Design of an Integrated Project Management Information System for Large Scale Public Projects: Iranian Case Study

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ABSTRACT

Due to the unprecedented growth of outsourcing ICT projects by the Iranian government, a critical need exists for the proper execution and monitoring of these projects. In this paper, the authors propose a web-based project management system to improve the efficiency and effectiveness of the management processes and accelerate decision making. Based on the requirements and information flow between various units involved in the complete life-cycle of ICT project management, a functional model and system architecture with various underlying structures has been designed. The functional model contains two sub-systems: process management and information service. The proposed system structure is based on a four-layer client-server computing model. As a part of a publically available ICT system, it must be secure against cybercrime activities. This system can bring efficiency in managing the projects, improve decision making, and increase the overall management process with total accounting and management transparency. The proposed system overcomes the problems associated with a central system and traditional management processes, as is currently the case in Iran.

Keywords: *Business Management, Client-server Computing, Government Projects, ICT Project Management, Information System, Privacy, Security, Web-based Management System*

INTRODUCTION

In recent decades, it has become increasingly obvious that ICT projects tend to be more large-scale and complex (He, Jiang, Li, & Le, 2010), thus creating new challenges, especially for developing countries. Furthermore, the existing commercially available project management software tools have many limitations and drawbacks which are particularly unsuitable for handling large and complex projects (White & Fortune, 2002; He et al., 2010). Hence, these commercial software tools are proven to be unsatisfactory in terms of the functional coverage scope, flow process adaptation and collaboration arrangements to meet the complicated management demands of large-scale

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ICT outsourced projects (Tseng, 2006; Buddhakulsomsiri, 2006). This is particularly true in the case of Iran, since at present, there are no matured techniques both domestically and abroad to be borrowed for practice in respect of the business and capital flows descriptions, public and private collaboration towards multi-purpose decision-making based on multi-source data flows for effective and efficient management of large-scale ICT projects (Simon, 2006; Crawford, Pollack, & England, 2006).

Two studies (Zhang, Li, & Tam, 2006; Olsson, 2006) indicate that any project participant can only hold less than 65 percent of the project information at the closure phase because of the multiple player and asymmetrical timelines. These problems pose serious constraints to the development of large-scale information-based management of ICT projects. Crawford et al. (2006) have found variation in project management knowledge and practices between industries, countries and application areas as well as the amount of attention with focus on construction industry. Due to this variation in understanding and application of project management, it is useful to investigate its application in developing countries which are trying to close the digital divide by performing more large and complex ICT projects through government and private sector partnerships.

Iran is a classic example of this partnership. It is at the threshold of closing the digital divide by making ICT official government policy to achieve a knowledge-based economy and society in a relatively short time. The Web-based project management of ICT projects outsourced by the government to external contractors one such example. It is also geared to overcome inefficiencies in managing large-scale projects.

Background-Problem Statement

Like any other developing country, Iranian ICT public projects are growing rapidly in all forms in government businesses ranging from financial services to social and public services (Jahangard, 2004). The government usually experiences huge problems trying to manage outsourcing of large ICT projects. Traditional outsourced project management methods are inadequate and fragmented. Project management systems are already ineffective for public projects that are causing numerous work bottlenecks, overloading workers, and inefficiencies from human-centered management systems and processes (Karami, 2003). The huge variety and quantities of paper and document handling make management persons very confused, which degrades over time to the point where good personal are not readily available, resulting in over-stretched management teams and the overall smooth functioning of the institution (Ahamdi, Ghazanfari, Aliahmadi, & Mohebi, 2003). These practices showed that the traditional management theories and methods for a simple and single project are not adequate or appropriate any more, when applied to large complex projects. In this day and age, one would expect a web-based project management utility that is simple and offering tools to managing teams and institutions to provide optimum project management and with transparency.

