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The Role of Technology Management in Information Technology Service Organizations: The Case of the ICT Industry in the Philippines

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Abstract: **This paper gives an overview of the ICT industry in the Philippines, discusses the role of technology management in IT service organizations and proposes a framework for managing technology within an IT company.**

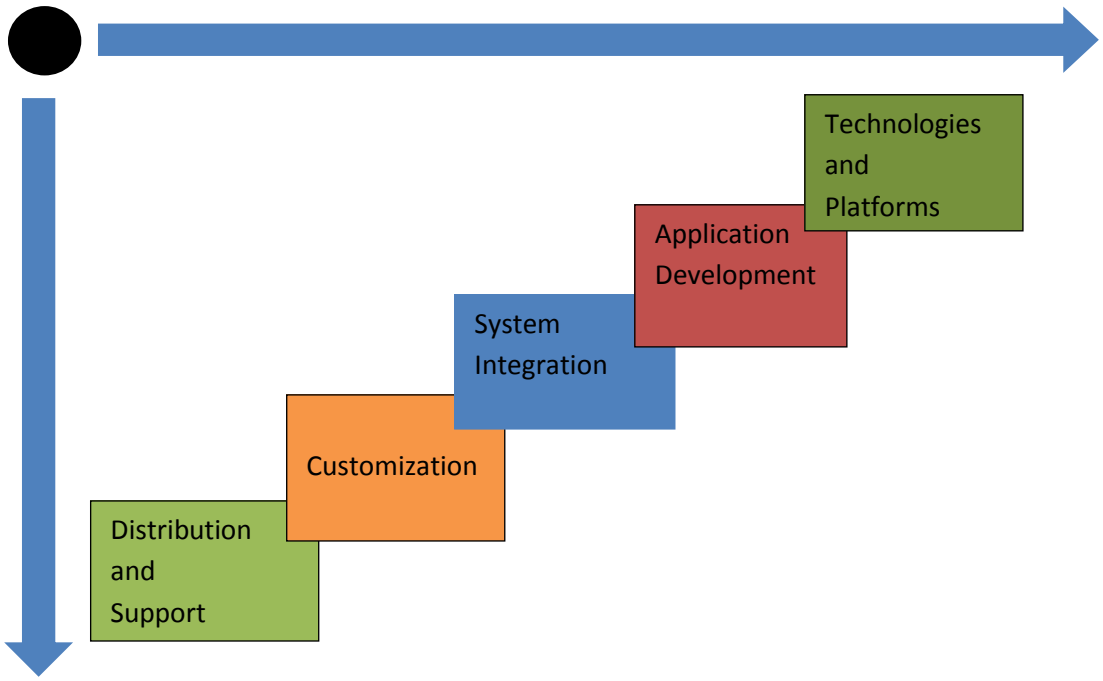
Keywords: **Technology Management, ICT Industry, IT Service organizations.**

I. INTRODUCTION

The Information and Communications Technology Industry has been growing at an increasing rate. This industry is composed of products and services that deliver the medium, the process, and the technology for the creation, modification, customization, storage and transfer of information.

The Philippines is one of the many countries highly affected by IT Industry growth. This has brought in new modes of transaction, new business models to the Philippine Industry, and new skill-requirements.

The Figure below presents a representation of the IT Industry Value Chain. The various parts of the value chain are arranged according to increasing Technological Capability/ Independence and increasing End User-Value.



Philippine IT Companies engage in parts of the value chain at differing degrees. Some companies are vendors that create outsourced modules and product components from other countries. Some supply project-based manpower to augment necessary resource. Other companies engage in ground-up development of software at a competitive price. Along with this trend is the introduction of evolving processes for effective project implementation.

Process Management in Information Technology Companies has been governed by several standards. Below are some examples of globally-recognized IT standards:

- Information Technology Infrastructure Library
- Software Development Life Cycle Models
- The Rational Unified Process
- Project Management Body of Knowledge
- Capability Maturity Model

These processes however, do not address a very important aspect of managing an IT organization – ***The Management of Technology.***

Often, companies are confronted with the need to decide on technology-related issues that are critical to the business. Below are some examples:

- *When do we purchase technology? What is Technology?*
- *How do we know when an IT Organization lacks necessary technology? How do we define Necessary?*
- *How is Technological Capability of an IT Organization Measured? How is it developed?*
- *What services can Philippine IT Companies provide in the future? What can they not provide?*
- *How can IT Companies Develop Skills and Technologies to provide extended services?*

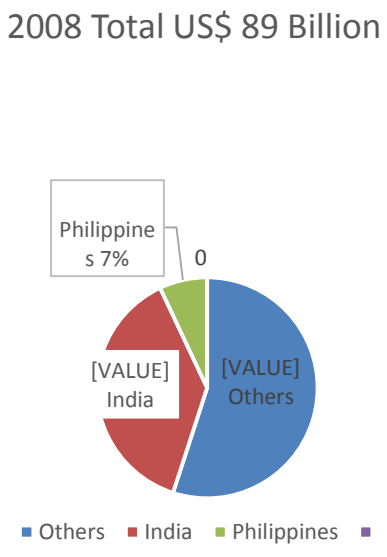
  How do we define services? What is current? What is extended?

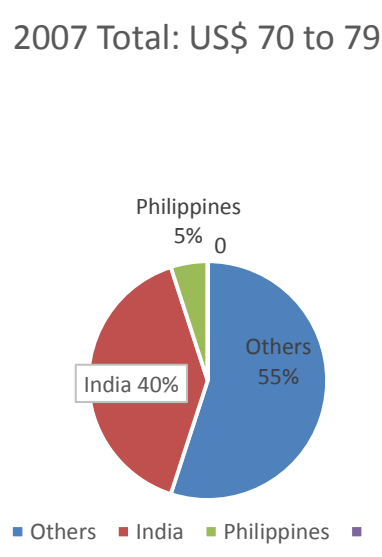
These questions, as important as they are, cannot be answered by on-time product delivery, effective project management, quality management activities, or software life cycle methodologies. These should be dealt with through the establishment of a process for analyzing and managing the Technological Capability of the IT Organization.

This study proposes a framework for technology strategy in Philippine-based IT Service Organizations.

Overview of the Philippine ICT Industry:

The industry of Off-shoring and Outsourcing (O&O) IT-enabled Services in the Philippines has been growing at over 50% per year on the average, since year 20001. Below is a representation of the Philippines' share in the Global ITO Market for the past two (2) years[2].





With such opportunity, this information suggests the feasibility of expansion of the market share for currently available IT service offerings, assuming available capability and appropriate strategy.

The Country[3]

The Republic of the Philippines, with a population of almost 90 million, is has more than 7,100 islands spread over 300,000 square km. It occupies a strategic position within the Southeast Asian region. The Philippines emerged, after a 425-year history of colonialism and a recent traumatic period of authoritarianism, as a flawed democracy laboring under continuing economic underdevelopment and periodic political upheaval.

The country has been ruled by a succession of elected governments by and large representing political elites who are also dominant in the economy, including the media and information and communications technology (ICT) sectors.

The Philippine civil society is one of the most vibrant in the world, and continues to be at the forefront in advocating for good governance, sustainable development, socioeconomic and political reforms, and communication rights. After the Martial Law years, freedom of expression naturally exploded, and a largely free (and freewheeling) press and mass media regained its pre-Martial Law reputation as one of the most liberal in the region. The telecommunications sector was deregulated in the 1990s, and universal access to telephony rose steadily, especially with the recent boom in mobile phones and short messaging service (SMS).

The Philippines formally linked to the internet in 1994, and it remains largely unregulated today. Though the infrastructure is present, access rates for the majority of the population remain low. The neo-liberal free market economic paradigm continues to be contested, including within the communications sectors, where significant sections are dominated by big private enterprises and conglomerates. ICTs are embraced in national plans for their socioeconomic potential, but ICT and internet governance is uneven due to limited state capacity, lack of resources, and occasional regulatory capture by dominant market players.

Comparative Data

Compared to its Association of Southeast Asian Nations (ASEAN) neighbors, in 2003 the Philippines had one of the highest education and literacy levels, but had a moderate ratio of ICTs to population.

