Malaysian Journal of Computer Science, Vol. 14 No. 1, June 2001, pp. 9-15

SYSTEMS INTEGRATION AND PROJECT MANAGEMENT

Zaitun Abu Bakar, Noriati Baharum and Mashkuri Yaacob
Faculty of Computer Science and Information Technology
University of Malaya
50603 Kuala Lumpur
Malaysia
Tel.: 603-79676378
Fax: 603-79579249
email: zaitun@fsktm.um.edu.my
bnoriati@hotmail.com

ABSTRACT

This paper is based on a survey carried out in the Malaysian public sector and a prototype system developed to assist in project management. The paper starts with a definition of Systems Integration and this is followed by a description of its current status in the Malaysian public sector. Focus is then drawn to the Project Monitoring System (SETIA), which is an information system used to monitor the progress of all government-sponsored projects implemented by ministries and agencies. This is followed by a discussion on how systems integration techniques can be used to eliminate some of the obstacles faced. A prototype system embodying the proposed solution was then developed and tested. Based on the feedback obtained from the use of the prototype system, a conclusion is drawn on the appropriateness of the systems integration technique in the area of project management.

Keywords: ***Project Management, IT in Government, Systems Integration***

1.0 INTRODUCTION

In facing global competition, information has been identified as an invaluable asset to organizations. We need information to establish future plans and to make better decisions in the course of running our business. Governments are no exceptions. In order to lead the country towards advancement, the government needs to be well informed of global trends and pushes. They have to play the role of the steerer rather than the rower towards development [1]. Only by having enough information to make good decisions in a timely manner can the government be effective in playing this role.

In this aspect, availability of data to the people in the public sector as well as the business at large is most vital. Information has to be available whenever or wherever it is needed. We cannot afford to have islands of information sources that are scattered throughout the establishments, which are difficult to access. Bridging these information pools will enable the public servants ease of access to information rather than spending time gathering data from different sources. The public will also be spared from the hassle of running around different departments when their services are required.

Decades ago, computers were used to serve specific functions. These standalone units began to accumulate data to serve the individual departments. Little information passed beyond the organizational boundary. As we move towards the information age, cross-boundary information needs become more important to provide organizations with the leading edge. The need for systems integration started to come into focus. Systems integration in the public sector context is not a new phenomenon in Malaysia. The Government's move towards becoming an electronic government is a clear target for systems integration. Providing hard infrastructure to link existing systems in a network, and making it accessible to all, is hardly sufficient. Systems integration has to be thought of not just in terms of making separate components of a technology base work together, but also in terms of joining business services into a harmonized environment.

To those who are involved in IT, systems integration has been one of the hottest buzzwords in the past years. Researchers and practitioners differ in their definition of Systems Integration; but, everyone agrees that Systems Integration is difficult and complicated, yet, **not** impossible. Integration is simply defined in a dictionary as *make whole or complete by bringing together parts.* System integration means different things to different category of people. Khun (1990) in [2] defines Systems Integration as the practice of joining the functions of a set of

subsystems, software or hardware, to result in a single unified system that supports the requirements of an organization. Another definition of systems integration is given as:

> *Systems integration is the assembling of various hardware (such as computers and telecommunication systems), software (such as accounting, desktop publishing and personnel management) and human interfaces to accomplish a specific goal. Often some unique software bridge is developed to bring together diverse hardware/software elements in order to allow the entire configuration in question to accomplish its intended task* [3].

A simpler definition is given as:

> *A service to make user's isolated computers link each other and make them much easier and more useful* [4].

2.0 STATUS OF SYSTEMS INTEGRATION IN THE MALAYSIAN PUBLIC SECTOR

Results from the survey [5] on the status of systems integration in the public sector, is as depicted by Table 1. Of the respondents, 30.8% said that their departments have already implemented systems integration, and another 35.9% are in the process of implementing systems integration. Verifying the answers given through phone calls revealed that their departments do have arrangements with related government agencies to transfer information on-line and in real-time mode. However, there is no processing invoked and this clearly shows that the level of integration practised is still at its lowest hierarchy [6].

Table 1: Status of systems integration in the public sector

Status	No. of Dept.	%
Already Implemented	12	30.8
In the process of implementation	14	35.9
Planning for implementation	12	30.8
No plan for implementation	1	2.6

In order to achieve a more efficient, effective and productive public sector, it is unavoidable for systems integration to be implemented. Within the government departments, bridging the different platforms of information systems can bring about improved data sharing, flow of information, and reduce duplication of systems development and maintenance work. This leads to better utilization of resources amongst the departments. The integration of systems in the public sector also benefits the private sector. The efficiency of the public sector will provide a more conducive environment for the private sector. This will help the private sector to conduct their business in a more effective manner and thus promoting better economic growth. To the general public, an integrated information system of the public sector will bring about a more approachable service. The concept of one-stop-shop to government services will be very convenient and less confusing.