Furthermore, Iran's General Policies affirm constitutional and twenty year principles which refer to developing modern technologies, creating an effective IT system, using advanced technologies in education and research, and emphasizing private sector development. The Iran Strategic document on Information and Communications Technology affirms the need for balanced development in all dimensions of the Information Society with emphasis on ICT's function in facilitating, enabling and improving (Supreme Council of Information and Communication Technology, 2008). Therefore, certain prominent issues arose when the Iranian government chose to procure ICT services and systems from private sector providers based on their new regulatory reforms and policies regardless of boundaries. Control and supervising of the projects outsourced to third parties is a big challenge due to slow information flow and decision making process between the different units which serve as a knowledge network to the various units. Also, the exchange of information between major players such as project managers,

professionals, contractors, and administrators occur very frequently in the forms of letters, change orders, and drawings to name but a few. Moreover, the lack of correct communication and exchange between the user and the supplier channels, varied and confusing forms of applying managerial methods, which are incompatible with traditional forms, experience other major problems. These are low quality, increased cost, delay in achieving correct deliverables and to avoid incompatible delivery to meet customer requirements. From the Iranian experience, corruption and failing of many serious public projects not only resulted in loss of national resources and investment, but also generated negative social influence and verbal abuse of the government and its policies (Taghavi, Patel, & Taghavi, 2011).

In addition, the government confronted incidents of cybercrime activities which resulted in modification of sensitive information, and loss of management control affecting public utilities such as telecommunications and transport. Therefore, security and trust are major issues in the developing and deploying of a Web-based Project Management System (WPMS), since some clients would be completely trustworthy whilst others would need to be checked and authenticated all the time during access. There is definitely a priority to ensure that the public users are assured and encouraged to use this system and to support technology as a benefit rather than a threat.

This paper proposes a framework which applies management methods and processes based on integrated governmental project management information systems and information flows between various parties and departments. This study is to analyze and design the construction of a web based project management system aligned with Iran's Policies and "Twenty Year Principles" to overcome all the problems mentioned before regarding development of ICT projects outsourced by the government agencies. Furthermore, it illustrates the system structure and supporting mechanisms.

PROJECT ORGANIZATION AND INFORMATION FLOW

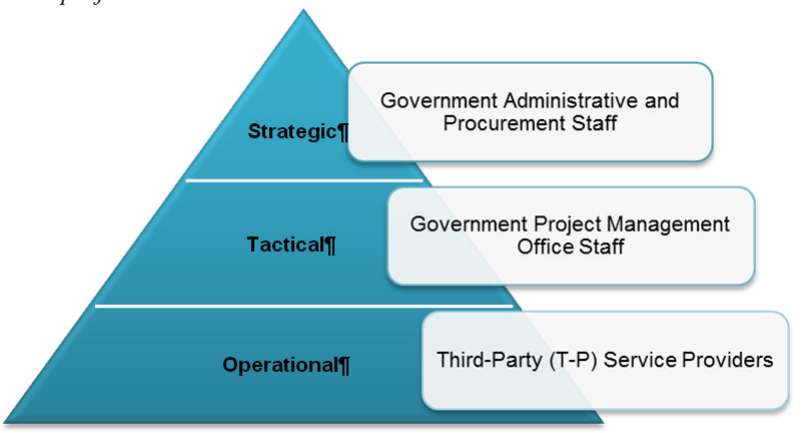
From the management point of view, three levels are involved in managing and executing a project: strategic level, tactical level and operational level (Scott, Kwan, & Cheong, 2003). Major units which are involved in a public project according to their levels of responsibilities are shown in Figure 1.

Government Administrative and Procurement (GAP) departments have a key role in constructing and directing the execution of ICT projects. This department is the sponsor of public projects; therefore they directly supervise all kinds of projects. Moreover, monitoring work in progress at regular times, assigning funds and assessing quality of work already performed are part of their responsibility with checks and balances. It is a complete project management life-cycle.

The Iranian Government Project Management Office (GPMO) represents a government administrative department which performs tactical responsibilities like bidding, contract management, evaluating project progress, funds, consistency and quality management. This unit is in charge of integrating management and supervising the accomplishments. According to the defined levels, Third-Party (T-P) performs the project processes. Most of the time private companies are the third parties. They are in command of conformation on quality and project progress, provide deliverables, and report work progress to the GPMO. Vendors for designing, supervising and constructing are identified in bidding. After selecting the vendors and negotiating the contract, the contractors are supposed to accomplish their tasks and receive payment according to their legally signed contractual agreement and schedule of work.

