# A Framework to Identify Information Technology Solutions that Support Knowledge Management for E-Governance

# اطار عمل لتحديد حلول تكنولوجيا المعلومات الداعمة لإدارة المعرفة للحوكمة الالكترونية

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**Abstract**

This research presented a framework to identify Information Technology (IT) solutions that support knowledge management (KM) for e-Governance by implementing SWOT (Strengths,Weaknesses,Opportunities,Threats) analysis tools via PEST(Political , Economy, Social ,Technological) factors. Analysis results have been classified for each type of knowledge based on Nonaka model. The critical successful factors for e-Governance initiatives and the expected benefits of SWOT tools with IT solution to manage knowledge have been discussed . A case study discuss success, scalable, flexible and feasible technologies that enough to meet the demands of IT infrastructure in governmental agencies. Various factors that influence KM and IT infrastructure were identified. Opportunities Strategic Model and Threats Strategic Model for KM with PEST factors identified IT Solutions strategic Model for KM which enhance knowledge management for e-Governance. This study presents a mix of several information technologies and create appropriate organizational environment for knowledge sharing in order to develop an effective knowledge management system .

Keywords: knowledge management, e-Governance, e-Government, SWOT analysis, PEST factors, Nonaka model, IT Solutions strategic Model.

**الخلاصة**

قدم هذا البحث اطار عمل لتحديد حلول تكنولوجيا المعلومات *Information Technology (IT)* التي تدعم ادارة المعرفة في الحوكمة الالكترونية . من خلال تطبيق ادوات التحليل *SWOT analysis tools* مع معاملات *PEST factors*، نتائج التحليل صنفت حسب انواع المعرفة المعتمدة في النموذج نوناكا *Nonaka model* . العوامل الحاسمة لنجاح مبادرات الحكومة الإلكترونية والفوائد المتوقعة من الأدوات SWOT مع حلول تكنولوجيا المعلومات نوقشت لإدارة المعرفة في هذا البحث و تم في دراسة حالة مناقشة التقنيات الناجحة والمرنة والقابلة للتطوير و الكافية لتلبية مطالب البنية التحتية لتكنولوجيا المعلومات في الهيئات الحكومية.كما تم تحديد العوامل المختلفة المؤثرة في ادارة المعرفة والبنية التحتية لتكنولوجيا المعلومات .بعد ذلك تم تقديم ثلاث نماذج من خلال بناء نموذج الفرص الاستراتيجي *Opportunities Strategic Model*ونموذج التهديدات الاستراتيجي *Threats Strategic Model* ثم تم تعريف وصياغة نموذج حلول تكنولوجيا المعلومات الاستراتيجي *IT Solutions strategic Model* الداعم والمعزز لإدارة المعرفة للحوكمة الالكترونية. تقدم هذه الدراسة مزيج من عدة تقنيات معلوماتية وتنشأ بيئة تنظيمية مناسبة لتبادل المعارف من أجل تطوير نظام ادارة معرفة فعال .

## Introduction

Information Technology (IT) promises to make knowledge management for e-Governance more efficient, responsive, transparent and legitimate and is also creating a rapidly growing market of goods and services, with a variety of new business opportunities [1]. IT gives analytical and methodological framework for data and information conversion to knowledge .

Nonaka and Takeuchi [2] classified two kinds of human knowledge, explicit and tacit. Explicit knowledge can be easily to document, share, and communicated quite easily in document form. Tacit knowledge is more important, and more difficult to express as it is embedded in individual experience. According to Jashapara [3], KM is the effective learning processes which associated with exploration, exploitation and sharing of human knowledge (tacit and explicit) that use appropriate technology and cultural environments to enhance an organization's intellectual capital and performance.

Many strength factors and opportunities support the development of e-Government such as sound economic policies, political willingness, robust educational system to generate tech-savvy future employees and low cost of phone calls .In addition , Without sustained leadership, careful planning, and ongoing monitoring, projects can easily fail - and many have Hardware and software vendors are only too eager to sell products and services to governments, sometimes without pausing to consider local conditions and local needs [4]. Internationally most countries are in the early stages of e-Governance. A good start has been made in Europe, USA and in other countries such as Australia and Singapore. But e-Governance will become more and more present around the world in the next few

years. However, the growth of e-Government will faced challenges and threats due to the rapid development of technology, as well as the vulnerability of the global environment [5][6].

This research employs SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis and PEST (Political, Economic, Social and Technological) determinants with Nonaka model to evaluate the current state of knowledge management (KM) for e-Governance and identify IT solutions to support it .