3.0 THE PROJECT MONITORING SYSTEM

Government departments are entrusted with the tasks of implementing projects such as building infrastructures, public utilities such as schools and hospitals, as well as running research projects and conducting training programs. Successful implementation of these projects is vital as they form the catalysts to further develop the nation. The process of planning, implementation and monitoring of development projects in Malaysia is given due attention by the government, to ensure that they are implemented as planned and according to schedule. In the process of fulfilling their roles in seeing to the successful implementation of projects, each department had developed a system to process project data that are relevant to their business areas. These systems, manual or computerized, reside within each organizational premise with little interaction between each other, besides forms or reports sent in by the implementing agencies. In 1974, a computerized information system called SETIA was developed to manage all

government-sponsored projects throughout the country. The project management aspects handled by the system starts from project proposals, project approvals and progress monitoring.

However, when SETIA was implemented, several issues were surfacing as obstacles to its success. These include:

a. The need for better coordination between participating central agencies
Having an integrated system such as SETIA, needs the participation as well as commitment from involved parties. The roles of each agency involved in the formulation, planning, approval, implementation and administration of projects in relation with the system, can be clearly defined and agreed upon. Procedures should be laid out and observed. The needs and constraints of each party must be carefully considered and solutions that are agreeable to all parties must be met.

b. The issue of system/data ownership
Participating agencies do not feel they are part of an integrated system. This is reflected through their lack of commitment towards information kept in the system. Each party concentrates only on their level of control. They do not show any concern on the breakdown of this data beyond their level of control.

c. Data capture
Data is not fed into the system at source. It gets fed into the system in batches and is seen like a report-based system. Rather than having input generated from the respective agents, as and when transaction is done, they are sent periodically upon request. This results in the lack of timely data for decision-making.

d. Macro analysis
Keeping data in the system to fulfill the requirements of central agencies, sometimes cause useful information to be lost. This information is only beneficial in generating a macro-level report. Most of the time, when intervention is required, detailed information on projects is needed. This is usually kept at the project manager's level on the ground. Integrating the micro-level information to the system may prove to be useful. The link up of data kept at a lower level and data from a higher level provides an integrated view of a project. It helps give a consistent view of a project. A wider profile of any project is made available whenever needed, without having to seek from many sources. In this way, agencies recording progression of their projects need not be burdened with the tasks of reporting to higher authorities involved.

4.0 SYSTEMS INTEGRATION AS A SOLUTION

An integrated system should form a repository of data on a common subject. Irrespective of where data is generated, they all have to *come into* the system through business functions that are related. Data ownership should remain, with levels of authorities clearly spelled out between business functions. Data security is an issue that has to be tackled, as the lack of it may cause non-usefulness of the system. Capturing data at source helps in getting timely data and prevents discrepancies of data, which is usually the result of different times of data input.

Coordination and commitment of agencies involved may be further improved by providing a tool that provides a window to the system at their end. By having such a facility they feel they are part of the system, rather than just a supplier of data. This arrangement will also provide the means to control information, which are under their jurisdiction.

The issue of timeliness of data may be overcome if agencies are provided with a tool that can be used in their daily tasks. When data is captured at source no added task of reporting is required. Integrating data from various levels of control provides flexibility in the way we utilize information. A top-level view is only good at giving a macro picture of subjects. When a micro level analysis is required, more detailed information is needed. In the context of project monitoring, for purposes of intervention by higher authorities, detailed information on project activities is most useful.

5.0 A MODEL DATA-CAPTURE TOOL ON PROJECT MONITORING

The points and ideas discussed in the previous sections have led the authors to develop a prototype system that serves as a data capture tool at source for all the agencies involved in government sponsored projects. The tool is designed to capture data at source, which is where works on projects are closely monitored on the ground. It

constitutes a module for updating data on project activities in an integrated environment. The area of focus is as shown in Fig. 1. Integration, as illustrated in the model encompasses two levels of integration - data integration as well as software integration.

