E-ENTERPRISE: AWARENESS AND IMPLEMENTATION OF TRANSPARENT FACTORY IN SOUTH EAST ASIA

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Abstract: Three strategies, which denoted as M[3]A, Management Automation, Marketing Automation and Manufacturing Automation have to be jointly incorporated to confront the more competitive market. An answer to these needs, transparent factory (TF), which is an open automation framework, based on internet technologies that provide seamless communication between plant floor and business system has been introduced by Schneider Electric. Despite the good work and technology introduced, the acceptance is only significant in United States, Europe and Africa. Hence, this paper is to look into the awareness of the TF in South East Asia (SEA) in particular. A particular reference to oil & gas plant in Indonesia, which had the system implemented recently, and a waste treatment plant in Malaysia will be highlighted in this paper.

1 INTRODUCTION

Business goes borderless as every entity within the business units such as production line, management system, information system etc. are forced to integrate for effective agile manufacturing system. The needs for flexibility due to demand, supply, product, process and workforce and equipment variability forces companies to transform their current manufacturing system into more lean production system or Big just in time (JIT).Two case studies are presented here and they are divided into three, namely pre-implementation, during implementation and post-implementation. Some of the points to be mentioned are the problems faced which drive the company to implement the transparent factory (TF).

As for the implementation stage, both case studies will focus on the local standards, which were taken into consideration during design. The details of the local standard specification or common practices in oil and gas industries in Indonesia will be elaborated. As a final point, the post implementation especially on the cost reduction is to be explained

2 TRANSPARENT FACTORY

Schneider Electric introduces its TF as an open automation framework based on Internet and Ethernet technologies that provides seamless communication between plant floor and business systems. This new automation system architecture support enterprise-wide operations, enable collaboration, and capture and dispense process knowledge wherever it is required throughout the enterprise. Adding to this the information and real time data can easily be accessed from anywhere, at anytime by authorized users. Another unique aspect of this factory is the fact that production can be followed live by the customer. It allows customers to directly access the wealth of information within the enterprise that is normally “buried” on the factory floor in proprietary systems, communications networks and workstations.

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TF solves these issues by developing a three-stage strategy. There are; Expose programmable logic controller (PLC) information using open standards, Interface/integrate automation systems with business applications such as Enterprise Requirement Planning (ERP), Develop an open infrastructure that supports real-time and determinism behaviors. Figure 1 illustrates the basic components involved in the TF concept

The benefits of the TF among others are reduced energy cost by 2-4%, saving on operation coast by 2-5% by avoiding purchase of unnecessary equipment, reduced downtime by 10% via remote monitoring and troubleshooting.

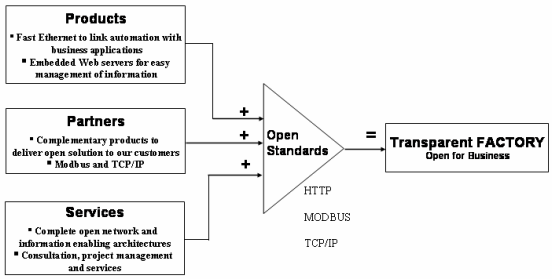

Figure 1: TF Concept (Schneider Electric, 2002)

3 AWARENESS

There is a need to move away from hierarchical organizational structure and functional management towards a horizontal cellular structure for people to work effectively, especially in a dynamic environment with cultural diversity.

Given the intense competition in the world market today, a greater degree of specialization among countries seems to be the trend in order to gain comparative advantage. This in turn leads to more and larger firms investing in countries where technical expertise is found. This new trend almost invariably means companies will increasingly have to face cross-cultural management. The cellular structure with its flexibility offers a good way for such firms to meet this new challenge.

One of the global e-business solution provider reports that 63% of memberships are owned by Asia region and 37% represented by the America and Europe. As Intel implemented the solution, Asia tops the list among Intel plants for about 65% compare to North America and Europe about 27% and 8% respectively (Annual Summary, 2003). Also mentioned that Asia-based government agencies have committed funds for implementation assistance, over US$51 Million through 2003. Looking at SEA, Malaysia's government allocated a US$1.4 Million for the said solution grant, whereas in Singapore, an authority has approved US$240,000 in funding for the development of the e-learning center for the e-business solution.