**Knowledge and Types of Knowledge**

Knowledge has been defined as 'know-why, know-how, and know-who', or an intangible economic resource from which future revenues will be derived [7]. Nonaka and Takeuchi [2] defined knowledge as a dynamic human process of justifying personal belief toward the "truth" (i.e. a justified true belief) and classified two kinds of human knowledge, explicit and tacit. Explicit knowledge can be easily to document, share, and communicated quite easily in document form. Tacit knowledge is knowledge that rests with the employee and its more important and more difficult to articulate as it is embedded in individual experience. Conversion of knowledge from one to another form occurs often and leads to the creation of new knowledge figure (1). Explicit-explicit knowledge conversion or 'Combination' is the reconfiguration of explicit knowledge through sorting, adding, combining and categorizing. Explicit tacit knowledge conversion or 'Internalization' takes place when one assimilates knowledge acquired from knowledge items. Tacit-explicit knowledge conversion or 'Externalization' involves transforming quiet personal knowledge to explicit knowledge that can be either recorded or unrecorded. Tacit-tacit knowledge conversion or 'Socialzation' occurs by sharing experiences, working together on a team, and by direct exchange of knowledge. knowledge management system should support all four types of knowledge conversion.

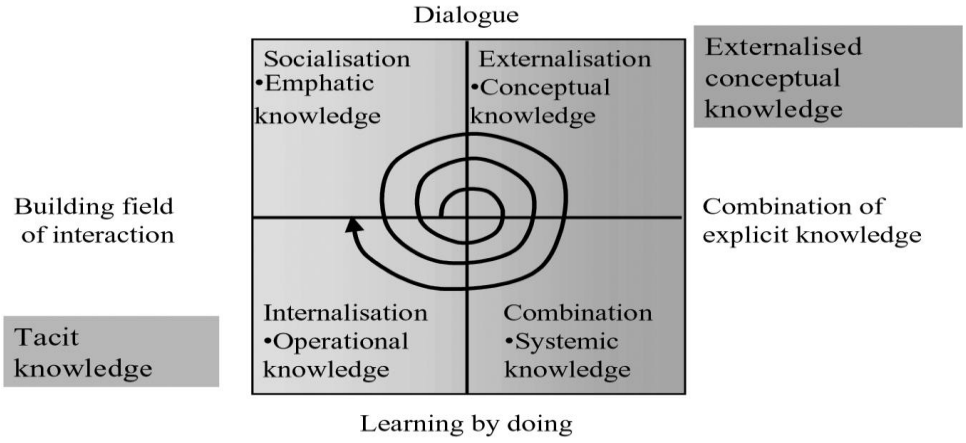


**Figure 1: The Tacit-Explicit Model [3]**

**IT Supporting For Knowledge Management**

Information Technology (IT) essential for successful knowledge management. Organizations employ IT to manage their knowledge. It is mainly used to store and transfer explicit forms of knowledge and transmission of tacit knowledge as it is, It is accepted that good knowledge management does not produce from the implementation of information systems alone [8] [9]. There are many researches [1] [2] [10] on universities of developed countries presented knowledge management supported by IT, concept of intelligent enterprise and social factors critical to success of knowledge management projects.

Subsistence and development of an enterprise depend on its abilities to absorb tokens from the environment, reveal the right meaning of the tokens and undertake adequate actions based on that meaning. Enterprise is deemed intelligent if it has institutional ability to gather, share and get meaning and knowledge from information coming from the environment, usually market environment. Thereby categories such as knowledge, intelligence and learning relating principally to people are moved into the domain of organization which is deemed an entity with ability to learn, acquire knowledge and behave intelligently in response to the threats or opportunities coming from the environment.

**E-Governance and Information Technology**

In simple terms Electronic Governance can be defined as giving citizens the choice of when and where they access government information and services. While e-Governance offers the processes used to provide services to the public, e-Government is the tool to accomplish e-Governance. This would mean using more and more of Electronics & Information Technology in many of the government functions. There are three aspects to the e-Governance:

1. IT enabling the government functions - something similar to back-office automation,
2. Web-enabling the government functions so that the citizens will have a direct access, and
3. Improving Government processes so that openness, accountability, accuracy, speed of operations, effectiveness and efficiency may be achieved.

