. A. Deshpande, "Application Of Plan-Do-Check-Act Cycle For Quality And Productivity Improvement - A Review," *Int. J. Res. Appl. Sci. Eng. Technol.*, vol. 5, no. I, pp. 197–201, 2017.
[35] A. Ahmad, R. A. Arshah, A. Kamaludin, and L. Ngah, "Adopting of Service Level Agreement ( SLA ) in enhancing the quality of IT hardware service support," vol. 1, no. 1, pp. 1–8, 2020.
[36] A. Bin Ahmad, I. Ibrahim, and L. Bin Ngah, "A review of service quality elements towards the overlapping IT framework process on the IT hardware support services (ITHS)," *Int. J. Adv. Trends Comput. Sci. Eng.*, vol. 9, no. 1.4 Special Issue, pp. 423–432, 2020, doi: 10.30534/ijatcse/2020/6091.42020.
[37] P. Case, R. French, and P. Simpson, "From theoria to theory: Leadership without contemplation," *Organization*, 2012, doi: 10.1177/1350508412437072.
[38] M. L. Markus and M. Silver, "A Foundation for the Study of IT Effects: A New Look at DeSanctis and Poole's Concepts of Structural Features and Spirit," *J. Assoc. Inf. Syst.*, 2008, doi: 10.17705/1jais.00176.
[39] S. Mardiana, J. H. Tjakraatmadja, and A. Aprianingsih, "International Journal of Economics and Financial Issues DeLone–McLean Information System Success Model Revisited: The Separation of Intention to Use -Use and the Integration of Technology Acceptance Models," *Int. J. Econ. Financ. Issues*, 2015, doi: 10.1016/j.procs.2015.12.150.
[40] N. Urbach and B. Müller, "The Updated DeLone and McLean Model of Information Systems Success," 2012.
[41] P. Lai, "THE LITERATURE REVIEW OF TECHNOLOGY ADOPTION MODELS AND THEORIES FOR THE NOVELTY TECHNOLOGY," *J. Inf. Syst. Technol. Manag.*, 2017, doi: 10.4301/s1807-17752017000100002.
[42] B. Wu and X. Chen, "Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technology fit (TTF) model," *Comput. Human Behav.*, 2017, doi: 10.1016/j.chb.2016.10.028.
[43] "WHICH THEORY APPLIES: AN ANALYSIS OF INFORMATION SYSTEMS RESEARCH," *Issues Inf. Syst.*, 2006.
[44] G. Lala (fădor), G. L. Fădor, and G. Lala (fădor), "The Emergence and Development of the Technology Acceptance Model ( TAM )," *Int. Conf. Mark.*, 2014.
[45] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Unified theory of acceptance and use of technology: A synthesis and the road ahead," *J. Assoc. Inf. Syst.*, 2016, doi: 10.17705/1jais.00428.
[46] A. Duane and P. O'Reilly, "A conceptual stages-of-growth model for managing a social media business profile," *Irish J. Manag.*, 2017, doi: 10.1515/ijm-2017-0015.
[47] L. G. Tornatzky and M. Fleischer, *The Process of Technology Innovation*. 1990.
[48] R. Oosthuizen and L. Pretorius, "Assessing the impact of new technology on complex sociotechnical systems," *South African J. Ind. Eng.*, 2016, doi: 10.7166/27-2-1144.
[49] G. H. Walker, N. A. Stanton, P. M. Salmon, and D. P. Jenkins, "A review of sociotechnical systems theory: A classic concept for new command and control paradigms," *Theor. Issues Ergon. Sci.*, 2008, doi: 10.1080/14639220701635470.

[50] M. Salahshour Rad, M. Nilashi, and H. Mohamed Dahlan, "Information technology adoption: a review of the literature and classification," *Universal Access in the Information Society*. 2018, doi: 10.1007/s10209-017-0534-z.
[51] H. Ahmadi *et al.*, "Organizational Factors Affecting the Adoption of a Technological Innovation: A Study of the Hospital Information System (HIS)," 2019, doi: 10.1109/ICWR.2019.8765270.
[52] "OVERVIEW OF THE OPERATIONAL SERVICE QUALITY IN UAE GOVERNMENT," *Overv. Oper. Serv. Qual. UAE Gov.*, 2018.
[53] A. Herdiyanti, A. N. Adityaputri, and H. M. Astuti, "Understanding the Quality Gap of Information Technology Services from the Perspective of Service Provider and Consumer," *Procedia Comput. Sci.*, vol. 124, pp. 601–607, 2017, doi: 10.1016/j.procs.2017.12.195.
[54] T. Levitt, "Production-Line Approach to Service," in *The Roots of Logistics*, 2012.
[55] P. B. Goes, "Design science research in top information systems journals," *MIS Quarterly: Management Information Systems*. 2014.
[56] A. R. Hevner, S. T. March, J. Park, and S. Ram, "Design science in information systems research," *MIS Q. Manag. Inf. Syst.*, 2004, doi: 10.2307/25148625.
[57] H. Gheysari, A. Rasli, P. Roghanian, and H. Jebur, "The Role of Information Technology Infrastructure Capability (ITIC) in Management," *Int. J. Fundam. Psychol. Soc. Sci.*, 2012.