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AN INTEGRATED FRAMEWORK TO BRIDGING THE GAP BETWEEN BUSINESS AND INFORMATION TECHNOLOGY – A CO-EVOLUTIONARY APPROACH

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ABSTRACT

Information technology has become an indispensable part of business organizations and as a result greater interdependence between IT and business has emerged. Due to increasingly dependency of business on information technology (IT) it is necessary that business processes and IT co-evolve so that co-evolutionary changes generate successes in business organizations. This paper presents study aims at providing a co-evolutionary framework that could facilitate organizations to understand co-evolution in an integrated way. A co-evolutionary layered framework will help understand the reasons for business-IT gap and assists organizations to reducing the gap in order to achieve alignment business and IT. A co-evolutionary methodology adopted for studying evolution in business and IT. Together with this a survey instrument technique has also been used for data collection in financial domain that is used to study and validate the framework. This study encourages researchers to further develop a framework that could determine the rate of co-evolution in order to control evolution of business and IT in organizations.

Keywords: Co-evolution, alignment, business-IT gap, framework.

INTRODUCTION

Business organizations are constantly changing and adjusting business processes in order to meet business requirements. A changing business environment causes a business to change its processes, services and products to be competitive in marketplace. This change in business affects underpinning information technology (IT) and requires new system that could fulfil the new business requirements (Khan and Zedan, 2010). Due to financial constraints organizations do not readily replace technologies and new functionality is added to the existing technologies that cause complications and problems in the systems. This behaviour attributes to a miss-configuration that creates a gap between business and IT (Khan, 2012). Organizations strive to reduce the gap between both the entities i.e. business and IT and develop different models to achieve alignment. In order to achieve organization's goals and objectives when business requirements are fulfilled by using IT in a timely and collaborative manner effectively, it is said there is alignment between both business and IT. An effective alignment greatly influences IT, effectiveness and leads to superior business performance. The importance of alignment between business and IT has been recognized a long time ago (Corteau and Bergeron, 2001; Sabherwal and Chan, 2001). The rapidly changing business requirements demand to develop new business processes and evolve the supporting IT in order to be competitive in market (Curtis et al., 1992). When business processes and

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supporting technologies are evolved, essentially the alignment gap should be kept a minimum between both the domains.

Many researchers and practitioners have developed various approaches and frameworks to reducing the business-IT gap and increasing an alignment between the two entities. A strategic alignment model was presented as a multidimensional model (Henderson and Venkatraman, 1999). This model has various dimensions that include strategic alignment, strategic and functional dimensions, internal and external dimensions. In this model 4 different alignment perceptions have been described. There are two perspectives 'strategy execution' and 'technology transformation', that are considered to be the drivers of the business strategy while the other two perspectives 'competitive potential', and 'service level', are thought to be the facilitator for IT strategy. To address business and IT alignment a process-driven architectural framework Strnadl (2006) introduces and employs four-layer model for reducing the gap between business and IT. It is considered that there is a gap between the management of IT perception and practice and the model aims at filling the gap by focusing on business requirements and information management. Organizations consider the gap between business strategy and IT strategy a critical issue as it directly impacts on the business. Therefore, it is important to know the reasons for the gap between the two entities and a case study methodology has been used to study the reasons. The study Rathnam et al. (2005) concluded that there was a gap between business and IT strategies in some targeted organizations. The research findings however cannot be