According to one school of thought, e-Governance is not just about government web site and e-mail, It is not just about service delivery over the Internet, It is not just about digital access to government information or electronic payments. It will change how citizens relate to governments as much as it changes how citizens relate to each other. It will bring forth, new concepts of citizenship, both in terms of needs and responsibilities. e-Governance requires evolutionary changes of institutional arrangement and causes it, strong commitments from political leaders, the private sector and civil society to carry out the necessary transformations. Government's

work gets done through governance processes, other organizations and groups engage in governance as well.

**SWOT and PEST analyses for e_Governance**

SWOT Analysis is a strategic planning tool used to evaluate the Strengths, Weaknesses, Opportunities, and Threats involved in a project or in a business venture or in any other situation requiring a decision. Strengths and weaknesses are internal to an organization. Opportunities and threats relate to external factors. The required first step in SWOT analysis is a definition of the desired end state or objective. The objective must be explicit and approved by all participants in the SWOT analysis process. According to Backus [11] Four SWOT-analyses are presented, with a focus on the following determinants:

- **Political aspects:** related to e-Governance include strategies and policies, laws and legislation, leadership, decision making processes, funding issues, international affairs, and political stability.
- **Economic aspects:** related to e-Governance are funding, cost savings, business models, e-commerce; spin-offs of governance.
- **Social aspects:** Examples of some of the social aspects related to e-Governance are people, level of education, employment, income, digital divide, rural areas vs. cities, rich vs. poor, literacy, IT skills.
- **Technological aspects:** involve software, hardware, infrastructure, telecom, IT skilled people, and maintenance, safety and security issues.

**Finding and Results**

According to Law [12] not only SWOT but also PEST factors are examined to assess the current and prospective states of e-Government by using a practical approach. On the other hand, the PEST analysis is a useful tool for understanding market growth or decline, and as such the position, potential and direction for a business. PEST analysis is a business measurement tool for a market; while a SWOT analysis measures a business unit, proposition or idea .

Once the objective has been identified, SWOTs are discovered and listed. This is a technique to help management teams formulate strategy. SWOT analysis consists of the following two activities:

- An assessment of the organization's internal Strengths and Weaknesses such as People (Human Resources), Properties, Processes and Products
- An assessment of the Opportunities and Threats posed by its external environment such as Environmental factors (PEST) (Political factors, Economic factors, Social factors, and Technological factors).

This study illustrated SWOT analysis and PEST factors for e-Governance as shown in table (1)

**Table 1: Analysis PEST and SWOT for e-Governance**

| ***SWOT /PEST*** | ***Internal region attributes of the organization*** | | ***External regions attributes of the environment*** | |
|---|---|---|---|---|
| | ***Strength (S)*** | ***Weaknesses (W)*** | ***Opportunities (O)*** | ***Threats (T)*** |
| ***Political aspect (P)*** | -Strong political leadership<br>- collaboration among ministries<br>- Cooperation between the public and private sectors;<br>-combination with democratization.<br>-reforms.<br>-modern image<br>-internet as pull factor.<br>- Public policy (e.g. Class License Scheme) | - Leadership failures<br>-budget<br>-cyber laws not available<br>-no problem owner within government<br>-no expertise about technology<br>-slow decision making process<br>-hierarchy in organization<br>-integration and reform<br>- Conservation in trying e-Services<br>- Lack of trust<br>-Workplace and organizational inflexibility | - increase the Political Willingness<br>-raise external funding<br>-show competitive edge<br>-transparency causes natural change of processes<br>- Modifying current laws<br>-reinvent government | -Political instability<br>- Security breach and copyright issue<br>-bureaucracy<br>-piracy, misuse<br>-corruption<br>-maintaining disorder<br>-No transparency<br>-resistance<br>- Cyber terrorism and cyber crimes |
| ***Economic aspect (E)*** | - Funds for eservices To improve social and physical infrastructure<br>- Low cost of Internet Subscription<br>-E-Governance good argument for external funding<br>-Transparency for businesses (procurement) | - Unemployment<br>-Investors<br>-Budget control<br>-Financial inhibitors | - IT-proficient people can have better opportunity for employment<br>-Cost efficiency through e-Governance<br>-New business<br>-More efficiency tax<br>-Revenues | -Higher cost of living and higher broadband subscription due to higher oil price<br>-corruption |
| ***Social aspect(S)*** | - Educational system (e.g. national IT | - Workers and older generation are computer | -Employment increasing<br>-Education | - The rapid development of mobile and SMS |