US Project Management Association (PMI) defines PMO as a kind of organizational element responsible for controlling and supervising the entire management system which improves organizational capacity to implement projects comprehensively and systematically and to

Figure 1. Public project stakeholders



obtain the greatest outcome aligned with organization strategy (Kanamanapalli, 2010). Since it provides more effective functioning of the environment for project portfolio management and workgroup management, it integrates and allocates the resources, assists in decision making of the corporate management, and has very frequent and interrelated interaction with the project stakeholders.

Figure 2 shows the key information flows concerning public projects. The difficulties existing in public projects are due to the great volume of information and high interrelation between information services. Information provided by services should be supplied to various people with different needs across the geographically diverse groups, ranging from government administration to public domain as well as national and international contractors. The information flows become very complex when it involves one or more subcontractors with other government departments.

REQUIREMENTS

In considering the Web-based Project Management System (WPMS), the general unit of the system's functions and operations are described as:

- *Input*: *Who* is responsible to input *What* into the system, *When* and *How*;
- *Process*: Data to go through a series of processes in the system;
- *Output*: Through a series of processes, system outputs, *What* to *Whom*, *When* and *How*.

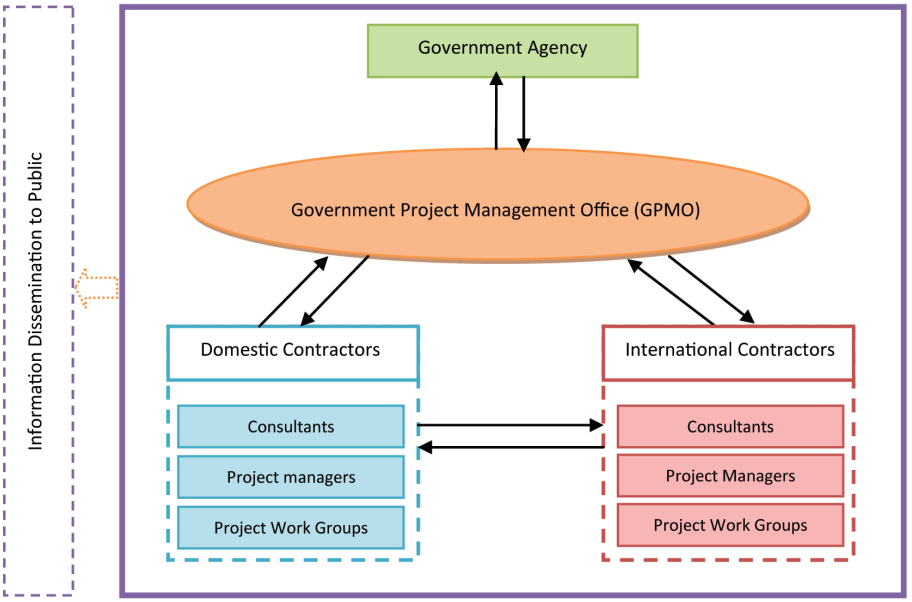
Management of the project entails:

- Who: WPMS stakeholders
- When: project management lifecycle phases according to *PMBOK* (Project Management Body Of Knowledge) (PMI, 2008)
- What: data or information
- How: user interface and mode of access

Primarily, WPMS requirements are composed of such elements and the links between them (Liu, Zhao, Sun, & Yin, 2008; Mustafa, 2010). The WPMS functional requirements are as follows:

1. Infrastructure services indicate the basic services which are known as business processes of the framework and system. It is the standard functional requirements of designing a framework and system.
2. Data system is supposed to be consisted of the data warehouse of the current public

Figure 2. Public project information flows



projects. These include the data warehouse of all public projects, the data mart that provides management information from different aspects, project data warehouse which memorizes all the information concerning the current projects, such as bidding invitation, process, closure, evaluation, identification, project design, construction, funds distribution, compensation claims and accomplishments. According to the projects' concerning topics, project data warehouse stores all the information of the public projects, including projects' constructing information with different granularity. Data Mart should be built according to the relative elements' decision-making requirement and information needs.

3. Technical support for both design and implementation which covers the necessary software and hardware for the project management system development for users. It also includes the middleware and the Application Program Interfaces (API) which separates the application from the underlying services and resources.