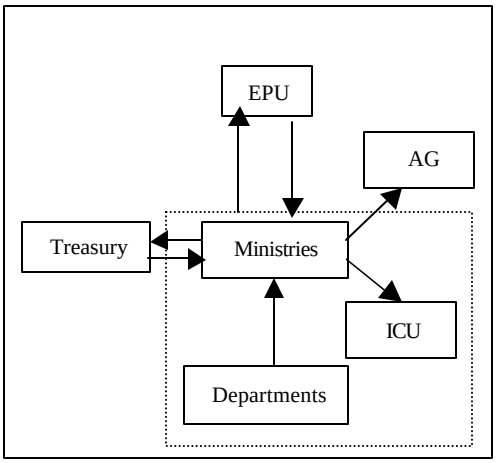

Fig. 1: Focus area of the prototype system

The data collected can be used by project managers and can be made accessible to relevant central agencies as a means of reporting project progress. This concept enables data collection at source. When implemented in a networked environment, integration is achieved, through data sharing with all relevant agencies dealing with the same project. In an integrated environment, each agency that deals with projects such as the Economic Planning Unit (EPU), Treasury, the Implementation and Coordination Unit (ICU), the Accountant General's (AG) office and the respective ministry may have access to the same piece of information without it having to be replicated. Data on projects, generated by these agencies, may at the same time be updated at their respective sites and made accessible to other participating agencies.

Data on project activities are collected at source through project-management software used to assist the project managers in the course of their work. The information are then linked to other data available on the main project. Using the client-server technique, the linkage on information at various levels (i.e. project, sub-project, activities) enables data generated by different sources to be linked up. Project managers are spared from having to re-enter data on projects for reporting to the central agencies and the ministries.

The prototype system also incorporates the use of images as a means for viewing physical progress of projects, as work progresses. This way, officers at the central level will have an up-to-date view of projects for visual evaluation. Graphic representation of data is also included to enhance data display. Graphs are generated from data directly accessed from the database. The prototype system runs in a networked environment, thus enabling it to become part of an integrated system for project planning and implementation by the Malaysian Government.

6.0 DISCUSSION AND CONCLUSION

The prototype system is able to overcome problems posed by isolated information systems whose functions are inter-related and are inter-dependent of each other. Among the objectives achieved are:

Enabling data collection at source

With the proposed system, data is entered at source. It is incorporated as part of a project management task. The project coordinator updates the overall project status. In a networked environment, this data may be shared or a copy of which is made available to agencies concerned. Data entry done at source saves the project manager from another task of data entry for the purpose of reporting. The speed at which data may be made available to the agencies concerned will be very much improved. The question of data timeliness can be achieved through prompt data entry as and when work is done on the ground. The issue of data duplication can be significantly reduced. Central agencies interested to know a project progress may have direct access to more up-to-date information. This will also reduce data inconsistencies among agencies having access to this information.

Allow flexibility of data kept at ground level

The proposed system allows flexibility in the level of detail of the data kept. This is done by providing a linkage between the project data (as requested by the central bodies) and a project management tool (used by project managers at ground level). Data that are useful to the people managing the projects are kept in a systematic manner. By doing this, useful information is not lost and the requirement of central agencies may be fulfilled.

Single-entry concept

Specific data should only enter into the system from a single source. It should not need to be repeated. The task of reporting progress to various authorities in different formats will only increase the burden of project managers and coordinating officers at the ministries. Every data item fed into the system should be updated by the authorized personnel where data is generated and not re-entered elsewhere. Access shall then be allowed to authorized parties through read-only.

In the present system, basic data items such as project location, project cost, and annual allocation repeatedly appear on various forms. With every party having access to the same data source, such information should not need to be repeated. In this way, data inconsistency would not occur. There is also no duplication of efforts.

Enabling multi-level monitoring

Projects being implemented by government agencies are monitored at the ministries, as well as the central agencies. The types of data required, vary. The levels of control imposed by the respective agencies also differ. For example, the Treasury is only concerned in controlling data at the sub-head level. Each sub-head may comprise several projects as listed by the EPU or ICU. Meanwhile, ICU may be interested at looking into project progress at sub-project level, such as the building of a particular ward of a hospital project.

Integrating the systems dealing with development projects, may seem to be a meritorious aim, but getting a consensus on the level of monitoring by central agencies seems remote. Efforts to achieve agreement on a certain level of standards in monitoring have not been successful. This has caused a considerable amount of burden to the implementing agencies in the course of reporting project progress and to synchronize data according the central agencies' needs.

Data control should be done through the computerized system. Levels of project details can be achieved through a database that is designed to accommodate these details. Various forms of data may be inter-linked with each other in an integrated system. By allowing data to be input as they are generated, linking data at various levels should not be a problem. For example, when the Treasury enters data on transfer of funds between subheads, tallying payments made by the agencies with the allocated amount for the project may systematically take place.

Non-duplicating data

One of the objectives of having an integrated system is to avoid duplicating data at several locations. Despite efforts to integrate the current systems on development projects, agencies are still keeping separate sets of data at their respective locations, whether in a database, flat files, or hardcopy documents. This increases the risk of inconsistent data between the agencies when reporting to the *National Development Working Committee (NDWC)*. Besides, duplicated data consume redundant resources, manpower or hardware.