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| | Literacy program)<br>- Recruitment of foreign talents<br>- Tech-savvy population (e.g. e-Ambassadors, PC Re-use scheme<br>-people eager to learn it skills<br>-skilled people<br>-possible export product | illiterate<br>-Basic educational poor: trainers needed<br>-no IT Literacy<br>-low Literacy<br>-different languages<br>-public acceptance of self-service models<br>-skill shortage: competition with private sector | system<br>-Improve people learn structural Job<br>-Cheap manpower widely available<br>-Promotion of internet<br>-Better healthcare | Technology<br>-brain drain it skilled people after training<br>-resistance of people<br>-digital divide<br>-privacy |
| ***Technological aspect(T)*** | - High-tech based Economy<br>-internet as driving pull factor<br>-Adopting new technologies<br>-High technology for Database (e.g. PHP, JavaScript, MySQL)<br>- Free packages for Web Design customers.<br>- Professional web design and information architecture.<br>- High quality products and good services.<br>- Free photographic download for graphic members.<br>- Information exchange and communicate for graphic members | -Some government websites are unfriendly-user<br>- Over-capacity of the Internet highway due to heavy traffic<br>-Shortage IT skilled people<br>-High cost of internet<br>-Heterogeneous data<br>-Lack of IT standards<br>Cost of software licenses<br>- Poor coordination<br>- Poor technical design<br>-Lack of marketing experience<br>- Lack of Brand awareness<br>- Location of company<br>- Lack of financial suppliers | -Broadband facilitates faster connection<br>-2nd hand hardware available<br>-Use one standard<br>-Development Market (Design English version for China Company)<br>- Redesign websites according to Web Standards for international clients.<br>- Moving into new attractive market segments for graphic members (To be a center of exchanging and communicating for graphic designers).<br>- Provide more security and effective | - Dependency on IT, i.e. small Technical problems will disrupt the entire networks<br>-costs of implementing and developing eGovernment,<br>-The same kinds of Web Design competitors.<br>- Price War between the competitors and DFY (Design For You) Company.<br>- Build relationship with suppliers and customers<br>- Political, legislative and regulatory change in different countries.<br>- New technology changes. |

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| | | | database environment. | |

*Source:* Based on own analysis

After SWOT analysis listed and discovered its benefit to explain how the type of KM can improve the external attributes of the environment (Opportunity and Threat as a case study) such as PEST through increase the Opportunities to improve e-Governance and elimination of Threats that impact on e-Governance. Analysis the external attributes of the environment (Opportunity and Threat) for PEST factors with the type of KM (Nonaka model) and listed the suitable type of knowledge to each factor depended on SWOT analysis that previous listed (see tables (2) ,(3) and also figures (2),(3) the strategic models ).

**Table 2: PEST factors with Nonaka (Tacit-Explicit) Model for Opportunities (O) factor**

| ***PEST*** | ***Socialization (tacit to tacit)*** | ***Externalization (tacit to explicit)*** | ***Internalization (explicit to tacit)*** | ***Combination (explicit to explicit)*** |
|---|---|---|---|---|
| ***Political aspect (P)*** | increase the Political Willingness and raise external funding etc. by Creates sympathized knowledge through the sharing of experiences between individuals, or between individuals and organization and development of mental models and technical skills. Language unnecessary. | _____ | Creates operational knowledge through learning by doing in order to Modifying current laws and reinvent government etc. Explicit knowledge like manuals or verbal stories helpful, learn/teach..etc Reading documents from many sources. | _____ |
| ***Economic aspect (E)*** | _____ | _____ | Cost efficiency through e-Governance in order to Creates operational knowledge through learning by doing. Explicit knowledge like manuals or verbal stories helpful, learn/teach..ect Reading documents from many sources. | Creates systemic knowledge through systemizing of ideas. proficient people can have better opportunity for Employment. May involve many media, and can lead to new knowledge through adding, combining and categorizing. |
| ***Social aspect(S)*** | Improve people learn structural Job in order to Creates sympathized knowledge through the | Improve Education system to Creates concepts knowledge through knowledge | Employment increases and Cheap manpower widely available In order to Creates | Promotion of internet to Creates systemic knowledge through systemizing of ideas. |

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| | sharing of experiences between individuals, or between individuals and organization and development of mental models and technical skills. Language unnecessary. | articulation using language. Dialogue and collective reflection needed. | operational knowledge through learning by doing. Explicit knowledge like manuals or verbal stories helpful, learn/teach..etc Reading documents from many sources. | May involve many media, and can lead to new knowledge through adding, combining and categorizing. |
| ***Technological aspect(T)*** | All type of e-services that support collaboration such as Collaboration Services/ Chat tool and an instant messenger. | All type of e-services that support Knowledge articulation using language. Such as Expert networks provide a forum for people who need to establish knowledge sharing focused on solving a problem | All type of e-services that support Operational knowledge through learning by doing. Such as E-Learning Management Systems | All type of e-services that support Systemic knowledge through systemizing of ideas. Such as Electronic Document Management |