Table 2: Comparative ICT Indicators, ASEAN countries

Country	Lines per 100 population			Literacy Rate	Enrollment (as percent of school-age population			Number per 100 population			
	Fixed	Mobile	Internet		Primary	Secondary	Tertiary	TV	Residential lines	PC	Internet
Philippines	**3.6**	**27**	**0.6**	**95.6**	**112.1**	**81.9**	**30.4**	**76.4**	**14.4**	**3.2**	**5.5**
Indonesia	3.9	8.7	0.3	88.4	110.9	57.9	15.1	56.7	12.6	1.3	3.8
Malaysia	18	44.2	4.3	88.9	95.2	69.7	26	92	60.6	16.7	34.4
Singapore	45	85.2	115.7	93.1	94.3	74.1	43.8	98.6	100	69.5	50.9
Thailand	9.6	39.4	1.6	96	12.1	82.8	36.8	93.3	28.2	4.5	11.1
Vietnam	4.7	2.3	0.2	93	103.4	69.7	10	86.1	13.4	1.1	4.3
Lao PDR	1.2	2	0.2	67.3	114.8	40.6	4.3	30.7	4.8	0.4	0.3
Cambodia	0.2	3.5	0.1	70.1	123.4	22.2	2.5	42.8	1	0.2	0.2

Source: ITU/Orbicom (2005)

This reflects the relative socioeconomic standing of the country among its neighbors. According to the International Telecommunications Union, while the Philippines has the second highest literacy and primary and secondary enrollment rates, its fixed-line telephone penetration rate is one of the lowest in Southeast Asia. However, other ICT indicators such as mobile phone, personal computer (PC) and internet penetration rates are close to the median of its neighbors (ITU/ORBICOM, 2005).

Globally, the Philippines is ranked somewhere in the middle of international indices that attempt to measure ICT success. In these ranking systems, the country was shown to have higher levels of human capital and a relatively open investment/business environment. However, it fares poorly primarily due to a low rate of access to ICTs among the general population (except for mobile phones) and the relative lack of public and private investments in improving telecommunications infrastructure. Below are some examples:

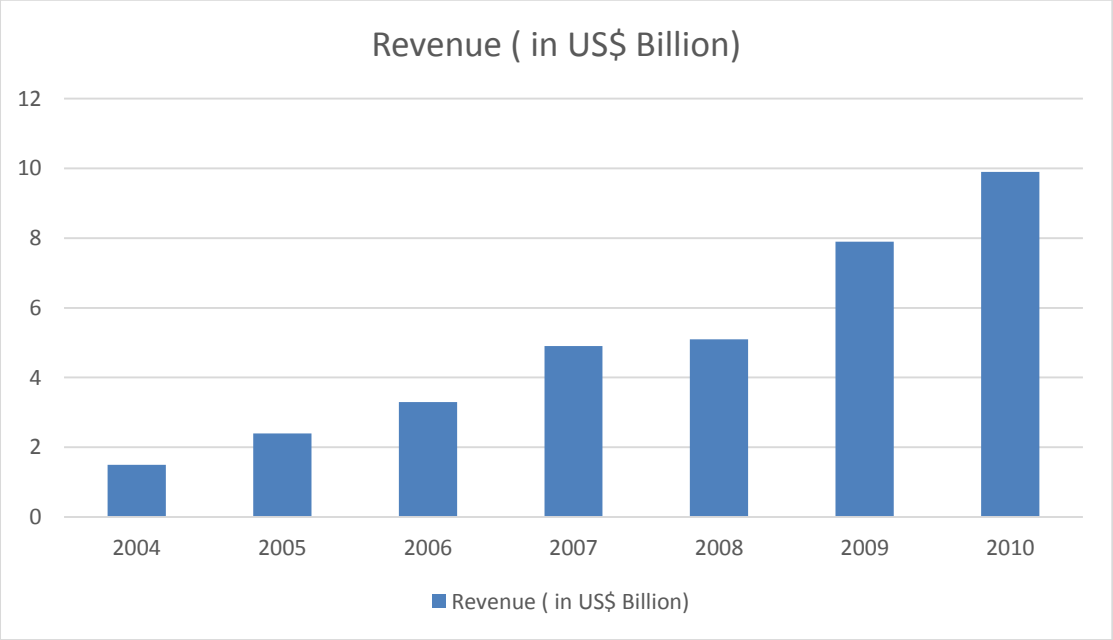
- The ITU/Orbicom Digital Opportunities (Infostates) Index (2005) ranked the Philippines 94th out of 180 countries.
- The UN Industrial Development Organisation (UNIDO) ICT Diffusion Index (2005) ranked the country 97th out of 180 countries.
- The International Data Center (IDC) Information Society Index (2005) ranked it 48th out of 53 countries.
- The Economist Intelligence Unit's E-Readiness Index (2006) ranked it 56th out of 68 countries.
- The World Economic Forum Network Readiness Index (2005) ranks it 70th out of 115 countries.

ICT Industry in the Philippines

Sector	2004	2005	2006	2007	2008
Customer Care	1,024	1,792	2,360	3,600	4,100
Back Office BPO/KPO	123	187	302	398	827
Transcription	72	115	159	197	182
Animation	52	74	97	105	120
IT Outsourcing	170	204	271	423	601
Engineering Service	34	48	68	152	228
Game Development	-	-	-	-	3
Total	**1,475**		**3,257**	**4,875**	**6,061**
Annual Growth Rate		**64%**	**35%**	**50%**	**24%**

The table above presents the Philippine Off-shoring and Outsourcing Industry Revenue in Million dollars (US$ Million). This is based on a report by the Business Processing Association of the Philippines (BPA/P) presented at e Services on February 2009. As shown, there is consistency in the increase in revenue year on year from IT Services being outsourced to the country.

The Figure below presents trend in ICT revenue for the past five (5) years and a 2-year forecast:



This is the forecasted growth in revenue for products and services enabled by Information and Communication Technology. Organizations that provide services through ICT represent a huge part in this industry. IT Organizations in the country which serve as technology centers for multinational organizations start by offering services (which are not novel or unique, initially) to prove capability.

This study suggests a strategy for organizations that offer Information Technology as a Service. Services may range from ground-up software development, hardware deployment, infrastructure set-up, process optimization, data processing to technical support. This study aims to stress and address the essence of the managing the technology embedded in IT Services.

The Goal of MOT in IT Service Management

(Information on IT Service Management, to be added in under this section)

Objective:

Development of a Technology Strategy for IT Service Organizations involves analysis of MOT concepts and its applicability to the IT Service Industry. The objective of this study is to present a framework for managing technology in IT Service Organizations. Specifically, this is a study aims to:

Discuss the applicability of Technology Management concepts to organizations that offer IT Service Management.

Research on approaches to Technology Management has been a popular focus of technology-centric publications. Strategies on how technology can be managed have been scoped, implemented and hypothesized in several studies. This includes focus on the management of product development and process engineering.

In this study, MOT concepts are analyzed for its applicability to IT Service Management. Technology, as the driver of the industry and its services should be managed, controlled, evolved and extended. Known strategies on how this can be done are discussed in several sections of this paper.

