

Enterprise Architecture and Information Systems

- In Japanese Banking Industry -

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Abstract— Japan is currently facing some environment changes, like global competition, deregulations, highly developed information technology (IT), etc., so Japanese firms need to increase their productivity more than ever before and use flexible information systems to survive. Historically, the biggest challenge facing firms is “adaptation” to any environment. The flexibility of information systems to create business values has long been discussed as a critical problem among IT communities. One potential solution is to adopt a web service using service-oriented architecture (SOA). When SOA is adopted, an enterprise architecture (EA) viewpoint is crucial. We clarify the problems when firms implement SOA and discuss solutions from an EA viewpoint while also discussing the relation between EA and information systems on the basis of our factor analysis of the Japanese banking industry.

Keywords: enterprise architecture (EA), service-oriented architecture (SOA), information system, factor analysis

1. BACKGROUND OF RESEARCH

Japanese firms in the banking industry are facing business environment changes, such as an expansion of products and services (like securities, insurance, and trust), investment behavior change, the increase of specialized internet banking firms, globalization, and merger and acquisition among industries. Due to these circumstances, they have to autonomously change their business models to be able to survive, and their information technology (IT) departments have to develop their information systems to effectively and flexibly adapt to these changes. One potential solution is to adopt a web service using service-oriented architecture (SOA). In this case, the enterprise architecture (EA) viewpoint is crucial. EA refers to how IT components fit together to support the business architecture. For instance, there is no way to alter automobiles or airplanes without product design sheets and descriptions, whereas when establishing business models, firms must describe what they do and how they will do it using IT. The architecture for building them is not so mature compared with making automobiles or airplanes.

In Japan, IT has penetrated to not only personal users but also to the business world. Though IT departments in Japanese companies have been developing information systems for many decades, they have focused on the maintenance and evolution of existing information systems, i.e., legacy systems that, from management viewpoints, are already recognized as hopelessly inadequate for using the most sophisticated IT to satisfy current

demands. Due to circumstances such as global competition, deregulations, and the highly developed IT surrounding Japanese business, it is imperative that Japanese firms accelerate productivity more than ever before by using IT at the right time and at lower costs as part of their business strategy.

When firms build their information systems, they do not build them from scratch, but implement and connect them with other systems by using web technology. Business users are then able to use the service. This SOA concept, however, is not new; it is similar to object technology or component based development. Since the IT itself is very sophisticated and highly advanced, firms have been able to focus on SOA. To achieve this, there should be one business architecture, such as EA, that describes the business rules by which the business is put together and that also includes the IT elements. This is necessary because the rate of change in the business environment requires organizations to cost-effectively synchronize these two activities to reduce unnecessary delays. Figure 1 shows this situation.

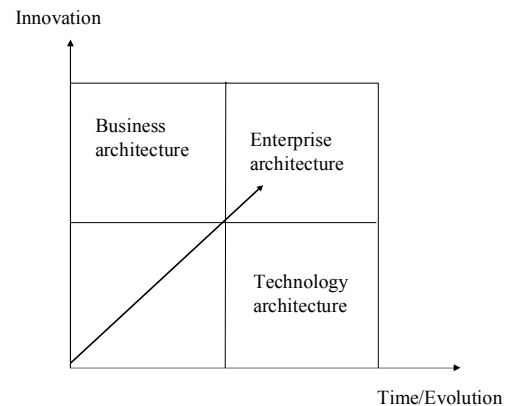


Fig. 1. Positioning of EA

In section 2, the requirements for information systems in the Japanese banking industry and the relationship with EA is discussed. Section 3 addresses the issues when adopting SOA. Section 4 describes the factors that influence the effectiveness of IT governance. Section 5 concludes the paper and presents future directions for this research.

2. REQUIREMENTS FOR INFORMATION SYSTEMS AND EA

For Japanese firms to implement EA is certainly not a new concept. There is considerable doubt however, that not only senior executives, such as the chief executive officer and chief operation officer, but also the chief information officer and system people, understand the difference between an EA approach and traditional standardization approaches using modeling framework or techniques similar to architecture frameworks. This will later be further discussed. Moreover, it is often challenging enough for them to recognize their own existing business system architecture, due to the increasing complexity of current information systems, heterogeneous information system environments, and the lack of integrated EA models.