*Source:* Based on own analysis

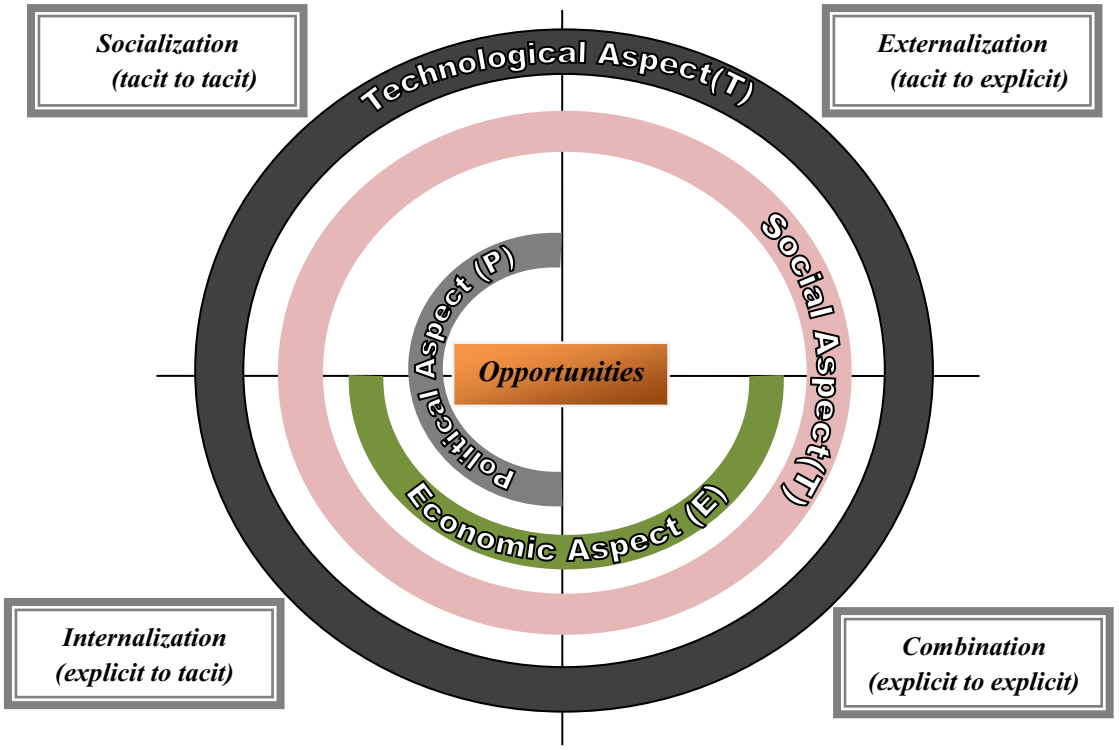


**Figure 2: Opportunities Strategic Model for KM with PEST factors**

**Table 3: the Pest factors with Nonaka (Tacit-Explicit) Model for Threats (T) factor**

| *PEST* | *Socialization (tacit to tacit)* | *Externalization (tacit to explicit)* | *Internalization (explicit to tacit)* | *Combination (explicit to explicit)* |
|---|---|---|---|---|
| ***Political aspect (P)*** | Overcome Political instability by Create sympathized knowledge through the sharing of Political experiences between individuals, or between individuals and organization and development of mental models and technical skills in Political aspects. Language unnecessary. | Create concepts knowledge through knowledge articulation using language. Dialogue and collective reflection needed. | Create operational knowledge through learning by doing to Elimination of Security breach and copyright issue and corruption..etc during the Explicit knowledge like Reading documents from many sources. | Creating systematical knowledge through systemize of ideas May involve many media, and can lead to new knowledge through adding, combining and categorizing. Example/ Elimination of Cyber terrorism and cyber crimes. |
| ***Economic aspect (E)*** | ____ | Increase the Dialogue of the economic aspects through the concepts knowledge using language. And collective reflection needed. | Reduce the Cost of e-Governance through Creates operational knowledge through learning by doing. Reading documents from many sources. | Creating systemic knowledge of ideas led to increase manpower widely available and reduce the cost of Employment .Also, May involve many media, and can lead to new knowledge through adding, combining and categorizing. |
| ***Social aspect(S)*** | Raise level for people culture about the position of their country through the sharing of discussing between individuals, or between individuals and organization using sympathized knowledge. Language unnecessary. | ____ | ____ | -Creating systemic knowledge in order to Elimination of privacy or brain drain skilled . etc, this required May involve many media, and can lead to new knowledge through adding, combining and categorizing.<br>- Explain comprehensive knowledge for people around the laws and conventions before the training |
| ***Technological aspect(T)*** | Elimination of special relationship with suppliers and customers through sympathized | Dependency on IT, i.e.to provide a forum for people who need to establish knowledge | Elimination of Price War between the competitors and DFY (Design For You) | Systemic knowledge for New technology changes and costs of implementing, |