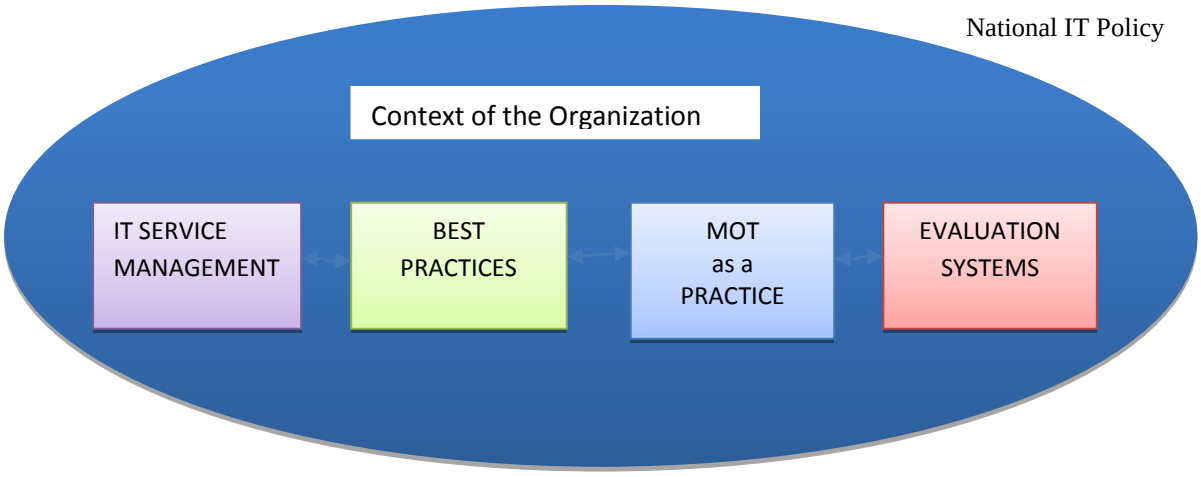
- Propose a framework that will illustrate factors to be considered when managing technology within an IT company.
- A framework is a real or conceptual structure intended to serve as a guide for the building of something useful.[4] This study presents a proposed framework, which is a graphical representation of the components of a strategy for managing technology.
- Recommend processes that will aid organizations to plan, develop, and implement management of technology and technological capability for competitiveness.

Each component of the proposed framework will be discussed in detail with recommended processes/ activities to aid organizational implementation of MOT. This study however does not recommend a specific structure/ system for MOT implementation. This may be a feasible candidate for future research/ extension.

II. METHODOLOGY IN A SPECIAL PROJECT IN TECHNOLOGY MANAGEMENT

To achieve the stated objectives, analysis on existing theoretical propositions is conducted. This involves a review of researches on the management of Information Technology, and best practices in IT Service Management.

Research and Analysis in this study is directed by the framework presented in the Figure below. This illustrates the factors internal to an IT organization, and elements internal and external to IT organizations, from which relevant data may be derived as input to the analysis of MOT.



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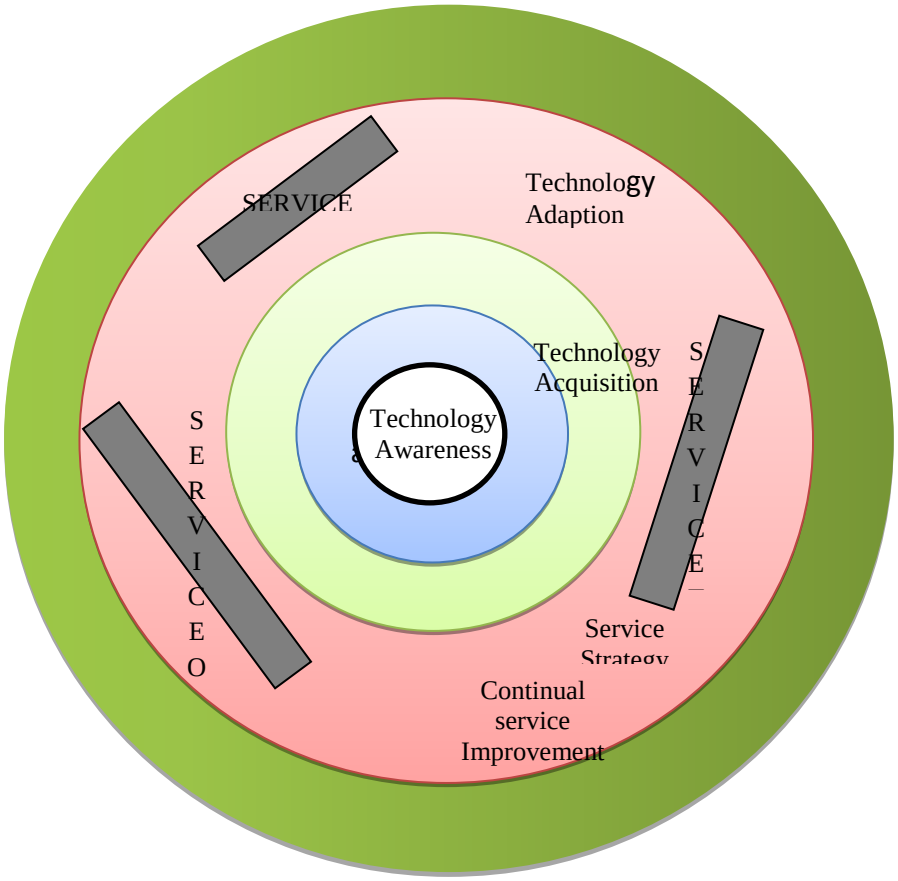
- It Service Management
- Best Practices
- MOT as A Practice
- Evaluation Systems
- Other internal factors
  - Context of the Organization
  - Organizational Learning
- External Dependencies
  - Industry Standards
  - Technologies Available in the Industry
  - National IT Policy

Upon completion of research and analysis on the factors presented above, an MOT framework for IT organizations is designed. This will be supported by a recommended processes and Supporting Tools for the MOT implementation.

III. RESULTS

Technology Strategy in IT Service Organizations:

MOT in IT recommends a strategy to address the need to manage technology in IT Service Organizations. This is a framework for managing technology while providing Information Technology Services to a business organization. The framework is broken down into phases to emphasize factors that need to be addressed for every specific stage of available technology. This is presented in the Figure below.



Technology as a medium for the solutions that organizations provide should be understood, analyzed, managed, controlled, and evolved. **MOT in IT** presents Five (5) phases with specific processes, activities and objectives, to address the concerns of active and assumed technology growth. These factors represent the core, the processes and the provision for evolution of technologies within the organization.

Technology Awareness phase is the first phase of the technology cycle where the company is assumed to have a formal mechanism to become aware of emerging technologies relevant to the company's needs. In an IT Organization, this is the comprehensive summary of the awareness of:

- Existing technologies in the organization,
- Available technology in the market,
- Status and types of technologies within the organization, and
- Current and future technological needs of the organization.

This phase emphasizes that awareness of technology within an organization should not be limited to the pull of the market nor on the pressure of new technology. There has to be a clear understanding of what is available internally and externally to the organization.

Complete awareness of a specified technology will serve as a stable basis for coming up with strategic technology-based service.

Technology Acquisition is the process of selecting the medium for acquisition of and acquiring necessary technology. This may be through different technology transfer channels, outright purchase of technology or the creation of novel technology to address the technological need. Below are two strategic approaches for technology acquisition recommended for IT Service Organizations:

- External Technology Acquisition – acquiring technology available in the market which has been tested and utilized by other organizations.
- Internal Technology Acquisition – developing technology in-house to come up with solutions to completely address specific business needs.

Technology Adoption is the phase of organizational acceptance and utilization of acquired technology. This involves showing that the communicated needs of the business are addressed by the acquired technology. This includes activities to ensure that technology is implemented in the manner that it was specified to be implemented at the onset, and that the organization creates an environment to complement and support the new technology.

The IT Organization, as the major stakeholder of new Information and Communication Technologies should implement an active approach in technology adoption. The business organization should implement a conscious effort to align with the technology and create processes to complement necessary technology.

Technology –based Service Implementation is the phase where the stages of providing technology-based service are emphasized. Based on the Information Technology Infrastructure Library v3.0, this phase is further described by the following:

- **Service Strategy Creation** – refers to activities that create processes for the design, development and implementation of Service Management as a strategic asset.
- **Service Life Cycle** – refers to the cycle of activities to be conducted for the implementation of communicated and committed services.
- **Continual Service Improvement** – refers to the conscious effort of aligning and realigning services to changing business needs. Improvement efforts should be identified and implemented to support business processes.

Technology Evaluation is an essential phase in the management of technology in ITOs. This involves thorough analysis of the parameters that have caused the motivation for acquisition of the technology (from the awareness process), and the evaluation of the extent of adoption that the organization was able to perform.

From the *evaluation* process, a decision must be made whether to abandon, extend or retain existing technology. Making this the last process in the Management of Technology in an IT Organization emphasizes that Abandonment and Obsolescence is not a definite fate of existing technologies after organizational adoption – at least not yet. Technologies, like skills and knowledge give rise to other forms of technologies, and the timing of technological evolution is something which need not be predetermined. It is to be prepared for and created.