PROPOSED SOLUTION OF WPMS

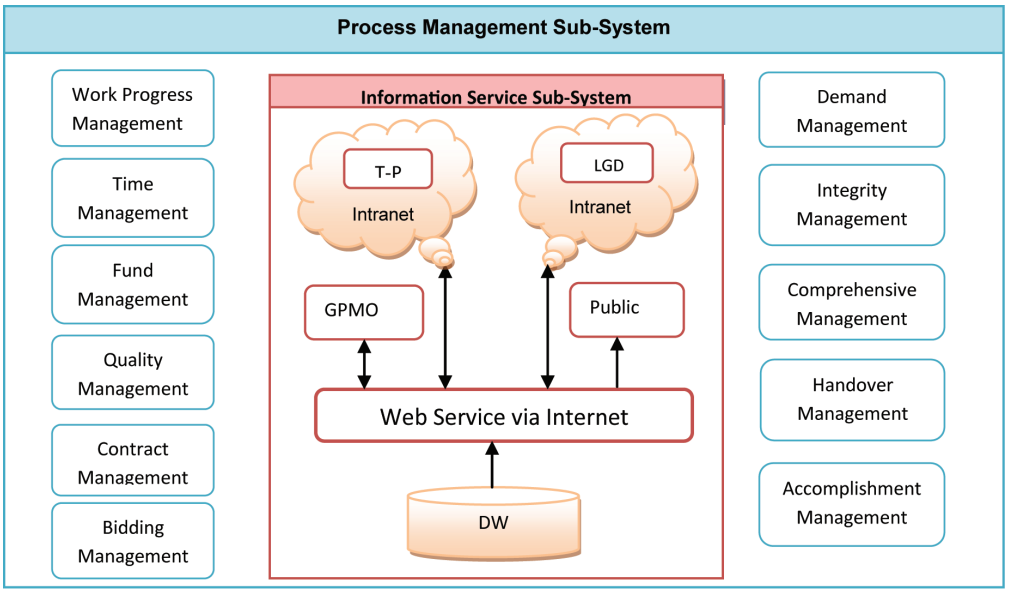
Functional Model

The only way to overcome traditional non-computer or web-based project management is to specify and make one that is integrated as a whole inter-locking system of subsystems which execute various critical aspects of the project management functions (Gałęzowski, Zabierowski, & Napieralski, 2009). In general, the aim of an Integrated Management (IM) is the understanding and effective direction of every aspect of an organization.

This concept can be applied and expanded to many management areas which include the concept of integrated cost management, and integrated quality management.

Based on this definition, public project management uses project resources properly, improves management ability and by directing, satisfies all the various interacting groups. Viewing from the government's aspect, public project management communication and coordination have a significant role in the success

Figure 3. WPMS functional model



of the project. At this point, the government is challenged with two problems:

1. The first problem is co-operation and control of integration management in the different project process, such as bidding and working process management.
2. The second problem is to realize these process tasks, project information should be collected and distributed. The proposed system consists of two sub-systems to meet the mentioned requirements: process management sub-system and information service sub-system.

Our proposed functional model is shown in Figure 3.

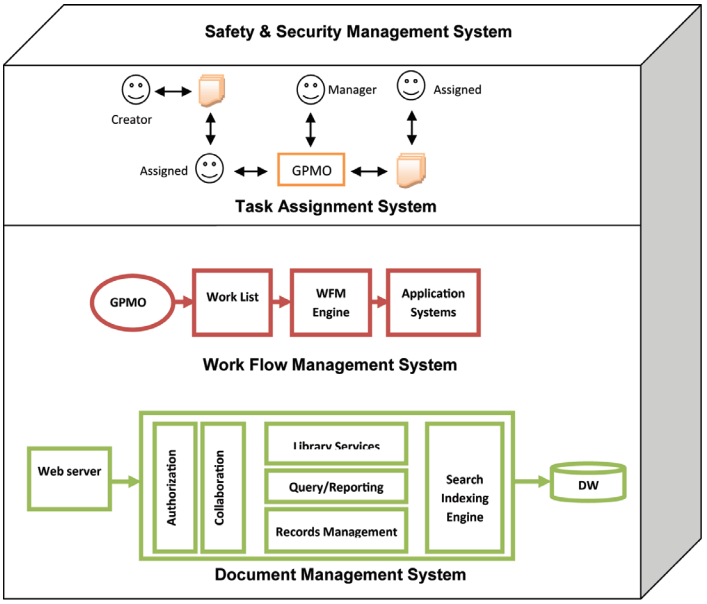
Process Management Sub-System

The process management sub-system, as depicted in Figure 3, is of concern to all of the activities related to managerial project processes like contract management. It is primarily concerned with three areas: Information management, management standard and process control.