2.1. Modeling in information systems and EA

Is the enterprise modeling framework a new technique for developing EA? We previously discussed how we should establish enterprise modeling covering 10 years from the viewpoints of both the business and the information systems domains. Enterprise modeling technology was first shown in an international conference in 1992 [1]. The IFIP¹ and IFAC² Working Conferences addressed problems regarding enterprise integration [2]. From a process-oriented presentation aspect, several enterprise modeling methodologies have been proposed in the past decade: CIMOSA³, IEM⁴, and PERA⁵. A process-oriented presentation has many advantages over other solutions, on the basis of a comparative study of the three models mentioned above [3]. The virtual corporation was also discussed in the mid 1990s [4]. However, concern about enterprise modeling for e-business or e-commerce has been growing recently. An e-business reference process model especially for e-business communities has been proposed by MIT [5]. It can provide a standard model for start-ups, which will conduct e-business entirely in the virtual world. Enterprise representation, which is standard for designing and creating new enterprises, is essential for a virtual enterprise using Internet technologies. On the other hand, from a data-oriented presentation aspect, which is beneficial for IS communities, entity relationship (ER) diagrams and data flow diagrams (DFDs) have been very useful for describing corporate data structure for the information system domain for decades. In Japanese industries, some firms have been trying to use these data and process models from an information system domain viewpoint rather a business domain viewpoint, but other firms have not. As we stated above, although enterprise modeling is very similar to EA, it clearly does not have the same effect.

2.2. EA and requirements for information systems in Japanese banking industry

The Ministry of Economy, Trade and Industry (METI) has surveyed the EA frameworks noted above, which the US

government was trying to use. METI planned to promote an enterprise architectural initiative to Japanese industries in 2002, which was originally based on the US Federal EA Framework (FEFA) model. Even though several EA frameworks have been introduced all over the world, there are very few research reports and theses that give scientific support on how to assess the effect of EA [6], although we only focused on the research regarding well-know frameworks.

In the Japanese banking industry, firms are facing business environment changes previously described. In particular, the industry will have to focus on not only compliance but also competition for the next few decades. Due to these circumstances, Japanese banking firms have to autonomously change their business models to be able to survive, and their IT departments have to develop their information systems to effectively and flexibly adapt to these changes. One potential solution is to adopt a web service using SOA, as discussed before. When SOA is adopted, the EA viewpoint is crucial. In the banking industry environment previously described, a web service using SOA and with an EA viewpoint would be effective.

Tokyo Mitsubishi Bank (TMB) is a major bank in Japan. TMB implemented EA in 2002 to maintain the integration between its business strategy and system structure and to optimize the system [7]. Of note in the TMB case is that every knowledge asset, including the intangible assets stored in a single database, was triggered by senior management awareness. This was because TMB considered this approach a method to achieve total optimization independent of personal skills. First, TMB developed a principle that defined system development and maintenance and an EA policy that described the integrity between its business strategy and system design policy, for a valid implementation that met its business requirements. TMB also developed a three-level architecture model. Level-1 describes six main system groups only for management. Level-2 describes five subsystems to be broken down from level-1 to show application logic and data and the relation with other subsystems for business users. Level-3 describes a detailed design for more than 200 applications for systems people. In addition, TMB defined a technology standard that specifies its own technology standard and technology trends and also specifies assessment criteria that shows the criteria for selecting packages and products. Moreover, TMB defined an EA management process, which is conducted by several reviews to maintain its quality.

EA is playing a critical role in innovating the business models of Japanese banking firms, such as in the TMB case.

In the next section, on the basis of our interest and previous related work, we raise some issues to be discussed about the relationship between IT governance and EA.

3. ISSUES IN ADOPTING SOA

Before implementing SOA, firms must establish EA, such as TMB did. A TMB system manager has said that IT governance is very important when implementing SOA, and Peter Weil and Richard Woodham, in their research, also emphasize that IT governance specifies a decision rights and accountability

¹ International Federation for Information Processing

² International Federation of Automatic Control

³ Open System Architecture for CIM

⁴ Integrated enterprise modeling

⁵ Purdue Enterprise Reference Architecture

framework that encourages desirable behavior in the use of IT [8]. To assert better control over IT, align IT with business objectives, and balance its potential benefits and risks, firms in recent years have paid considerable attention to the issue of IT governance. Also spurring this renewed attention are financial regulations such as Sarbanes-Oxley, which calls for the improved documentation of IT systems and tighter control over who uses the systems and to what end. The result is that firms have sought to bring to IT the kind of streamlined and rigorously defined business processes and reporting structures that IT has helped make possible everywhere else in the firms. We address the following issues with regard to IT governance:

- (1) What is an appropriate model for IT governance in the Japanese banking industry?
- (2) What are the challenges and issues with existing business models and information systems?
- (3) What will drive IT governance?

4. FACTOR ANALYSIS OF IT GOVERNANCE

4.1. Introduction of fundamental model

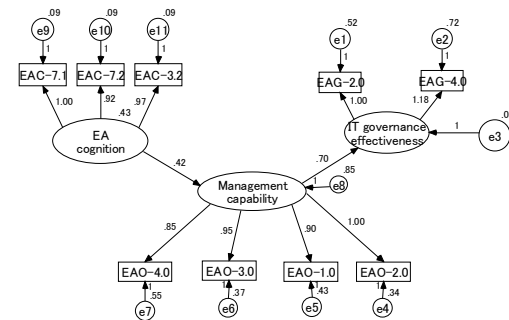
We assume that firms would have had many problems, such as delays in responding to business needs, the increase of system maintenance costs, problems with the overlap and reuse of existing resources, and system integration difficulties, without EA. This will cause the implementing of an enterprise information system to be high risk. As we discussed earlier, firms do not have to, by themselves, develop EA from the beginning. Instead, they can refer to existing EA frameworks. However, the framework itself cannot directly impact anything, though it will guide architecture development. On the basis of our related work, described in section 2, and the outcome of a survey regarding EA trends [9], the following assumptions can be made.