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| | knowledge | sharing focused on solving a problem through concepts knowledge. | Company by Improve the Operational knowledge through learning by doing. | developing eGovernment, and communicate with Political, legislative and regulatory changes via different countries through many media |

*Source:* Based on own analysis

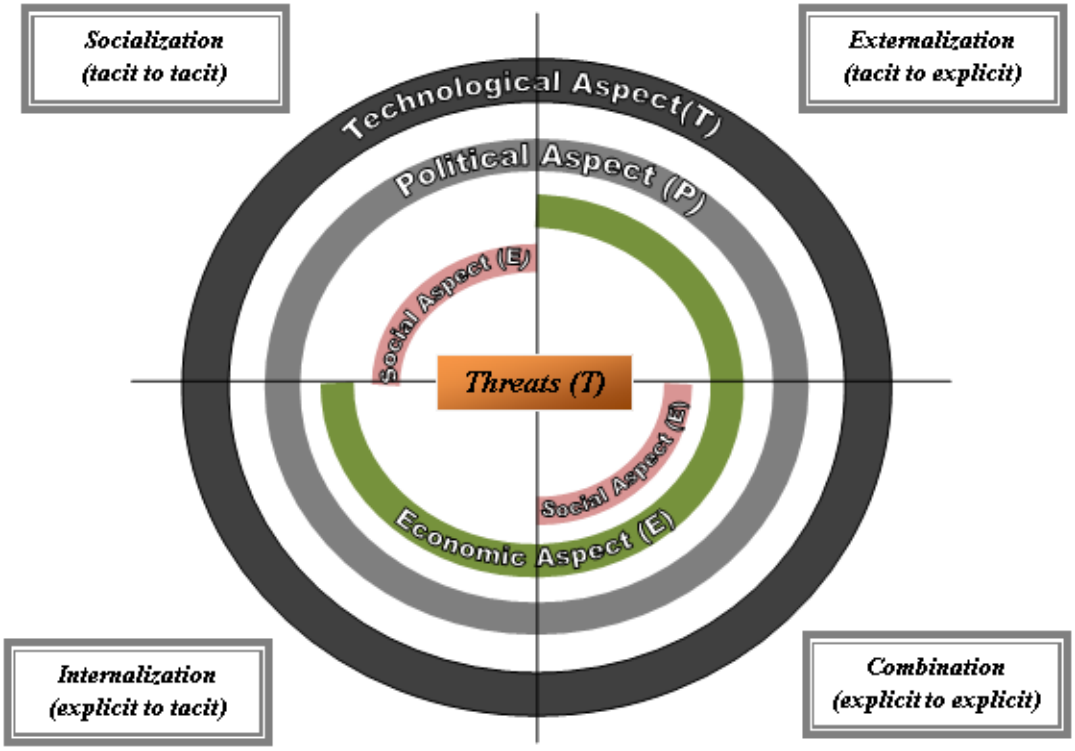
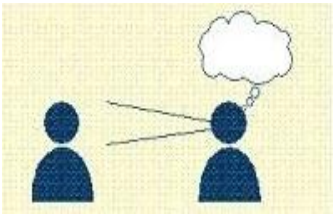
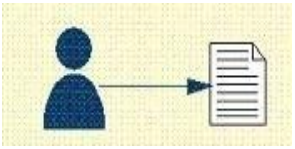


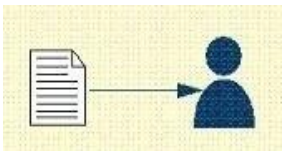
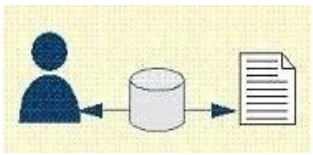

**Figure 3: *Threats* Strategic Model for KM with PEST factors**

As we mentioned previously, the information technologies can be organized and implemented in form of knowledge management systems (KMS) [3]. KMS establish organizational relations between people, regardless of time and geographic barriers and so increase opportunity for combination and exchange of knowledge and intellectual capital. Although IT plays a vital role in enterprise knowledge management, but without human factor it would be useless. Results of some researches [5] [6] in knowledge management field show that one of the main barriers in information technology implementation is the absence of organization culture promoting collaboration and knowledge sharing.