Project departments, the GPMO unit and the work groups need a multitasking information system from the beginning until the end of the project. It has four components which include Document Management (DM), Workflow Management (WM), Team Communication (TC) and Task Assignment (TA). Figure 4 is about a multitasking information system which enables easy information management with standardized and monitored processes. Document Management System can be viewed as three main layers: input layer, document process layer, and storage layer.

The main function of the input layer is to upload files. In uploading files, metadata of the file which is saved in XML format, such as author, date and description are required (Chan & Leung, 2004; W3C, 2002). Core document management functionality is performed in the document process layer. Two main functions of this layer are to search files and topics. In the case of file searching, the system has the capability of offering various search results based on the user's search criteria, such as the category of the file or by text in the description of the metadata of the file that results in improv-

Figure 4. Process management sub-system framework



ing search quality. Topic search is an integrated information search and display facility which shows results as per user request at near instant response. It allows users to extract useful information from all sources in the project for analysis and decision-making by researching related information in the project website, and integrating the search result (Mehrdad, Mokhtari, & Aski, 2005). In the third layer, Data Warehouse (DW) stores all the information of the public projects according to their concerning topics to feed information needs to the various clients.

In the Workflow Management System, by adopting standardized workflow management method through information templates and automatic execution of business rules, they speed up the communication and confirmation of decisions. A workflow consists of several tasks, which are assigned to different project roles. GPMO defines the main tasks of "Process definition" and "Workflow administration".

After a task is finished, the system projects and schedules the next task to be done. Team communication is a form of less formal discussion through instant messaging as chat or buzz, online conferencing, emailing, and project calendar. It facilitates and simplifies workflow management. Task Assignment System is a personalized tool. Each user can assign a task and view his own tasks, alarms and status relevant to his job. This enables the users' environment to focus on relevant information. After the task creation is authorized, members should update their task information.

The proposed multitasking information system can intelligently search for relevant information, extract useful data, share updated information on progress, retrieve historical data for new applications, and control the sequence relation of project management steps through these four components. Advanced tools in intelligent information flow and workflow handling are essential for smart decision making.

In the meantime, a safety and security management system is developed to support the collaboration activities. This subsystem is able to carry out multi-tiered safety authorizations starting from the network platform going through the system platform and the database management system and ending with the application data and visit control.

Each public project applies different standards like obeying contractual procedures and schedules or evaluation criteria. For example, evaluation criteria for selecting a project have a different rate in each unit. So the system should be able to allow users to define different factors, weights and scoring methods by revising predefined factors. Project management involves a series of steps and processes that have complex relation to each other. It means that the output from one activity is an input to another activity. This subsystem is applied to ensure the steps sequence and relation among them.

Information Service Sub-System

This sub-system (refer to Figure 3) provides information services to satisfy a client's demand for information. Therefore, it enables permitted users to access a broad range of information resources by designing a data warehouse and proposing inquiry services to promote transparency of management processes.

The Third-Parties (T-P) and Local Government Departments (LGD) interwork via the intranet to jointly organize themselves respectively, and use the Web Services via the Internet to interact with other stakeholders. The data warehouse is the repository of all data from which information is derived that is meaningful in the context of its use. It is capable of comprehensively serving information for various client groups. For example, it offers to government administrative departments development project progress, information inquiry services, actual and budget cost, schedule information services, and payment accounts services to facilitate both technical and financial auditing of projects in real-time.

In our model, the public is informed about project news such as work-in-progress of projects through the inquiry services on different project items and the relevant information in a layman understandable manner.