generalized for other organizations. Companies are using IT to providing personalized services to their customers and to develop better customer relationship management. Therefore, business and IT are not only in alignment relationship and model, but they are in co-evolution relationship where business develops as the IT capabilities enhanced (Agarwal and Sambamurthy, 2002). Tivnan (2005) supported co-evolutionary dynamics and agent-based models in organizational science in his study. Co-evolution term was adopted by Morrison *et al*. (2007) to describe the evolution of business and software at different rates. Then co-evolution was extended to accommodate wide-informatics systems that are assembled from parts that co-evolve with each other and their environment. Zedan *et al*. (2001) developed a framework 'K-Mediator' (Knowledge Mediator) that acts as a mediator between business requirements and underpinning technologies. The framework is knowledgeable of business needs and available IT assets within the organization. To achieve business-IT alignment (Aier and Winter, 2009) have proposed an architecture-centric approach that separates external view of architecture from its implementation. Jan *et al*. (2010) have supported enterprise architecture for business-IT alignment. They have presented a situation-based solution as situation varies from organization to organization. A conceptual model-driven approach (Martin *et al*., 2010) has been presented for business-IT alignment that aims at restriction of freedom in process modeling. Benbya and McKelvey (2006) have viewed a -IT alignment as a co-evolutionary process and presented a model based on co-evolution theory. A process-oriented approach has been presented by Tallon (2007) for the alignment of IT and business. Strnadl (2006) has introduced a process-driven architecture (PDA) that is based on four layers (process, information, services and technology integration) and each layer attempts to bridge the gap between business processes and IT by using a nomenclature understandable to both business people and IT people. Aversano *et al*. (2005) presented a coarse-grained approach in which they described when changes are implemented in business processes a misalignment occurs that can be detected by coarse-grained strategy.

As many researchers have proposed different models for aligning business and IT, but none of them presented a co-evolution framework that could achieve alignment at all levels in an organization. Therefore, this study proposes a co-evolutionary framework that may bridge the gap between business and IT.

MATERIALS AND METHODS

The Research Methodology
The term co-evolution has been introduced by Ehlrich and Raven (1964) and in research context it is taken to mean that the evolution of one entity partially depends on the evolution of another entity (Ehlrich and Raven, 1964; Kauffman, 1993; Koza and Lewin, 1998; Mckelvey, 1999). In other words one entity changes in the context of another. Co-evolution takes place in an ecosystem and in biology an ecosystem means each type of organism has other organisms of the same type and of other types as parts of its environment (Kauffman, 1993). Business and IT strategy should co-evolve mutually to respond to changes in the business environment. A multilevel perspective helps to study the co-evolution between the business processes and IT. The co-evolution study at different levels such as at strategic level - business and IT strategies, at operational level – business and IT functionalities and at individual level – IT infrastructure with end users is carried out to finding out the co-evolution between the entities. The co-evolution methodology helps to determine the co-evolution at different levels in any organizations (in present study it is a bank ABC). For collecting data multiple research methods approach has been used (Burgelman, 1994).

In order to collect data a survey instrument was devised in which open-ended and close-ended questions were designed. For the instrument a five-points Likert's scale has been used where the range of responses is from 'Strongly Disagree' to 'Strongly Agree' with a middle option as 'Neutral'. A respondent opted 'neutral' to indicate the middle response between neither agree and disagree. A typical Likert's scale (with the numerical values) to represent data has been used i.e. SA = Strongly Agree (5), A = Agree (4), N = Neutral (3), D = Disagree (2), SD = Strongly Disagree (1).

There were 118 questionnaires delivered to the employees working at different levels in the bank and 71 completed questionnaires were received. The reliability of a questionnaire is significant in extracting the results and internal consistency is an important aspect of reliability that shows consistency in the measuring scale (Cronbach, 1951). An item is said to be reliable when it produces the same results from the same object (Carmines and Zeller, 1979).

In the survey instruments and interviews all the items were found with alpha coefficient values in the range of 0.67 to 0.72 that show reliability of the data.

Co-evolutionary Integrated Framework
A well-known strategic alignment framework (Henderson and Venkatraman, 1993) proposed alignment between business and IT in terms of organizational patterns and scope that are dependent on IT. The model demonstrates the alignment between business and IT in two aspects; i.e. the first aspect is strategic fit (i.e. alignment) between external and internal domains and second aspect is functional integration between business and IT domains. To achieve alignment, it is necessary that IT is positioned strategically in the corporate structure. This ensures that

business strategy has the latest supporting technologies and the required services. An appropriate strategic IT planning is useful in aligning with the business processes that help to find out new opportunities (Papp, 2004). Reich and Benbasat (2000) suggested that for strategic position of IT within organization requires professional from both domains (i.e. business and IT) should be knowledgeable in both domains.