- **MOT in IT** highlights three (3) essential factors in IT Service Management:
  - Business

  (description of these factors, to be added)

  - Service
  - Technology

Technology Awareness:

What makes a company stronger than another company in terms of technology?

How can overall technological capability be described?

Evaluation of the strength of a technology-based organization depends on the analysis of its ***technological base***. It is its ability to exploit technology as a core competency, to invest in future technology, to incorporate better technology in its products and services, and to do so in a shorter time period with lower costs, and with better performance than competitors.[5]

The goal of Technological Awareness is to identify and evaluate the status of an organization's technological base and evaluate the potential to address the current and future needs of the organization. This is the first phase of the framework which presents a formal mechanism for an organization to become aware of the status of relevant technologies within and external to the organization. The following processes are recommended:

Supplier	Input	Process	Output	Customer
Business Units within the IT Organization (led by the technology management group)	List of Technologies available internally to the organization	Internal Technology Audit	**List of Technologies** grouped and described according to: Classification Origin Category Life cycle Position **Technological Needs**	Technology/ IT Managers
Partners Suppliers Market Customers Competitors Professional Associations Local Community	List of Technologies outside the organization	External Technology Survey	**List of Technologies** grouped and described according to: Classification Origin Category Life Cycle Position Competitive Position **List of that potentially address technological needs**	

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Internal Technology Audit:

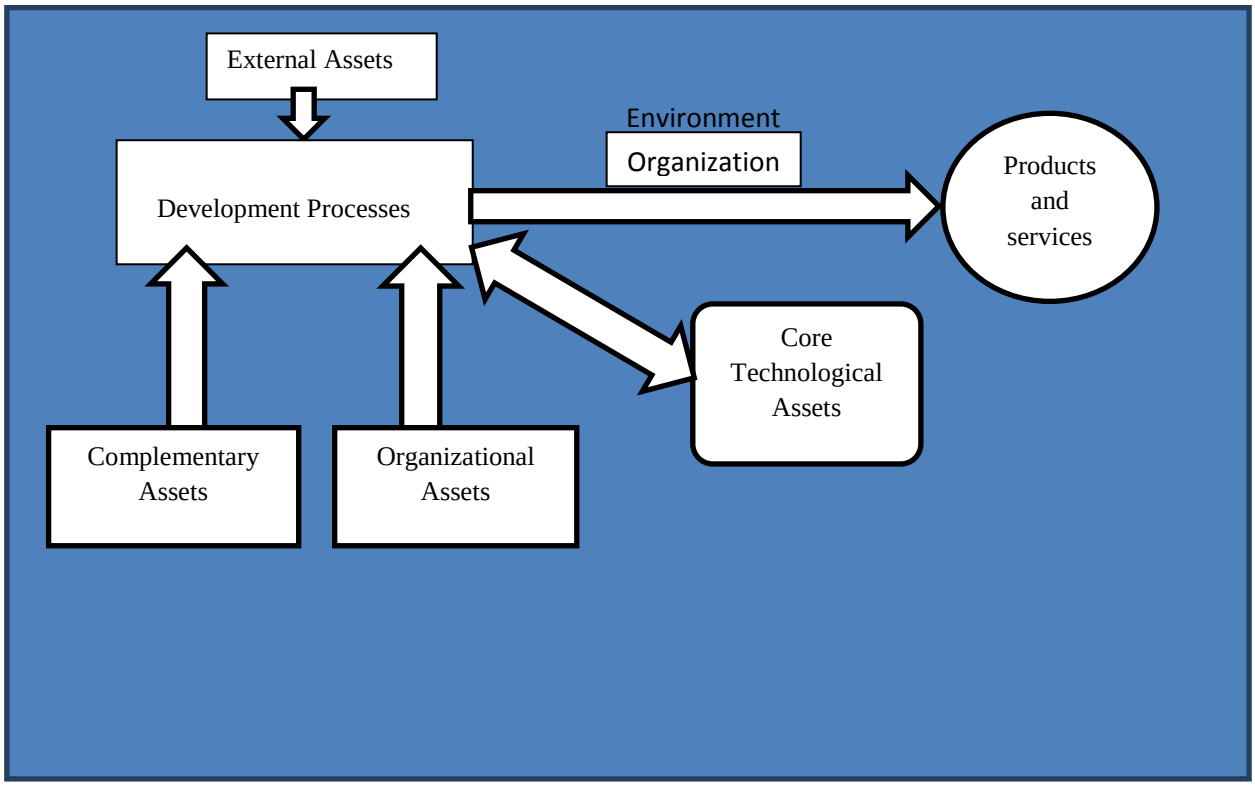
Periodic Internal Technology Audit is the regular review and analysis of internal technologies and technological needs. This process is performed to identify the strengths and weaknesses of technological assets of an organization to identify opportunities. Based on a study by Shenhar and Adler, analysis of five (5) elements of the technological base is suggested. Four (4) of which are internal to the organization: *Development Processes*, *Complementary Assets*, *Organizational Assets*, *and Core Technological Assets.*

External Technology Survey:

External Technology Survey is the process of review and analysis for the fifth component of an organization's technological base - External Assets. External Technologies link the firm to its environment. This includes technologies that link to current and potential partners, rivals, suppliers, customers, professional associations, research institutes, political actors and local communities.

A continuous External Technology Survey may be performed to *determine Available Technology in the Industry and Future Technological Needs.*

- **Classification of Technologies within an Organization**



The Figure above presents the relationship among the five components of an organization's technological base. This should be utilized to classify available technology.

- **Development Processes** – this includes the product, process, and technological development processes in an organization.

To gain technological strength, it is further emphasized that there is a need to establish and implement processes for technological development. Following are examples:

1. Product Development Process – in the case of Software Development, this includes Software Development Life Cycle processes, Test Management Process, and Quality Control Process.
2. Process Development Process – the method of Process Development includes procedures on process review, change management, process optimization and policy formulation.

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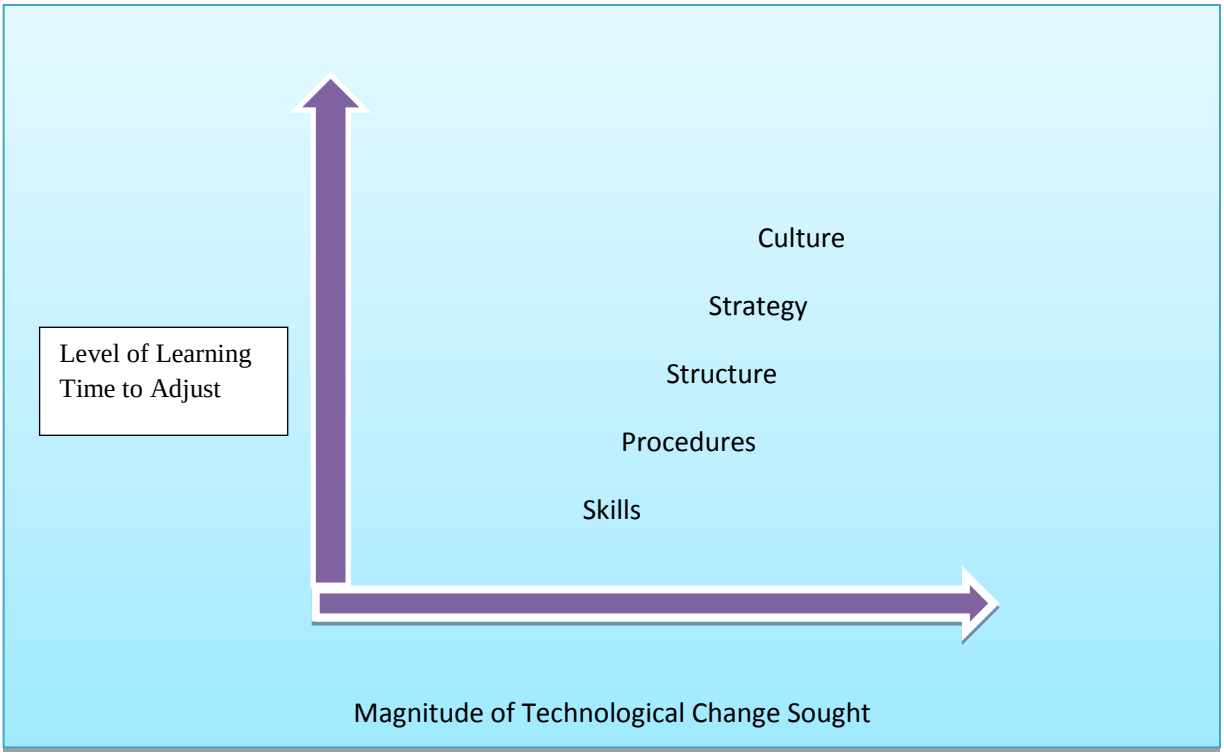
3. Technological Development Process – the technological development process includes procedures to acquire, implement, evaluate and extend current technology within an organization.