In general, trend in information technology (IT) usage over the last two years has shown significant improvement both for primary and support activities. Significant increase in usage is noted for the procurement/purchasing activity, after sales service and inbound logistics. It is observed that companies are increasingly using IT for both operational as well as strategic purposes. The application of IT has clearly shown its effectiveness. IT has enable companies to provide better services, promote revenue growth, innovate new products and processes, and form strategic alliances. The diffusion of IT across all industries ought to continue as the nation geared towards the knowledge-based economy.

It is a huge market in SEA as far as electronic business is concern. Governments in this region are putting great effort and to some extend create competition among them to attract investors into their country. They believe that electronics related businesses and manufacturing would capture the current business world in very near future.

4 CASE STUDY 1

The plant was incorporated on 9th December 1991, operates Malaysia's first integrated scheduled waste management system. The system constitutes complete management of scheduled waste from collection at the waste generator's premises to transportation, treatment and final disposal.

In line with the implementation of OHSAS 18001, the management has targeted two main objectives. There are to achieve zero Loss Time Injury (LTI) and to ensure legal compliance to related legal and other requirement.

One of the programmes arranged to achieve zero LTI is Monitoring program for potentially exposed personnel to radiation. This was found as a significant hazard and to minimize time spend by their employees for activities like monitoring, troubleshooting, data collections etc, TF has been identified as the best solution by providing remote access to their monitoring and control devices.

Breakdown minimization has seriously encouraged the company to implement TF. It is estimated that for every 1 hour of downtime, the company has to bear lost of approximately US$52.6K. With the system installed, instrumentation staff that takes about 5 hours drive from hometown in the case of urgent situation, can

actually rectify the problem from his hometown while happily spend time with family. The total cost to implement the system is insignificant compare to the total maintenance budget the company spends annually which is about US$2.63 million.

The system consists of a single master radio modem connected to Human Machine Interaction (HMI) workstations with PLCs and modems. The PLCs serve eight stations scatter-ed throughout the factory limits as shown in figure 2.In the master station sites' configuration, the Master modem communicates via remote access server, which in turn communicates with the 24 PLCs over a 2.5km fiber optic network. All stations use Schneider's Connexium Switches connected directly to PLCs via a RS232 to Ethernet converter. The system runs at 19,200-baud rate via RS232 and 10Mega-baud rate via Ethernet TCP/IP. The HMI system provides monitoring and control of all stations to operators at a Central Control Center.

Plans include connecting the current system to a Wide Area Network (WAN) to further extend access to the remote sites. One of the features that is most useful is the ability to remotely monitor any of the PLCs over a web browser via a Schneider's Embedded web-server from the host workstation. This SCADA (Supervisory Control and Data Acquisition) succeeds two previously installed radio systems, neither of which operated acceptably.

Schneider Automation's TF's architecture provides seamless communication between Ethernet and Control network. Now with Schneider Electric's embedded web servers, industrial plants may gain the benefits of TF without additional cable installation. Designed for control, configuration and data collection applications, the TF architecture adds broad capability to Ethernet in PLC systems. By providing a highly reliable Ethernet connection, peripherals may communicate on the plant network without the expense and delay of cable installation.

The wireless connectivity also solves the problem of communicating to devices where cable workstations and devices installed on moving platforms. In the past, these devices would be isolated from the plant network. For example, a portable PC may now connect to the network virtually anywhere in the plant. This permits plant engineers to work at the problem location while having full access to the network

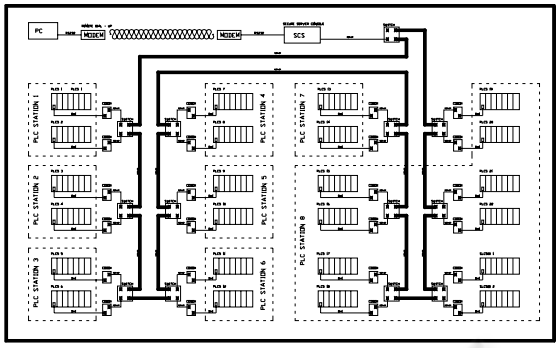

Figure 2: The Plant Remote Access System

5 CASE STUDY 2

In line with the end user's initiative to achieve operational excellence, they have chosen the TF concept for the following reasons. First, *Global data access*, as data is made available at any time and able to be assessed from anywhere through internet, it minimizes unnecessary travel to remote site. It also improves quality management as the plant is controlled in every aspect including the production and productivity.