In our proposed co-evolutionary framework we understand there should be a monitoring mechanism that could check the requirement either for business or technology so that co-evolution process occurs. Zedan *et al*. (2001) developed a framework 'K-Mediator' that plays a role of mediator between business and information technology. The K-Mediator tool is knowledgeable in both business needs and the supporting technology assets in organizations. It can have first-hand knowledge of business requirements that need an IT solution; this makes it more important than an architect, requirement engineer or domain engineer since these can make errors in expressing requirements. Figure 1 shows that in result of internal and external events such as politics, business tactics, finance and strategies the impact is analyzed as k-mediator is knowledgeable in both domains.

K-Mediator
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can have first-hand knowledge of business requirements that need an IT solution; this makes it more important than an architect, requirement engineer or domain engineer since these can make errors in expressing requirements. Figure 1 shows that in results of internal external environment and events such as politics, business tactics, finance and strategies the impact is analyzed as k-mediator is knowledgeable in both domains. The computation unit of K-Mediator is component that encapsulates services which are accessed by interfaces. A component contains two types of services i.e. 'provided services' and 'required services'. Provided services have set of features while required services contain components for performing services.
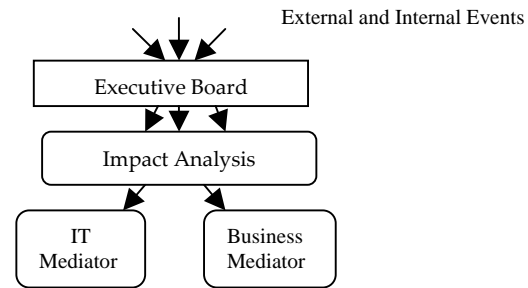

Fig. 1. K-Mediator.

The mediator is an important part of our co-evolutionary framework that is responsible to monitor the requirements
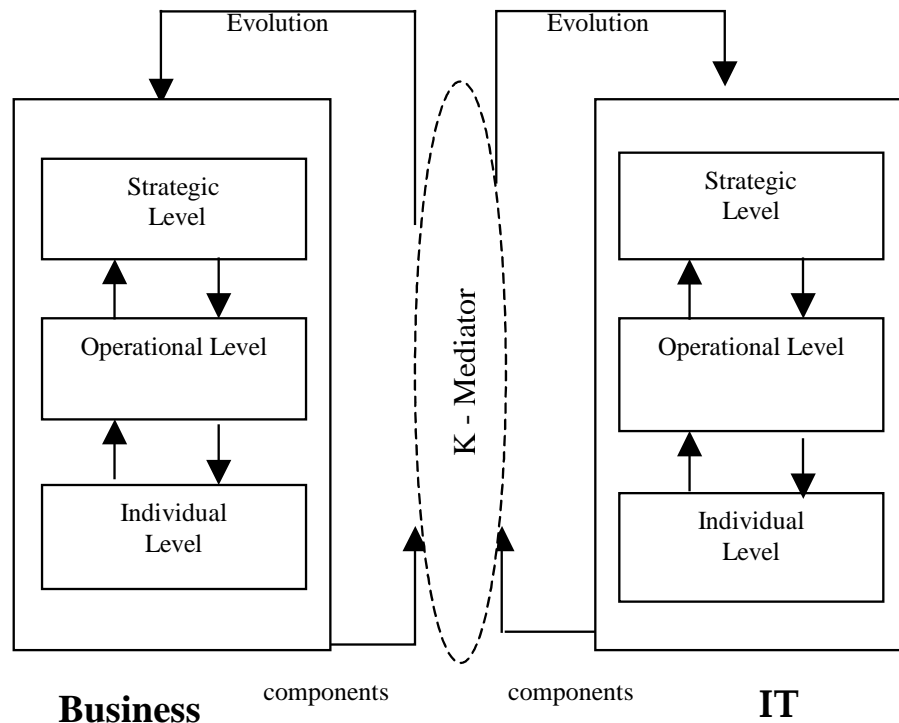

Fig. 2. Co-evolutionary Framework.

and create or compose the required components. Figure 2 illustrates the co-evolutionary framework that shows three levels of business and IT and their components such as strategy, rules, policy, departments, software, hardware etc. All levels are integrated by K-mediator that facilitates co-evolution of business and IT.