The proposed system, though not illustrated in full, supports the concept of integrated data environment. Whether data are located in a central database or several distributed databases, needs further elaboration. The decision would be based on how dynamic are the data, data sensitivity, rate of access etc., which is outside the scope of this study. However, data should be stored once and updated by the authorized party, at source. The data shall then be made accessible to the parties concerned, in order to support other functional areas. For example, the breakdown of the annual allocation by sub-heads, according to projects, should be entered directly by the implementing agencies, as authorized. Subsequently, the central agencies interested may have access to this piece of information in order to support decisions. In the current system, this information is sent to the ICU, to be updated into the central database.

Common Interface (if implemented under internet/intranet)

Today, it is common to use a desktop computer for the daily work, in the Malaysian public service. At the same time, having Internet access is not uncommon. The point-and-click tool in today's information era has become a common phenomenon. The developed model does away with the hierarchical, menu-driven method to access information. It uses state-of the-art point-and-click technique. This enables the operator to be familiarized with the system faster. As explained earlier, by implementing the prototype on an intranet platform, this system provides a convenient tool for users through the use of a common platform with the other commonly used software.

Works on multi-platform

The prototype, developed to illustrate the proposed module for monitoring development projects, works in a client-server environment. It was developed using Powerbuilder 5.0 desktop version. Adapting the developed module onto a different platform such as a Windows 95 PC or a UNIX environment is possible even though it is developed under WINDOWS NT. It is also capable of interfacing with several databases at the same time, as long as it supports ODBC. Today, with the new version of Powerbuilder tool, it is also possible to run the application under an Internet environment, with the use of the appropriate DLL. This will, thus, enable agencies with different machine types to use their existing machine to interact with the system, rather than having to change everything altogether in order to be part of the integrated system.

Ability to access multiple databases

The software used for this prototype allows concurrent access to different databases. Data may be kept at the respective agencies for security reasons. Authorized access to data is enabled across data sources by providing linkages between databases. Data locations are transparent to users. The same piece of data need not be replicated between agencies, in an integrated solution.

The advantages derived from the prototype system have further strengthened our claim that systems integration is indeed very suitable in the areas of project management. This is especially true for project implementation involving similar related organizations.

REFERENCES

[1] D. Osborne and T. Gaebler, *Reinventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector*. Pesseus Fr, Feb. 1993, pp. 34-42.

[2] D. R. Khun, "On the Effective Use of Software Standards in Systems Integration", in *Proc. of the First International Conference on Systems Integration*, New Jersey, 1990, pp. 455-461.

[3] Systems Integration a, 1996 *http://www.ecrc.gmu.edu/definition/si-define.html*
Last access date: 25/09/96.

[4] Systems Integration b, 1996: Systems Integration
http://www.ksc.co.jp/eng/int.html
Last access date: 25/09/96.

[5] Zaitun A. B., "The Diffusion of Systems Integration in the Malaysian Public Sector Triggers, Obstacles and Success Factors". *PhD. Thesis*, University of Malaya, Kuala Lumpur, 1999.

[6] E. G. Nilsson, E. K. Nordhagen and G. Oftedal, "Aspects of Systems Integration", in *Proceedings of the First International Conference on Systems Integration*, New Jersey, 1990, pp. 434-443.

BIOGRAPHY

Zaitun Abu Bakar is an associate professor at the Faculty of Computer Science and Information Technology, University of Malaya. Prior to that, she was a systems analyst in the Public Services Commission of Malaysia and was a senior systems analyst at the National Institute of Public Administration. She obtained her PhD of Computer Science from University of Malaya, specialising in systems integration. Her current research interests include IT in Government, Information Systems Evaluation, E-commerce and E-learning.

Noriati Baharum graduated from University of Manchester, Institute of Science and Technology (UMIST), U.K., in 1979, with an Honours Degree in Computation. Upon graduation, she joined the Malaysian public service through the Examination Syndicate, Ministry of Education. In 1983, she was promoted to Senior Systems Analyst and moved to the Implementation Coordination Unit (ICU), of the Prime Minister's Department. At ICU, she was involved in the development and maintenance of a system to monitor development projects. After serving ICU for 8 years, she was again promoted and became the head of the Computer Division of the Election Commission of Malaysia. In 1996, she took leave from the service to take up a Masters Degree in Computer Science at the University of Malaya. She later continued her service from 1999, as a Deputy Director for Information Systems at the National Registration Department.

Mashkuri Hj. Yaacob is a Professor in Computer Science and Deputy Vice-Chancellor (Academic) of the University of Malaya. He joined the University of Malaya in 1976. He has published over 130 research papers and presented papers at both local and international conferences. He is a member of the IASTED Conference Organising Committee and IEEE Computer Society. His research interests are software engineering, and computer architecture which includes ATM network architecture, virtual circuit management performance, and others.