KM strategic models led to the best solutions that supported the types of KM for e-Governance via IT Solutions Strategic Model (see table (4) and figure (4)).

**Table 4: IT solutions that support KM for e-Governance**

| | **Tacit Knowledge To** | **Explicit Knowledge** |
|---|---|---|
| **Tacit Knowledge**<br><br>**From** | **Socialization**<br>  <br>Creates sympathized knowledge through the sharing of experiences between individuals, or between individuals and organization and development of mental models and technical skills. Language unnecessary.<br><br>**-Groupware** improves exchange of tacit knowledge allowing formal and ad hoc conversation between employees in spite of time, spatial and social barriers.<br><br>**-On-line meeting**: video and text-based conferencing(Lotus ,Microsoft NetMeeting)<br><br>-**Forums:** An online discussion group. Online services and bulletin board services (BBS's)<br>Collaboration Services/ chat tool and an instant messenger.<br><br>-**e-teaching and e-learning/** Computer-based and on-line training tools.<br><br>**-Workflow** applications enable users to codify formalized knowledge transfer processes<br>and to manage flow of information compatible with flow of work processes in enterprises | **Externalization**<br>  <br>Creates concepts knowledge through knowledge articulation using language. Dialogue and collective reflection needed.<br><br>-**Expert networks** provide a forum for people who need to establish knowledge sharing focused on solving a problem<br><br>-**Expert systems** : A software system with two basic components: a knowledge base and an inference engine<br><br>**-Intelligent agents and web search engines** improve rapidity and accuracy of information search through nature query languages, information filtering or creation of abstracts.<br><br>**-E-teaching:** teacher's tacit knowledge is converted to explicit learning material.<br><br>**-Decision support tools using neural network**.<br><br>**-Knowledge mapping** is technology playing the role of yellow pages for transfer of best business practices to interested users. |

| | Internalization | Combination |
|---|---|---|
| **Explicit Knowledge** |  |  |
| | Creates operational knowledge through learning by doing. Explicit knowledge like manuals or verbal stories helpful, learn/teach..etc<br><br>-**Reading documents from many sources**.<br><br>-**Expert networks** provide a forum for people/ finds a solution to a problem.<br><br>-**E-Learning Management Systems**/ includes computer-based and on-line training tools.<br><br>**-Training systems and simulation software** enable employees to acquire knowledge and support the conversion of explicit knowledge to tacit one.<br><br>-**Innovation Support Tools**/ Invention Machine.<br><br>**-Video and Audio tools** like MP3 ,MP4<br><br>- **Web site** to get access to video like YouTube, Metcalfe. | Creates systemic knowledge through systemizing of ideas. May involve many media, and can lead to new knowledge through adding, combining and categorizing.<br><br>-**Electronic Document Management**/ Excalibur Retrieval Ware and File Net.<br><br>-**Intellectual Property Management**/ patents, copyrights, trademarks, and service marks<br><br>-**Data and Knowledge Discovery**/ visualization and data mining.<br>- **Data warehouse** is hardware and software platform with integral and cleaned operational data of improved quality for support of decision making processes in organization.<br><br>-**storage of e-mail threads** to create a repository of best practices.<br>-**corporate memory database** also known as knowledge archives.<br><br>**-database for classification, codification and categorization in information.**<br><br>**-employee home pages on an intranet**<br><br>-**Knowledge Portals/** software organizations: **Enterprise information portal** is web application enabling company to make available stored information to internal and external users<br><br>-**Competence Management**/ stored possession information about knowledge. |