In our framework the K-mediator plays a central role at all levels that inputs requirements into an IT repository where a Knowledge Base supports the requirement as the concerned business. The mediator checks the IT asset in order to find available component(s) to support the requirements or create new ones (i.e. evolution in IT). If components are available then composition of the components fulfills the business requirement otherwise new components are to be developed and integrated. Hence, the system co-evolves with the change in business requirement and its IT solution.

The proposed framework consists of three layers with K-mediator and the layers are strategic layer, operational layer and individual layer.

Strategic level
At the strategic level both business and IT strategies co-evolve. Companies manage their business processes and deliver products and services to their customers. At times companies need to adapt business strategies in order to be competitive and effective in the marketplace. As the business strategies are changed IT strategies must be changed in order to support business processes. This will be achieved by the knowledge mediator (k-mediator) who is knowledgeable in both the domains. Therefore, at the strategic level business and IT strategies are co-evolved as the k-mediator is always there in order to achieve co-evolution.

Operational level
Business executives and IT planners need to understand each other's requirements in order to build successful links between business objectives and the IT architecture. At this level software applications and related components fulfill the business requirements that rely on underlying operating systems and databases. People from both business and IT must discuss and develop an effective collaborative partnership at all levels. The IT resources are used to support the business processes in order to meet organization's objectives and therefore, operational performance at all levels is important.

Individual level
A system or IT architecture may not be effective unless if fulfils the user's requirements. The individual's requirements change drastically and therefore, it is necessary to involve users in the development process.

In our the proposed framework the K-mediator plays a central role all levels that inputs requirements into an IT repository where a Knowledge Base supports the requirement as the concerned business. The mediator checks the IT asset in order to find available component(s) to support the requirements or create new ones (i.e. evolution in IT). If components are available then composition of the components fulfills the business requirement otherwise new components are to be developed and integrated. Hence, the system co-evolves with the change in business requirement and its IT solutions.

Evaluation of Framework
To evaluate the proposed co-evolutionary framework in financial domain different measures and dimensions are subjects of interests in order to determine the co-evolution of business and information technology. There are four methodologies for empirical research in information systems areas namely case studies, laboratory studies, field studies and field tests. For collection of data we one of the largest banks in Saudi Arabia was selected and questionnaire were delivered to employees at different levels in business and information technology. The questionnaire approach is useful in obtaining quantitative scale and qualitative data (Cronford, 1997). The questions in the questionnaire were categorized concisely and clearly for example, business strategy, technology strategy and overall organization performance. Many researchers have found that IT has great impacts on the performance of an organization (Anderson, 2001; Cragg et al., 2002; Guneskaran et al., 2001). To measure this dependent variable different items were used that are listed in table 1

Table 1. Items for organizational performance.

Item	Expression
FPS	Financial products and services
ASG	Annual sales growth
CS	Customer satisfaction
OC	Operational cost
MS	Market share
RS	Rewards to staff
OI	Organization image
QPS	Quality of products and services
ROI	Return on investment
IRR	Internal rate of revenue

Performance of the company is affected by various factors, but the interest lies in the business strategies, IT strategies and the IT environment including the architecture that is being used in the company. The

measurement items for business and IT strategies are listed in tables 2 and 3, respectively.

Table 2. Items for business strategies.

Item	Expression
BSIT	Significance of IT
BSP	Engagement of IT people in business strategy
BRIT	IT role in business strategy
BOGT	Organization growth due to technology
BMIT	Involvement of business and IT managers
BPRO	Business process reengineering
BPAS BART	Awareness of business and IT strategies in personnel
BSPC	Updates in business architecture
BOR	New services and products to be competitive
	Organization's willingness to take risk

Table 3. Items for IT strategies.