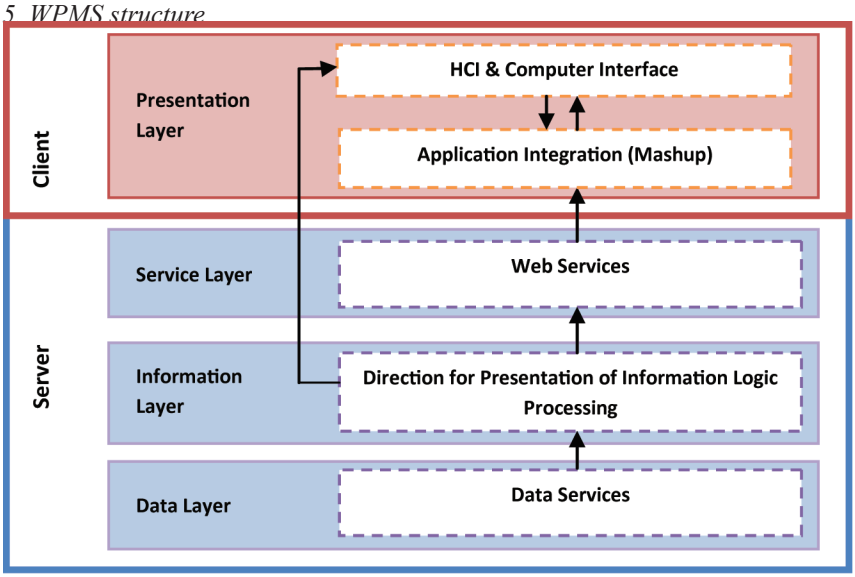
The information service sub-system can adopt various methods for providing the platform to produce information from project data which is meaningful and expressed in a readily understood manner to offer direct and dramatic information services for both the client and the project contractor (W3C, 2004). For example, it can show work progress by Gantt chart or make comparisons by using the histograms, pie charts and graphs besides the statistics (Forsberg, Mooz, & Cotterman, 2005).

Web-Based Public Project Management System Structure

The proposed system is constructed based on four-layers of a typical Client/Server presentation data processing and calculating model that is shown in Figure 5. It has:

1. Computer interface is the first layer. Clients of this system are from various levels with different applications that should be considered in the user interface at the design stage. Clients in the government administrative departments focus on a project progress and assess whether the project process is compatible with other contractual obligations or not. Thus, their interface style can be of a variety of charts (like Gantt/PERT charts), figures and tables showing the reports of the project progression, the quality evaluation results, and funds' ratio and providing a feedback and comments. The Application Integration module exists as an integrator *"mashup"* function between the user interface (the client HCI) and Web Services to manage context-related events within the host application and to process and display data returned from the information layer. This is technically the middleware layer with a plethora of services, ranging from database access, cross mapping of data and it transformation to a common format, as well other object management services.
2. Web service is the second layer. It provides information services as well as a standard means of interoperating between different clients and applications. It means that the web services share business logic, data and processes through the appropriate

Figure 5. WPMS structure



interfaces of the composite system. For example, when a unit needs to report a project status, a function would be chosen from the third layer, logic processing, to process the data for data-recoding and then would be processed in the computer interface layer. Once the work of the logic processing layer is complete, feedback information reaches the web service layer, which chooses a method or function to deliver the information with the proper computer interface.

3. Direction for information logic processing is the third layer, which deals with specific logic affairs, including data maintenance for budget and quality information, contracts, bid documents, and work progress. It also analyzes the data of funds comparison, work progress comparison, and quality records. In conclusion, it responds to a client information query.
4. The forth layer is a data service which scans the data by reading, writing and sorting. Relational data warehouse is adopted as a storage media for structured data such as for funds, and quality in contrast to unstructured content where the photo or video data file is adopted. Also, a web server should be provided to deliver and support the public Internet services in a safe manner with appropriate security, privacy, trust, audit and digital forensic functions and processes to give the overall system a very high level of confidence (Patel, 2010).

The adoption of a distributed data warehouse repository hosted in a distributed system computing environment with high-speed data accesses is essential to cover the whole country especially where the government departments are located in different towns and cities. This requires a very high standard of security and operational safety in order to avoid inconvenience to the client by having to visit the central data warehouse directly and also to deter the hackers from penetrating the system to cause damage. The four-layered proposed model ensures integrating and extending the capabilities of the system as well as reducing the degree of coupling in the system's modules to achieve connectivity, efficiency and openness in a safe and secure computing environment. It includes safety measures comprising of security, privacy, identity management, trust, audit and digital forensics. This is necessary to ensure

high levels of confidence, connectivity and reliability of the overall system.