- **Complementary Assets** –assets that complement a company's technological base are necessary. This includes assets that are needed for processes that address other organizational functions such as marketing, procurement, distribution, financial and field services.
- **Organizational Assets** include skills, procedures, structure, strategy and culture.

An organization's technological strength is highly dependent on its organizational assets. Below is a hierarchical structure of the components of organizational assets, as suggested in Shenhar and Adler:



The Figure above presents the components of Organizational Assets in order of increasing level of learning required. From this, we derive:

1. That the greater the magnitude or change that the organization seeks, the higher in this hierarchy the organization needs to make adaptations. That is, simple technological changes require modest changes in skills and procedures; more radical changes on the other hand, call for organizational changes in skills, procedures, structure and strategy.
2. Changes with lower levels of required learning are more amenable to faster change. Higher levels are more resistant to change.

These propose a basis to put up guidelines, structure and strategy for the implementation of technological change.

- **Core Technological Assets** – These assets constitute the set of technologies embedded in products and processes that are instrumental to the company's present and future technological assets.

Origin/ Ownership

Where did the technology come from? Was it purchased from an external entity? Was it developed from ground-up within the organization? Who owns the technology?

Technologies should also be classified based on its ownership and origin. Technologies owned by the organization are candidates for internal research and extension when perceived to be contributing to organization's needs. Technologies owned by external entities have the risk of external dependency, but also have greater opportunities for upgrade, since it is shared among several organizations.

- **Technology Category**

Technologies may be classified as one of the following, to determine the extent that the organization is dependent to it:

Basic Technology – includes base technologies where the organization is completely dependent on. IT Services offered are equipped with this type of technologies, and absence of such technologies will stop service delivery. This includes technologies for software development, database management, infrastructure framework, and network technology.

Distinctive Technology – refers to technologies that confer competitive advantage. This includes technologies that bring about more effective processes, better management of assets, value-added customer service, or efficient communication with stakeholder groups. Such technologies are not required for service delivery but are necessary for the delivery of better, faster, or cheaper services and thus contribute to overall competitive advantage.

External Technology – are technologies embodied in products but are not owned or acquired directly by the organization. To a certain extent, the IT Service Organization has a dependency on such technologies because absence of such technologies will hinder production from the direct suppliers of the technology. These technologies should be noted for possible risks.

- **Life Cycle and Competitive Position:**

To come up with a strategy for acquisition of technology, we can create and utilize an ADL matrix6, which proposes classification of technologies based on Life Cycle and Competitive Position.

Life Cycle Position:

Embryonic – Introduction stage, characterized by rapid market growth, very little competition, new technology, high investment, and high prices. This is a rare case for IT Service Organizations in the Philippines. Utilization of embryonic technology usually requires high risks and investment. Organizations with such technologies however, have the probable advantage of leading a particular service offering equipped with novel technology.

Growth – Increased sales, few (if any) competitors exist, and company reaps for bringing a new product to market. Technologies classified in this stage have high potential for extension either through enhancement or creation of new needs and services,

Maturity – the technology's market share is stable, there are lots of competitors, and energy is put towards differentiating from competitors. Services provided with this type of technologies should be reviewed and enhanced for competitiveness. Analysis and foresight for extension of services or diversification should also be considered.

Ageing – demand decreases, companies start abandoning the market, the fight for market share among competitors gets too expensive, and companies begin leaving or consolidating. Services based on ageing technologies should be reviewed. With ageing technologies, there can be foreseen decline in the demand for the services offered, and a risk of lack of support from technology providers. Steps to counter these risks should be taken.

The lifecycle position of available technology should be analyzed with its competitive position:

Dominant – technology is rare and typically short-lived, there is little, if any, competition, usually a result of bringing a brand new product to market

Strong – market share of the particular technology is strong and stable, regardless of what competitors are doing.

Favorable – business line enjoys competitive advantages in certain segments of the market. However, there are many rivals of equal strength, and competitive advantage has to be maintained. This type of technology gains a lot of current interest and has huge potential for extension and upgrade in the near future.

Tenable – position in the market is small and market share is based on niche, a strong geographic location, or some other product differentiation. Strong competitors are overtaking market share by building their products and defining clear competitive advantages.

Weak – There's continual loss of market share, and the business line, as it exists, is too small to maintain profitability. Technology will most probably be abandoned soon.

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Here's an ADL (Arthur D. Little) Matrix that summarizes recommendations on the combinations created based on the lifecycle and competitive positions of the technology. This may be used to create recommendations as an output of the

Technology Awareness process.

Technologies may be recommended for creation, acquisition, extension or abandonment depending on its life cycle stage and competitive position.

	Embryonic	Growth	Mature	Ageing
Dominant	Aggressively push for market share for services offered with this type of technology. Invest faster than market share dictates	Maintain industry position Invest to sustain growth	Maintain industry position Evaluate if reinvestment is necessary Invest to sustain growth	Maintain industry position Evaluate if reinvestment is necessary Invest to sustain growth
Strong	Aggressively push for market share Look for ways to improve advantage with current technology Invest faster than market share dictates	Aggressively push for market share Look for ways to improve advantage with current technology Invest to sustain growth	Maintain industry position Evaluate expected result of possible reinvestment Invest when necessary	Maintain industry position or cut expenditures to maximize profit Minimum reinvestment
Favorable	Moderate to aggressive push for market share Look for ways to improve competitive advantage Invest selectively	Look for ways to improve competitive advantage and market share Invest selectively to improve position	Use the technology to develop a niche or other strong differentiating factor and maintain it. Minimum or selective investment.	Cut expenditures to maximize profit or plan a phased withdrawal Minimum investment or Study opportunities to get out of current investment or divest.
Tenable	Look for ways to improve industry position Invest very selectively	Use the technology to develop a niche or other strong differentiating factor and maintain it. Invest selectively.	Use the technology to develop a niche or other strong differentiating factor and maintain it, or Plan to switch to new technology. Selective investment.	Plan to switch to new technology. Get out of investments or divest.
Weak	Evaluate costs and potential benefits. Drop the technology when found necessary. Invest or divest.	Look for ways to improve position, or switch to more competitive technology or Divest	Look for ways to improve position, or Plan to switch to new technology. Selectively invest or divest	Switch to new technology. Divest.

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Technology Acquisition:

Technology Acquisition is the process of acquiring technology through one of several forms. This may be through different technology transfer channels, outright purchase of technology or the creation of novel technology to address the technological need.[7]

The goal of *Technology Acquisition* phase is to select appropriate means of acquisition and acquire needed technology. This phase takes in data gathered from the *Technology Awareness* phase and selects appropriate means of acquisition for specified technologies. The table below summarizes the components of the Technology Acquisition process.

Supplier	Input	Process	Output	Customer
Technology Management Group, based on data gathered from Technology awareness phase.	**List of Technologies** grouped and described according to: Classification Origin Category Life Cycle Position Competitive Position **Technological Needs** **List of Technologies that potentially address technological needs**	Technology Acquisition	Acquisition Plan Delivery of acquired Technologies Acquisition Report	

Three strategic approaches for acquisition of technology may be considered:

Internal Technology Acquisition – creating technology through internal R&D efforts and or tacit knowledge capture. IT Service Organizations rarely create technology through internal R&D. With service delivery as the primary product of the company, technologies are usually acquired externally as tools to deliver better value in services.