Item	Expression
TICS	IT link with corporate strategy
TA	Acquisition of technology
TBA	IT budget is not considered as an asset
TLB	Lack of business knowledge in IT
TUR	Systems are updated with requirements

RESULTS AND DISCUSSION

It is observed the bank performance is satisfactory and the business model is working appropriately. However, it is noted that in overall performance of the bank people did not agree entirely that IT has helped to gain more revenue and market share. The significance of IT is not recognized in business strategies and IT personnel are not invited during the formation of business strategies. This trend shows at operational levels in business and IT do not co-evolve. As business strategy is composed of corporate strategy, business and operation strategy, it is noted in the most of the employees do not agree that IT has significance in business strategies and IT people should be engaged in business strategy. This implies that operational levels between business and IT do not co-evolve. Due to the lack of communication successful links between business objectives, IT strategy and underlying architecture insufficiently developed and a gap is created. Since most of the employees were not well aware of business and IT strategies in the bank, the co-evolution did not occur at all levels. Although the performance of the bank is good but it can be improved by applying the proposed co-evolutionary framework.

Organizations need to utilize the full capabilities of its IT infrastructure that is composed of technical (such as software, hardware, networks etc.) and human components (such as technical skills, capabilities and IT knowledge). Business processes should be reengineered continuously and it is important that all people in organization are well aware of it. The awareness of business process reengineering will be affective when all the three levels co-evolve that are proposed in the co-evolutionary framework.

In figure 3 it is evident that customer satisfaction increased (CS value 4.13) in result of increasing quality of service and product (QPS value 4.09). This resulted in growth of internal rate of revenue (IRR value 4.24) and return on investment (ROI value 4.23). Although, overall performance of the bank is satisfactory but the image is not improved as depicted by organization image (OI value
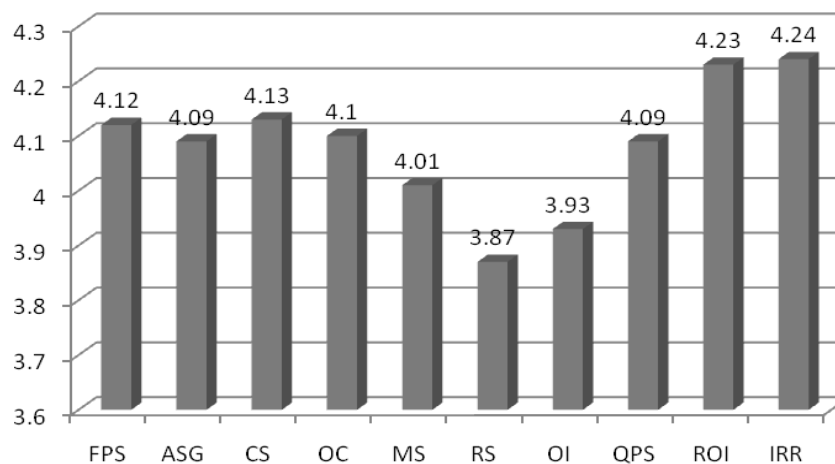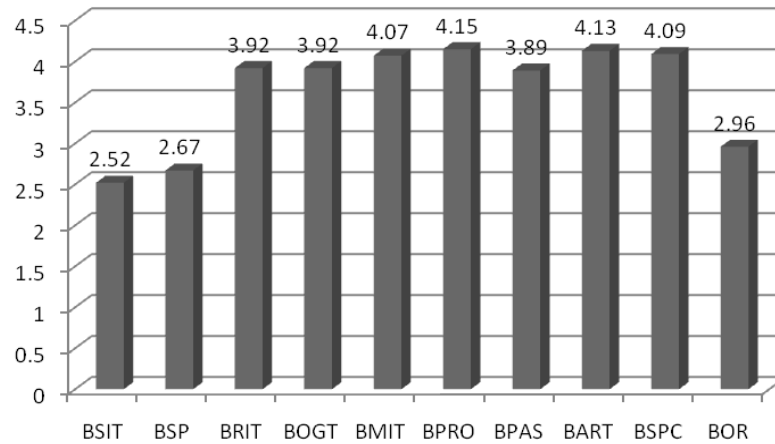

Fig. 3. Organizational performance scores.