It is largely self-managing system based on autonomic principles. An autonomic system primarily has four basic self-managing characteristics: self-configuring, self-optimizing, self-healing, and self-protecting functions. Hence, the essence of autonomic computing systems is self-management, the intent of which is to free system administrators and technical support from the details of system operation and maintenance, and to provide computing services which run at optimum performance 24 hours per day, 7 days a week. Their availability is paramount for ICT-based workflow operations.

The WPMS sub-system's structure and their functions are designed by selecting the latest open system technology to ensure ease of use, deployment and compliance to meet all essential requirements. It is also based on the Client-Server model but the server side is more than just a data service operator. It is heavily supported by the underlying self-management autonomic functions.

PROTECTION AND SAFETY ISSUES

It is inconceivable to imagine all the countless ways in which today's ICT affects us daily. Our social, business and political behavior as an Information Society is based on the rapid growth, deployment and uptake of ICT. This fact alone necessitates a very high *dependency* on ICT in all walks of life. It provokes a fundamental thought and requirement that these strongly interrelated technological infrastructures, as well as the information systems that underpin them with their networking technologies, become highly critical if their disruption would lead to a serious economical, material and, sometimes, human loss. As a consequence, the protection and safety of these critical information infrastructures is a major goal for the Iranian government, companies and various other interacting organizations.

As is shown in Figure 4, our proposed Web- Based Project Management System is architected to ensure that as part of the critical information infrastructures, it covers both the data security of information content through the use of cryptographic methods and access through open networks in cyber space through a set of safety measures in the form security solutions by means of protection, control and evaluation mechanisms (Patel, 2010). These solutions are increasingly using wireless networks as one of the main technological platforms because it facilitates distributed control and allows the different components of the system and network to remain functional and operative, even in extremely high alert or disruptive situations.

In order to guarantee the faultless interoperability of the protection, control and evaluation mechanisms, creation of new security services are essential. These services are integrated into a service-oriented architecture of the Web Based Project Management System with the aid of a trust management model designed for this specific purpose.

The functionality of the architecture can be verified in different ways. The management and maintenance systems embedded into the architecture, such as an early warning, dynamic reconfiguration and auditing systems based on some autonomic computing schemes should be tested for operability. On the other hand, the infrastructure tools for decision, support, risk analysis and management should be exercised periodically to ensure compliance against cyber security rules and regulations.

Moreover, these trends are expected to intensify because ICT and its applications are becoming more and more pervasive to society, leading to new types of and larger scale vulnerabilities and risks. Economic and societal interests go beyond technical security, as they relate to:

- Business opportunities and growth: new business models, virtual enterprising, delocalized workforces, tailored services, digital asset management and economic value of knowledge.

- Individual: privacy, confidentiality, intimacy, cyber-crime, protection of minors and ethics.
- Society: new dependencies on volatile technologies, long lasting preservation of knowledge, culture and digital divide.
- Government's recognition, power-base and control: interdependencies of critical and sensitive departments, critical interworking ICT infrastructures, national defense, social order and international cooperation and governance.

Security issues are not new. They have been around for a very long time, but however, as the Internet and other information-communication networks become an ever-increasing part of our daily lives, so does our dependency upon their underlying infrastructure. Unfortunately, as our dependency has grown, so have the hostile attacks on the infrastructures. Newly discovered forms of attacks, the availability and wide distribution of attack tools, as well as the flaws in common desktop computing software have resulted in networks becoming increasingly vulnerable. Simple viruses, malware and denial of service attacks are argued to have cost billions, if not trillions of dollars worldwide in lost productivity. More recently it has become known that sophisticated distributed denial of service attacks on the Internet are on the rise, causing severe damage, loss of revenue and functioning of basic information applications and infrastructures. It is expected that more serious threats are still to come in the future (El Sheikh & Khadra, 2009).

As many factors are causing ICT, from the lowest to the highest levels, to migrate from centralized systems and components into more autonomously distributed structures, such as:

- Large scale systems of casually networked and evolving real-time embedded devices, like wireless sensors
- Mobile codes in heterogeneous and mobile environments
- Volatility of networks and service infrastructures, and end-user applications

Safety and security are serious concerns. Therefore, security issues and their accompanying trust functions in the digital environment are becoming everyday features. In addition, geographical, trans-border and jurisdictional boundaries are fast disappearing and the ultimate basis for *trust* and the recognition of *powers* in the digital environments are changing, uncontrolled and giving unlimited access with resulting increase in potentially harmful side-effects of technologies and services. This can cause a high scale of potential disruptions of ICT services worldwide with the high dependencies on the Internet.