1. The methodologies and tools for EA will be effective for developing and maintaining EA, but using only these ways will be not enough in the long run.
2. The corporate culture is one of the barriers when changing business models based on EA. Corporate governance needs to be controlled when changing the model. With regard to IT, IT governance and management capabilities are especially important. As a result, EA and IT governance are tied together.
3. The top management's involvement is necessary when changing the business model. Cognition with regard to EA is also very important. Therefore, the top management's cognition must be higher than ever

before.

4.2. Approach to analyze EA and IT governance relationship

We conducted an online survey for verifying these hypotheses. The data was collected from 308 Japanese firms in 2006. The questionnaire consisted of 3 categories: EA cognition, governance with related EA, and organization. We then developed a covariance structural model by making a measurement and a structure model. Figure 2 shows the fundamental model, and Table 1 shows the latent and measurable variables of the covariance structural model.



Chi-square = 56.29
 GFI = 0.961
 AGFI = 0.930
 RMSEA = 0.64

Fig. 2. Covariance structural model for EA and IT governance

Figure 2 shows some major indications that this model fits the hypotheses noted above relatively well. We found that it is crucial for business processes to be transparent through data and application architecture and to focus on the returns from the investment of integrating business and IT in the organization. In addition, this research showed that risk management and internal control within an organization are highly linked to IT governance. In conclusion, EA cognition that is highly related to management capability will drive the effectiveness of IT governance.

Table 1. Latent and measurable variables of covariance structural model.

Category	Latent variables	Observed variables	Explanation
EA	EA cognition	EAC-3.2	Whether or not EA influences visibility of business operations
		EAC-7.2	Whether or not data architecture is implemented in scope
		EAC-7.3	Whether or not application architecture is implemented in scope
Governance	IT governance effectiveness	EAG-2.0	Whether or not internal control is established
		EAG-4.0	Whether or not risk management is controlled
Organizational management	Management capability	EA0-1.0	Whether or not relationship between business and IT is well coordinated
		EA0-2.0	Whether or not way to check relationship between business and IT strategy is effective
		EA0-3.0	Whether or not business process is well supported by IT
		EA0-4.0	Whether or not return on investment is calculated

5. CONCLUSION

Although in the Japanese banking industry not many firms have implemented SOA, the fundamental model we showed is a good reference not only for this industry but also others. A recent trend in this industry is that web services are being used in not only transactional banking systems, such as part of the core banking system, but also in analytical banking systems and information management systems. Moreover, with regard to banking channels, Internet banking and mobile banking have also expanded. When firms implement a web system, we noted that an approach from an architecture viewpoint is critical. However, SOA is simply a system architecture. Though we did not investigate any SOA implementation method in this research, we showed what is essential for it in section 3. We also noted that IT governance is a critical factor. To increase its effectiveness, we discussed what would be needed and showed a fundamental model based on a covariance structural model analysis. As a result of this analysis, we found that EA cognition with management capability will influence the effectiveness of IT governance. For the next step in this research, we will conduct a more detailed factor analysis and create and compare some different models to identify the best selected fundamental model with regard to not only EA and information systems such as SOA, but also the EA and IT governance relationship model.

[9] EASurvey, <http://www.enterprise-architecture.info/images/EA%20Survey>

REFERENCES

- [1] C. Petrie, Jr., "Enterprise Integration Modeling Technology," in Proc. 1st International Conf., MIT Press, Boston, 1992.
- [2] P. Bernus and L. Nemes (ed.), "Modeling and Methodologies for Enterprise Integration," in Proc. of the IFIP TC5 Working Conference on Models and Methodologies for Enterprise Integration, Chapman & Hall, Queensland, Australia, November 1995.
- [3] K. Kosanke, "Process Oriented Presentation of Modeling Methodologies," Modeling and Methodologies for Enterprise Integration, (ed.) P. Bernus and L. Nemes, pp.45-55, 1996.
- [4] J. A. Byrne, The Virtual Corporation, International Business Week, New York: McGraw-Hills Publication, 1993.
- [5] MIT eBusiness, <http://ebusiness.mit.edu> (10 March 2005).
- [6] J. Schekkerman, How to Survive in the Jungle of EA Frameworks, Canada: TRAFFORD, pp.67, 2004.
- [7] T. Hoshino, EA TAIZEN, Tokyo: Nknei BP, pp.128-131, 2004.
- [8] P. Weill and R. Woodham, "CISR Research Article 2002 April 2002," Center for Information Systems Research, MIT Sloan School Management, Cambridge Massachusetts, CISR WP No326 and 4237-02.