Creation and upgrade of technologies internally should be considered for:

- Technologies seen to have high potential for growth and extension.
- Technologies where the organization has high dependency on
- Technologies where internal capability has already been developed
- Process technologies, which may be incrementally improved by the organization

External Technology Acquisition – acquiring technology developed by other organizations, through purchasing/ licensing-in. This is a common means of acquisition for IT Service Organizations.

Organizations should be keen in selecting and establishing the motivation for acquisition of technology. Information gathered in the *Technology Awareness* phase is essential to determine the needs of the organization and the appropriate timing of acquisition.

Combined Acquisition – is the acquisition of technology through a collaboration of internal and external efforts. This involves the combination of internal research and development and the acquisition of complementary technology or external R&D outputs.

For an organization with minimal to no internal R&D activities, combined technology acquisition is a good opportunity to start internal efforts and learn the required capability.

Below is a table that suggests parameters for deciding which approach to acquisition should be carried out for a particular technological need. This is based on information to be gathered in the *Technology Awareness* phase, and other parameters descriptive of the technological need.

Parameter	Internal acquisition	External Acquisition	Combined Acquisition
Technological Growth	Highest potential for technological growth	Low technological growth	Reduced technological growth
Exclusivity/ Competitive Advantage	Highest potential for unique product/process	Have to adapt to technology	Have to share information
Capability	Need for strong technological Capability	Address internal capability	
Time to Market Risk of Failure	High risk of failure	Reduced risk	Share risks Potential problems in implementation
Cost/ Affordability	Generally, very high costs	Includes implementation cost Generally lower cost	Share costs Generally between internal and external cost
Company's relative standing in the technology being considered	High or Low	Low	High or Low
Urgency	Lowest	Higher High (in licensing in buying)	Higher
Level of investment and commitment	Highest	Lower (in contracting) Lowest (in licensing) None (buying)	High (in joint venture)

Parameter	Internal acquisition	External Acquisition	Combined Acquisition
Technology Lifecycle position	Earliest	Early Later (contracting) All stages (buying)	Early
Category (basic, distinct or external)	Distinctive or Basic	Basic or not present (contracting R & D, licensing in)	Distinctive or Basic
Critical Success Factors		Selection Agreement Transfer of knowledge Clear briefing	Specific performance criteria Harmonization
Human Resource Factors		Negotiation Skills Managerial rotation Common Vision and Mission	Negotiation Skills Managerial rotation Management

			Development and Training Team building Skills for implicit communication

Technology Adoption:

The biggest challenge for CXOs today is justifying IT investments. A Society of Information Management (SIM) survey of 300 senior IT leaders found that the successful alignment of business and IT was the top management concern for all of them. 80% of companies lacked means to confirm, measure, and optimize benefits delivered from their technology programs.

How does can an IT Service Organization adopt a new technology?

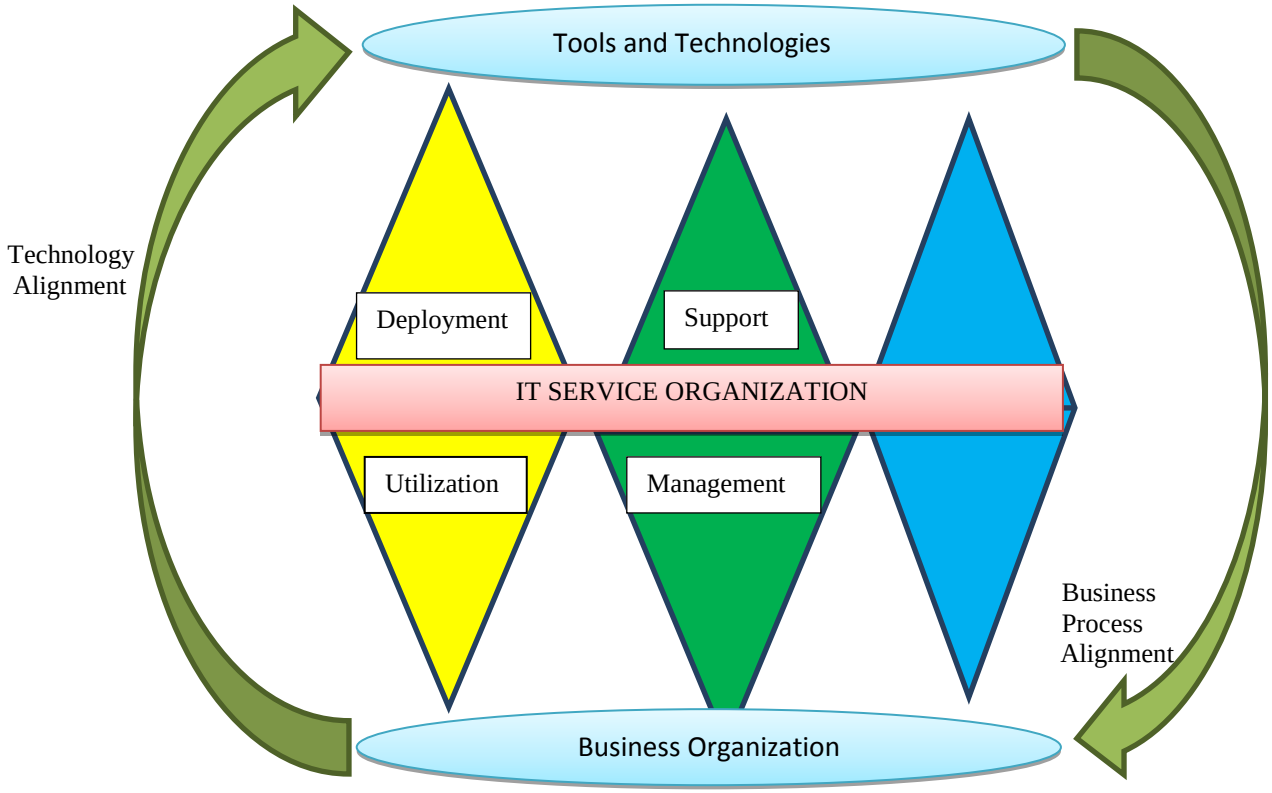
How can the technology be customized enough to suit the needs of the organization?

How should technologies be implemented? How can it be driven to its full use?

These are some of the questions to be addressed when implementing a new technology within an IT Organization. Generally, **how can new technology be implemented within an IT Organization in a manner that will aid its business goals and exploit it to its maximum use**?

For the purpose of this study, we intend to look at how acquired technology may be adopted by an IT organization. After selection and acquisition of the required technology, there has to be a consistently active effort on the part of the organization to adapt to the technology and exploit the specified benefits.

The goal of Technology Adoption is to create and implement a plan for organizational acceptance and utilization of acquired technology. Based on a study by Tilloo, Shraddha8, a framework for the adoption of new technology within an IT Organization is proposed. This is shown in the figure below.



Two entities are highlighted here: **New Tools and Technologies** and the **Business Organization**. This framework proposes factors that need to be addressed to come up with an effective strategy for making an organization adopt new and necessary technology.

- Business Process Alignment

Aligning new technology to current business processes is the most important consideration when selecting, purchasing, and implementing new technology. Awareness and complete understanding of what the business process needs and how the new technology can aid/ complement existing technologies is both a requirement to initiate and a motivation to continuously implement new technology within an organization.

New Technology to be implemented within an ITO has to be aligned to existing business processes through customization and establishment of supporting policies. These may be established through:

- Analysis of the current business process • Analysis of related technologies
- Engagement of stakeholders
- Continuous requirements gathering and scope definition
- Forecasting evolution of existing processes and technologies

- Technology Alignment

Choosing the right technology at the right time and making correct use of it is a requirement and a challenge for IT Organizations. This part of the framework emphasizes that the organization, as part of implementing its processes should be able to select appropriate technologies, and be able to establish processes and policies that will align with new technologies. While new technology is customized to complement business processes, organizational process should be updated to promote and support the chosen technology.

- New Tools and Technologies

- **Deployment**

Installation/ Roll-out of new technology include:

- Setting-up a Project Team that will ensure timely and effective technology deployment
- Setting-up of an Infrastructure that will house and support new technology
- Identification of Target Users, User Groups and their needs
- Setting-up a provision for extension/ expansion from the would-be status of the new technology
- Making the Technology available to target users and user groups

- **Support**

Setting up a team to provide Support Services for new technology is essential to effective technology adoption. Users of the new technology should be given adequate training and support service to make sure that they are capable of utilizing the tool for its communicated purpose.