Recently we have seen a rapid growth in the number of attacks on identity, since acquiring such information allows miscreants to commit fraud that is hard to detect. Breaking the weakest link in the network is a cause for serious concern to individuals and businesses alike, because they depend on it for survival. A trusted authority on the Internet could be a fraudulent authority. It reminds us of the danger of security and identity failures. The fact that even the basic technology of security is sometimes flawed is also interesting. They have an impact on our privacy as well. Much work on the future Internet and Web requires monitoring of research, but at the same time ensure that the real user's privacy is not compromised. It is difficult to reconcile these two conflicting aspects/goals. Indeed, in gathering data about network use there are legal requirements relating to intercept laws and user privacy that must be met.

However, regardless of the tools provided to protect personal privacy on the Internet, currently privacy aware network monitoring is required in order to promulgate new legislations, standards of behavior, design protocols and most importantly offer near absolute trust to the end users. Similarly, new tools are required to pro-actively protect systems under illegitimate attacks while laying bate to prosecute the culprit, and also to invoke processes to trace the culprit in order to prosecute after post-event has taken place. Systems are never perfect, and this is never more true than for security and privacy because we can never prove that a system is

secure and guarantees privacy, but only discover (eventually) when it no longer is.

Under the bane of safety measures incorporating *security, privacy, identity management, trust, audit* and *digital forensics,* our proposed architecture of Web Based Project Management System takes all of this into consideration.

DISCUSSION

With application of the above-mentioned theories and methods and in accordance with the actual conditions of current infrastructure, Iran can benefit from a fully web information system in order to lead ICT projects. The proposed WPMS can contribute to increased collaboration and cooperation among various roles executed either by persons or by automated processes playing the role of persons in the project management processes. The proposed system is compatible with not only the traditional manual systems but other ICT or web-based systems which are much more reliable and easily support on an ongoing basis.

The proposed web-based project management system can bring efficiency in managing projects effectively and has a key role in enabling,, facilitating, and improving functions aligned with Iranian ICT policy statement. Over time, it will simplify and improve data collection which is currently fragmented in various units and departments that do not even communicate with each other properly. This will speed up decision making in various managerial levels regardless of the exchange of official letters. In the long term, it will decrease cost and make information available in real-time for administration and other departments to improve public projects. This will allow skilled personnel more time to concentrate and deal with other more urgent and important matters. At the same time they will be able to monitor the work in-progress, quality management, funds control, technical and financial audit much more effectively which will improve the overall project management efficiency and level of trust in the system.

However, for strengthening of the government's supervision, a perfect system of internal and external control is needed to prevent individual and tissue fraud. In order to facilitate the public and private co-operation, an easy and feasible system is needed for the contractor's entry and interaction. This proposed system needs to be investigated in terms of available infrastructure such as the Internet access to be validated to apply across the entire country level.

CONCLUSION

This paper proposed a web based project management system for the Iranian government to manage all its projects more constructively, regardless whether they were ICT based or not. The important issue was to use ICT and web technology to construct such a system. This paper described a functional model and system structure which has enormous capability to achieve robustness and transparency of the management process and to improve decision making in an open distributed computing environment. This is currently lacking in the Iranian government's administrative departments and project management units. It overcame all the problems associated with a central system and traditional management processes, as is currently the case in Iran. It overcomes all the problems associated with a central system and traditional management processes, as is currently the case in Iran.

Now, what is required is a detailed study against very good terms of reference to determine all the requirements for the proposed system and then present it to the Iranian government for their consideration. The detailed study is an absolute requirement as it concerns Iran as a whole, taking into account the concerns of access to the Internet, level of security and user acceptance. It will also help close the gap in the digital divide. ICT is perceived to be the only enabler, which can meet the demands of a modern, forward looking Iran heading in the direction of a fully developed country or nation in the fraternity of nations of the world. This paper is a provocative action in that direction.

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