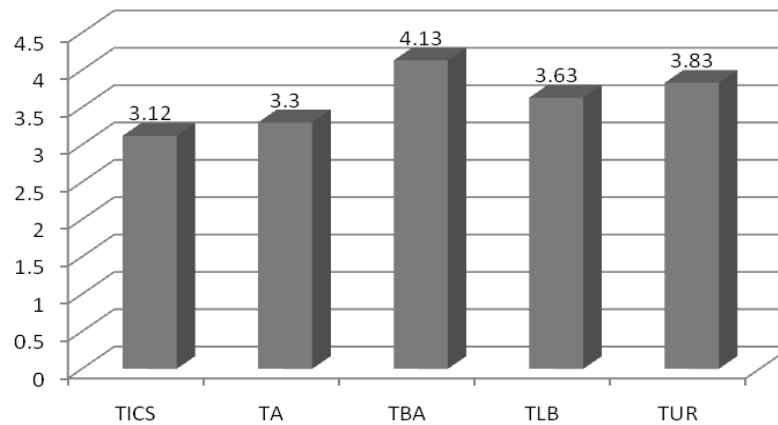Fig. 4. Business strategies scores.

Fig. 5. IT strategies scores.

3.93). This data may be complemented with RS (value 3.87) where staff members are not rewarded based on their performance.

Figure 4 shows that majority of the employees agree that business process reengineering (BPRO value 4.15) is necessary for business effective performance. This is supported by another item business architecture BART (value 4.13) in which people agree the business architecture needs to be changed in order to be aligned with the underpinning technologies. However, significance of IT in business BSIT (value 2.52) is not considered within the bank as most of the employees did not recognize it. This is also supported by BSP (value 2.67) where employees do not agree to engage IT personnel in business strategy. This shows absence of co-evolution in both business and IT.

In figure 5 the item TBA (value 4.13) shows that people do not consider IT as an asset for the bank and this also shows the gap between business executives and IT personnel.

Co-evolution in organization may not occur unless the evolving business processes are supported by the evolving technologies. As depicted in figures 4 and 5 that most of the respondents consider IT budget as an expense (item TBA) that is the organization does not value the adaptation of technologies. This argument is supported by the data TUR and TA as well where new technologies are not readily acquired and updated with the new systems. The data shows the information systems in the bank are updated with the existing technologies due to financial restrictions. This also depicts that co-evolution does not occur effectively as when business and IT strategies are changed the lower levels do not co-evolve due to budget constraints and therefore, a misalignment occurs. This also validates the co-evolutionary framework that requires co-evolution from first level to the third level.

The case of the bank illustrates that there is development in business as a result of business evolution (new services and products), but due to absence of evolving IT there is a gap between business and IT. Co-evolution in the bank may occur in result of a change that requires changes in all levels and components. Currently co-evolution does not occur since the architecture of the bank does not co-evolve i.e. when the new services or products are introduced or new business strategies are adopted, the supporting technologies do not co-evolve. Secondly, the absence of appropriate communication between business and IT people at all levels causes the misalignment and does not allow co-evolving the system and the gap between the two entities arises.

CONCLUSION

The purpose of this research study was to develop a co-evolutionary framework by integrating three levels i.e. strategic level, operational level and individual level. The three levels have been integrated by a k-mediator that facilitates co-evolution between levels of each entity. The benefit of the framework is that it ensures the co-evolution occurs at all three levels of business and IT. Therefore, business processes will become more efficient and effective in order to fulfil clients' requirements and more revenue generated. The findings show that the co-evolution does not occur at all levels and the data obtained from different measurements exhibit good validation of the framework.

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