The Support Process should also include the process of receiving and responding to incident (issue) reports and new requirements from stakeholders (i.e.: users). In general, the Support Process for a new technology should be designed and implemented in a manner that will ensure alignment of the technology and organizational processes, and effective use of the tool by the target users.

- **Measurement**

"You cannot manage something you cannot measure."

This, which has been true for the management of functions and resources, is proposed to be equally applicable to the management of the adoption of new tools and technologies.

Establishing metrics that will support and complement the technologies and the business processes is essential to consistently monitor the compliance of the rolled-out technology to the communicated objectives. Metrics should also be defined to monitor the extent of adoption by the IT Organization. Metrics should be an output of the analysis of the objectives and needs of technology adoption.

- The Business Organization

The Business Organization, as the major stakeholder of the introduction of new technologies should implement an active approach in technology adoption. The organization should implement a conscious effort to align with the technology and create processes to support new complementary technology.

- **Utilization**

Usage of new technology is to be promoted, controlled, monitored and reported. This involves providing sponsors, stakeholders and management updates on the extent that the organization has adopted the technology.

The manner by which new technology is utilized should be monitored and analyzed. More than usage, effective use in accordance to how it was planned to be utilized should be ensured.

- **Management**

Managing the availability and distribution of new technology includes but is not limited to the following activities:

- Establishing policies and processes

- Setting-up guidelines on Usage

- Revising established guidelines according to results of analysis of metrics and utilization

- Setting-up parameters that may be used as triggers for extension, update or closure of technology implementation

- **Control**

Established policies and processes are to be implemented. The control process in technology adoption highlights the value of metrics established, and the conclusions derived from these. The organization should ensure a balance of adoption, business use, technological upgrade and process control. Parameters that will highlight thresholds on usage, process applicability and provision for extension should be established.

Through analysis of the components of the *Technology Adoption* phase as presented above, an effective plan for adoption of acquired technology may be designed and consistently implemented to maximize the use and advantage of acquired technologies.

Technology-based Service Implementation:

As an entity that provides service to the business, the IT Service Organization enables business to meet its goals. The table below presents responsibilities of an IT Organization in comparison with the demands from the business.

Business Challenges	**IT Responsibilities**
Increasing business performance	Adapting quickly to changing needs
Improving ROI	Minimizing costs and complexity
Minimizing cost and time-to-market	Optimizing resources and costs
Minimizing risks in a dynamic business scenario	Ensuring a stable and flexible IT environment

This is based on the Information Technology Infrastructure Library (ITIL) 9, a public framework composed of books and training manuals that outline and explain the practices that are most beneficial to IT Services. The goal of ITIL is for managers to have extremely high standards in IT value, as well as high financial quality in day to day operations. ITIL procedures include instructional materials on IT Infrastructure Operations and Development Issues.[10]

Analyzing the ITIL Framework will provides an understanding of the management of IT Services and the processes it covers, to come up with a comprehensive recommendation for Technology Strategy.

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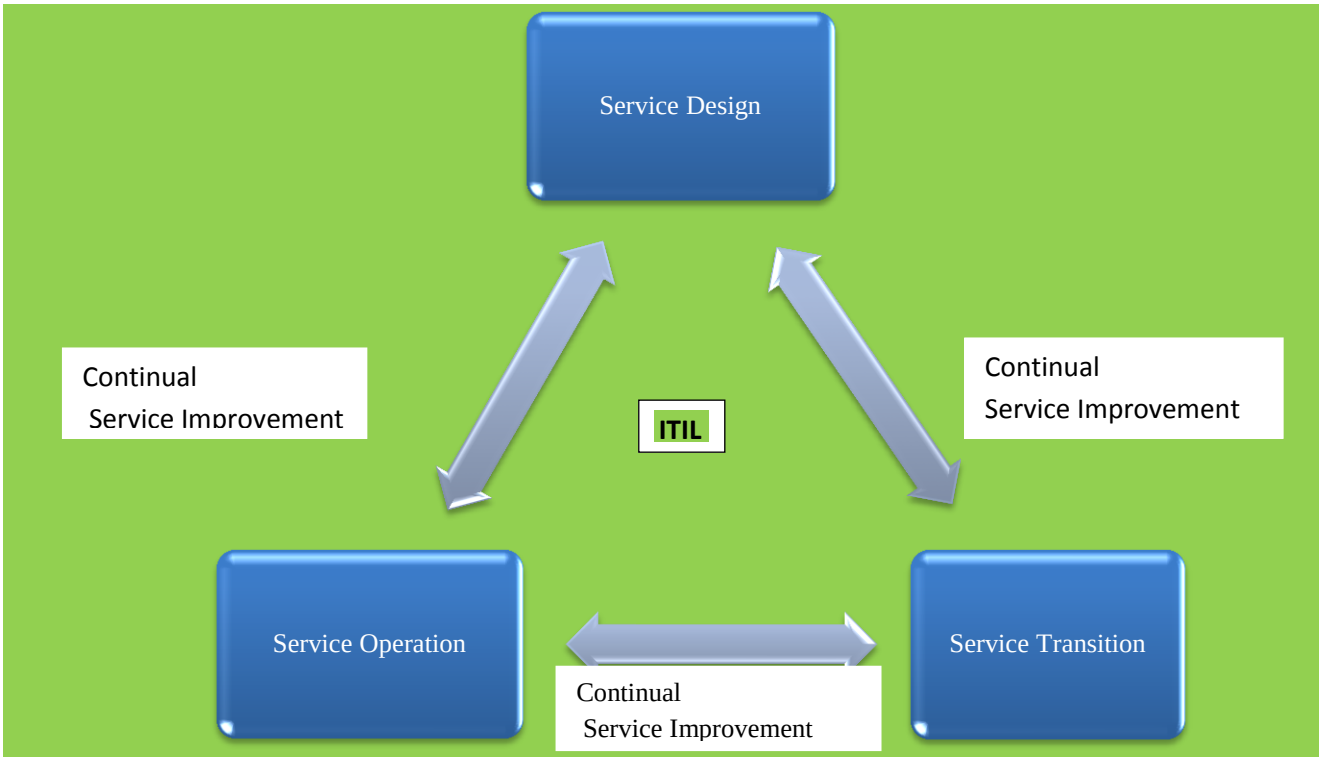
Below is a diagram that presents the Service Lifecycle part of the ITIL v3.0 Framework. This illustrates how each phase of the lifecycle transitions to the next. The ITIL Framework provides guidelines that illustrate the phases of providing IT as a service.



Service Management is a set of specialized organizational capabilities for providing value to customers in the form of services. In this study, the ITIL Service Management Processes are taken as one phase in MOT in IT – Technology Service Implementation.

Service Strategy – provides guidance on how to design, develop and implement service management not only as an organizational capability but as a strategic asset. IT involves the following activities:

- Define the market
- Develop the offerings
- Develop Strategic Assets
- Prepare for Execution

It also includes the following processes:

- Service Portfolio Management
- Demand Management
- Financial Management

1. **Service Design** – provides guidance for the design and development of services and service management processes. This includes the processes of:

- Service Level Management
- Service Catalogue Management
- Availability Management
- Information Security Management
- Supplier Management
- Capacity Management
- IT Services Continuity Management

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2. **Service Transition** – provides guidance on the development and improvement of capabilities for transitioning new and changed services into operations. This translates into how requirements of Service Strategy, designed by Service Design, are moved into production while controlling the risk of failure and disruption. This includes:

- Service Asset and Configuration Management
- Transition Planning and Support
- Release and Deployment Management
- Change Management
- Knowledge Management
- Key Roles of Staff Engaging in Service Transition

3. **Service Operation** – involves the best practice for achieving the delivery of agreed levels of services both to end-users and the customers (where 'customers' refer to those individuals who pay for the service and negotiate the SLAs). This is the part of the lifecycle where the services and the value is actually delivered. Topics include:

- Balancing conflicting goals
- Event Management
- Incident Management
- Problem Management
- Request Fulfillment Management
- Service Desk
- Technical Management
- Application Management
- Operations Management
- Responsibilities of staff engaging in Service Operation

Continual Service Improvement (CSI)[11] – aligning and realigning services to changing business needs. This is through identification and implementation of improvements to the IT Services that support the business processes. To manage improvement, CSI should clearly define what should be controlled and measured. Like any other service practice, there has to be:

- Planning, Training and Awareness
- Scheduling
- Roles Created
- Ownership assigned
- Activities, Inputs, Outputs
- Reporting

Below is a table that summarizes the requirements and outputs of each process under *Technology Service Implementation.*

Supplier	Input	Process	Output	Customer
Technology Management Group, based on data gathered from Technology Awareness phase. Marketing Group	Acquired Technologies	Service Strategy	Developed Offerings Defined Strategic Assets Execution Plan	IT Service Organization Business Organization

IT Service Organization	Developed Offerings Defined Strategic Assets Execution Plan	Service Design	SLA Service Catalogue Service Continuity Plan	Business Organization
IT Service Organization	Developed Offerings Service Catalogue Service Continuity Plan	Service Transition	Configuration management Plan Support Turnover Document	Business Organization
Supplier	Input	Process	Output	Customer
IT Service Organization	Developed Offerings Service Catalogue Service Continuity Plan Support Turnover Document	Service Operation	Request Fulfillment Management Incident resolution Problem Resolution Technical/ Application Management Operations Management	Business Organization
IT Service Organization Business Organization	Results	Continual Service Improvement	Recommendations for process revision/ upgrade	IT Service Organization

Technology Management Evaluation:

The goal of Technology Evaluation is to provide information on the results and the effectiveness of the technology management process within the organization. This includes:

- Analysis of the triggers that have caused the motivation for acquisition of technology
- Evaluation of the effectiveness and correctness of the technology adoption process
- Evaluation of status of existing technologies (as an input to Technology Awareness)
- Achieve a decision on whether to abandon, retain, extend/ upgrade existing technology

Six Sigma Approach to the Management of Technology

Having defined and elaborated the first four phases of MOT in IT, we explore the idea of utilizing Six Sigma Methodology in MOT Processes, to come up with an effective system for the evaluation of the management of technology.

Six-Sigma is a disciplined, data-driven approach and methodology used often in organizations to measure quality and to strive for near perfection. It is a process, with a statistical representation, that specifies boundaries for defects in a particular process. This is used as a basis to define and parameterize the quality of production or process execution within an organization. Specifically, to achieve Six Sigma, a process must not produce more than 3.4 defects per million opportunities. This is the Six Sigma goal that drives organizations to create and modify organizational processes to achieve desired quality.

The fundamental objective of the Six Sigma Methodology is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction through the application of Six Sigma Improvement Projects. This is accomplished through the use of two Six Sigma sub-methodologies12:

- Six Sigma DMAIC Process (an improvement system for existing processes falling below specification and looking for incremental improvement) and
- Six Sigma DMADV Process (an improvement system used to develop new processes or products at Six Sigma levels)

With the goal to create a process that complements the needs of the organization, the Six Sigma DMADV Process is utilized.

Technology Awareness

D	Define Project Goals and Customer Deliverables	(Specific activities to be included here)
M	Measure and determine Customer Needs and Specifications	
A	Analyze the process options to meet customer needs	
D	Design (in detail) the process to meet cut	
V	Verify the design performance and the ability to meet customer needs	

Technology Acquisition

D	Define Project Goals and Customer Deliverables	(Specific activities to be included here)
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Technology Adoption

D	Define Project Goals and Customer Deliverables	(Specific activities to be included here)
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Technology Service Implementation

D	Define Project Goals and Customer Deliverables	(Specific activities to be included here)
M	Measure and determine Customer Needs and Specifications	
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D	Design (in detail) the process to meet cut	
V	Verify the design performance and the ability to meet customer needs	

The Path to Alignment:

Organization-wide Information Technology implementation requires conscious efforts on the alignment of Technology with Business Strategy. IT and business strategy alignment means linkages among competitive strategy, information technology and performance. IT should be positioned as an enabler, in the manner that in can be effective at, to realize the goals of the business.

Strategic Alignment is necessary:

- to create and improve efficiencies
- to attract, source and retain appropriate skills
- to reduce costs
- to create barriers to entry
- to improve customer and buyer/ supplier relationships
- to create new products and business solutions
- to gain credibility with the business
- to provide proactive rather than reactive services

IT is expected to enable or enhance organizational processes to achieve these specified goals. IT is an enabler. However, it is also a constraint due to its limitations13. The extent of implementing organizational processes to achieve the goals of the business may be limited by what IT can deliver. To address this, technology should be continuously updated to respond to business needs.

In a study by Weiss and Anderson14, a classification system for grouping organizations based on IT-Business Alignment is proposed. Organizations were classified based on the extent of value that IT contributes to the organization, and the level of its integration with the business. Below are descriptions of each classification:

- Operational Resource – an organization oriented over operational versus strategic approach to IT/ Business alignment. Here, leadership and culture of the organization are not ready or capable of transforming the enterprise; resources are lacking or could not be mobilized.
- Strategic Resource – organizational classification where there is medium level integration and medium-level value introduced by IT. Organizations found to be within this category are either striving to further the alignment or satisfied with the current profile.
- Strategic Weapon – this profile covers organizations which have placed significant emphasis on alignment, have achieved significant progress on alignment, and have changed the culture of their organization to enhance alignment among different organizational units.

In this study, a profile of each alignment classification is presented to support the proposed technology strategy – MOT in IT:

Alignment Diagnosis		Operational Resource	Strategic Resource	Strategic Weapon
Technology Strategy	Availability of Metrics to Measure Technology Management	Measures number and statistics only	Evaluates Return on Investment	Evaluates the effect of Technology Management decisions to other groups and the business
	Perception of Technology management Group on the business	Unaware of the responsibilities and deliverables to the business	Supplies Technologies as part of organizational strategy	The business is treated as a major stakeholder/supplier of information and a customer that awaits effective technology implementation for competitive strategy

Alignment Diagnosis		Operational Resource	Strategic Resource	Strategic Weapon
	Rationale for Technology Spending	To equip services To reduce costs	To enable organizational processes	To achieve competitive advantage
	Benchmarking	Seldom Not deemed necessary	Perform benchmarking	Routinely perform benchmarking and implements actions in accordance to benchmarking results
	Types of Technologies	Core Technological Assets that drive services Complementary assets External Assets *Automation/Technologies that drive products and services	Core Technological Assets that drive services Complementary Assets External Assets Organizational Assets *Business process enablers	Core Technological Assets that drive services Complementary Assets External Assets Organizational Assets Development Processes Technologies that enable strategy
	Standards	None, or not enforced.	Emerging across functions	Implemented and coordinated with all stakeholders and external partners

IV. SUMMARY AND RECOMMENDATIONS

(Summary part to be included here)

With the proposed Strategy for the Management of Technology in IT Service Organizations, the following are recommended to strengthen and extend current proposition or further define parameters for the framework's applicability:

- System and Structure for Technology Strategy Implementation

MOT in IT is a strategy that proposes processes for the Management of Technology complementary to IT Service Management. As an extension, a study to analyze the effect of Organizational Structure on strategy implementation is suggested. Further, a structure and a system should be designed to complement the proposed framework for effective management of IT Service Technology. Below are suggested elements of the study:

- Presentation and Analysis of current organizational structures in IT Service Organizations in the Philippines
- Presentation of a Proposed Organizational Structure that will complement MOT in IT
- Design of a System with specific activities to be conducted to implement the framework
- A sample implementation plan

- Analysis of Team Training Requirements

Training that will enhance the suggested System, Structure and Strategy should be established. Taking into consideration best practices in IT Service Management and the recommended processes and activities, a training plan should be designed to address the gap between current organizational processes and MOT in IT.

- Process Modeling

To evaluate the applicability and effectiveness of the established framework, a computer simulation of process implementation may be designed and created to model how the process may be affected by changes, holding certain parameters constant.

The simulation may aid process review and highlight insights for further research/ extension.

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