*Source*: Nonaka and Takeuchi [3] and based on own analysis

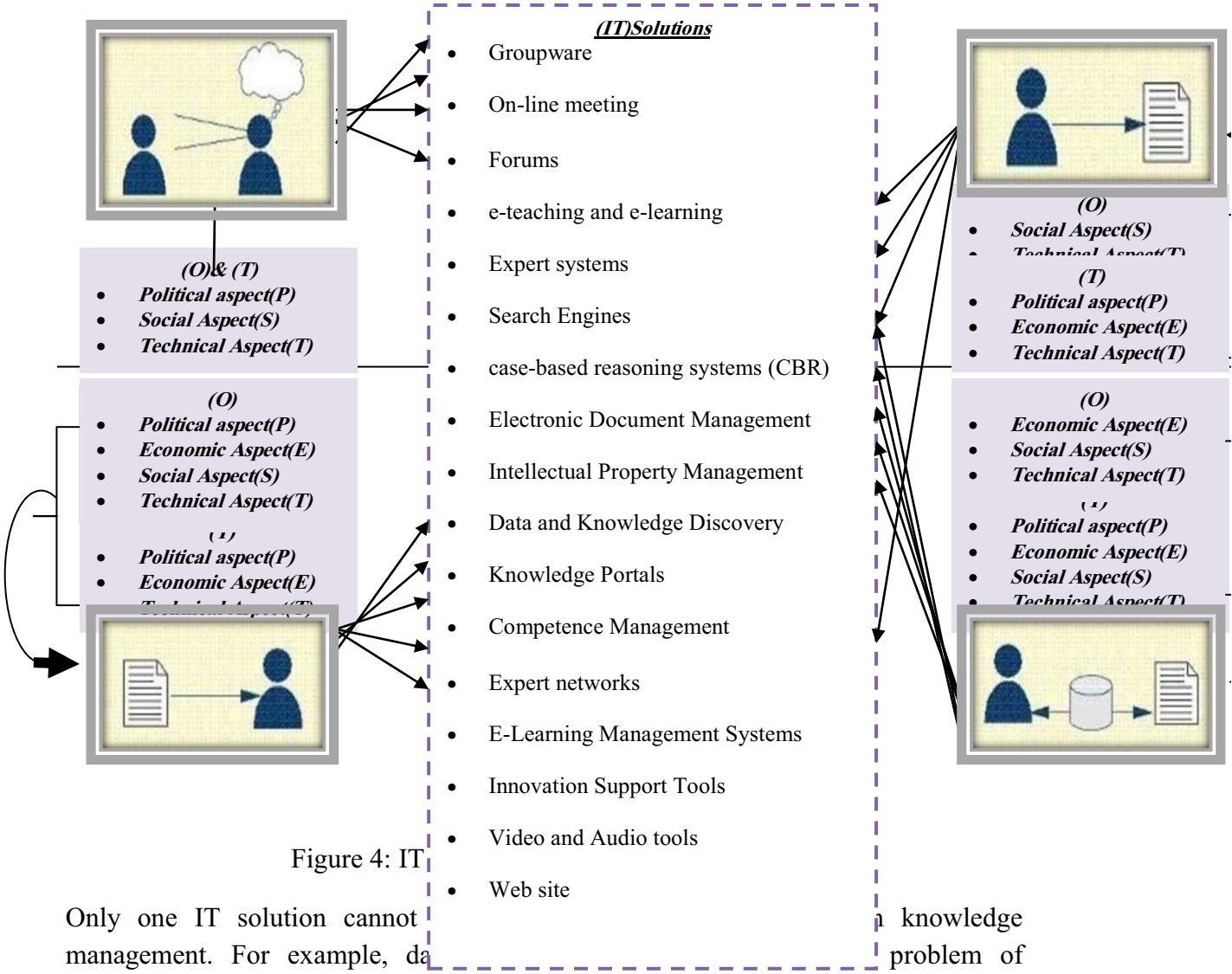



Figure 4: IT

Only one IT solution cannot n knowledge management. For example, da problem of knowledge storage and access, but cannot meet requirement of users for exchange of information and sharing of ideas and knowledge. Therefore enterprises should implement a mix of several information technologies and create appropriate organizational environment for knowledge sharing in order to develop an effective knowledge management system.

**Conclusions**

Knowledge management is the key factor of the successful implementation for e governance. knowledge management must be developed for each organization individually. Most of IT systems provide support for one or more of the four areas (Creation, Sharing, Processing, Capture And Codification), so they cannot be labeled 'knowledge management systems'. It is accepted that good knowledge management does not produce from the implementation of information systems alone .Implementing an efficient KM system must identify supporting IT solutions for this system by using strategic and KM appropriate tools.The technologies should be

integrated under the umbrella of formal strategic of KMS implementation. The strategy must be shaped according to organizational structure and culture.

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