As the site is located about 150 km from the office and the journey to the field is not comfortable. It is a good idea to monitor, maintain the system remotely from the office, and reduces the trips to the field. Secondly, *Standard based architecture* which obviously reliable and it enables collaboration, lowers total cost of ownership, reduce training cost, and widely applicable skill sets. The end users are able to bring application online faster hence maximize Return of Investment.

Third, *Scalable*, Publish-subscribe technology that supports deterministic many-to-many communications and synchronization of distributed application. It allows efficient utilization of available bandwidth. Fourth, *Seamless Integration* with existing system without significant additional cost contributes towards efficient utilization of communication networks. The existing Area-1 system is using Modbus and Modbus Plus Network. Area 2 & area 3 are using Modbus TCP/IP through embedded web server module (NOE), complete with web support. Area 2 consists of the following system: Water injection system PLC, MCC for water injection system and Vibration Monitor systems. Whereas, Area 3 consists of the following system; Oil shipping system PLC and MCC for Oil shipping system. The detail layout is as shown in figure 3.

Remote monitoring through close circuit TV (CCTV) in remote area 2 &3 is achieved over the coaxial link into the multiplexer to be displayed on

the surveying monitor in KB control room. These signals are also being conveyed onto the local LAN.

The seamless integration of Area-2 &3 with Area-1 through Modbus TCP/IP, Modbus plus and Modbus network allows the information flows freely anywhere in the system. SCADA for Water Source Well & Production Well is using Serial Radio Communication. There are about 60 wells are monitored and controlled. These wells are spread around the site for about 20 km in radius.

Fifth, *Maintainable;* Internet remote access offers remote support capabilities including diagnostics, trouble-shooting, remote alarming, predictive maintenance , download program or parameters updates, automatic node recovery, reconfiguration capability and faulty device replacement. Poll of support personal located at centre office can directly access to plant control system during breakdown to troubleshoot.

Since TCP/IP technology is used in TF, the system also integrate the existing human machine interface (HMI) and CCTV through TCP/IP network. Therefore, user can access the site remotely using the existing intranet.

Generally, the system consists of two main SCADA system that are SCADA for Water Source Well & Production Well and SCADA for Gathering Station. Both SCADA systems are integrated in one Server. All data in the server can be accessed remotely, depends on the user's password. SCADA for Gathering Station is based on Modicon Quantum PLC with TF, enhanced with HMI, Vibration Monitor, CCTV Monitor, etc.

6 CONCLUSION

In this paper, the concept of TF has been explained in simple manner with typical application examples. The initial cost has not been mentioned in this paper even though it is the main criterion for any organization to decide on the possible imple-mentation, of TF. Notwithstanding an obvious high preliminary cost the concept has been proven of its competence on providing complete solution to the entire enterprise's efficiency in a long run. Also presented that in order to implement more flexible and effective business, government in SEA is pumping millions of money in for the past few years. Two case studies presented clearly show that TF will be accepted gradually in South East Asia. As business gets borderless, TF will indeed the best solution for productivity, safety & health and ultimately for the overall enterprise's efficiency.

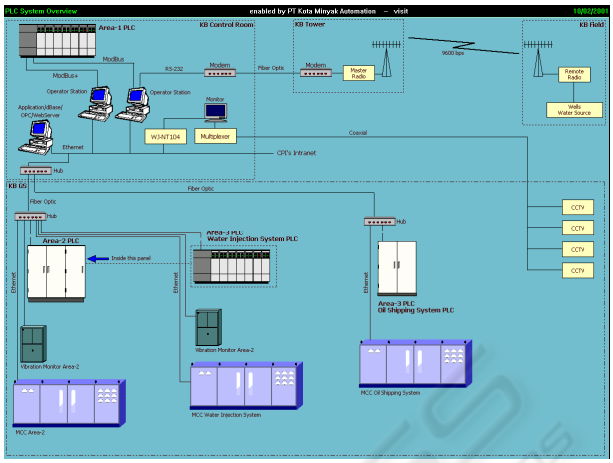

Figure 3 : Detail Layout

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