Abstract

Business Process Management (BPM) and Service Oriented Architecture (SOA) are two approaches that receive considerable attention in the scientific domain and in industry. Although both concepts can exist independently, they are considered as two-sides-of-the-same coin and seen as promising IS/IT strategies. Aligning both approaches should enable organizations to be agile and flexible in their responsiveness to the dynamic market environment. This is also propagated as the BPM/SOA synergy. Yet, there are misconceptions on the full complexity of implementing an enterprise-wide BPM system and SOA. This research proposes a maturity model that focuses on providing organizations a holistic view of the alignment between BPM/SOA in their current situation and in relation to their desired state. As such, it supports the organization in evolving towards BPM/SOA alignment, enabling it to establish a truly agile and flexible business-driven service-oriented enterprise that is highly responsive to the market dynamics in collaboration with their partners, customers and stakeholders within the ecosystem. The model has been validated at a financial institute, regarding consistency, comprehensiveness and applicability within specifically the financial domain. As a result, refinements were made and the updated model was used to assess the organization and build a roadmap providing key activities to support the already running BPM/SOA improvement project.

Keywords: Business Process Management, Service Oriented Architecture, Maturity, Enterprise architecture, business/IT alignment, BPM/SOA synergy.
INTRODUCTION

Nowadays, many organizations perform interaction and collaboration with stakeholders, partners and customers on a global scale. Global interchange enables enterprises and organizations to quickly respond to environmental changes and utilize new methods to introduce (new) products and services into various (global) markets. Organizations are then able to directly target specific customer groups and moreover address their needs more quickly than ever before. At the same time, customers are accustomed to rapid product deliveries and are increasingly demanding such things as product configuration to personalize their needs.

To cope with such important business changes and challenges, organizations make large investments in IS and IT. New technological possibilities give way to new methods, frameworks and technological infrastructures, which enterprises integrate and implement to become more agile and flexible in their IS/IT landscape. This has resulted in information spread across various (mostly) non-integrated information systems, distributed in all sorts of ways: across technologies, languages, and places and in different types of groups and objects, causing information and process inconsistencies everywhere across the enterprise (Evgeniou 2002).

Business Process Management (BPM) provides methods to enable continuous analysis, optimization and management of the business processes, resulting in higher business process visibility (Elzinga & Horak & Chung-Yee & Bruner 1995). According to Smith and Fingar (2003), enterprises are increasingly dependent on BPM to keep their business processes in control due to these booming business globalization and commoditization. BPM utilizes advanced tools in order to automate processes in conjunction with functionality to analyze, measure and improve their performance. Although these systems and applications provide some flexibility in the management of process flows, the underlying IT infrastructure is often rigid and full of high couplings (Gopala & Behara 2006). Combining BPM with SOA, creates opportunities to, not only be able to visualize the enterprises processes, but to also develop a flexible internal IT infrastructure. However, despite the obvious synergy between BPM and SOA, leveraging the two concepts is not that straightforward. Obtaining optimal alignment requires major organizational transformations (Gopala & Behara 2006, Woodley & Gagnon 2005, Kamoun 2007).

In a survey conducted by the Aberdeen Group (Donham 2007), where CIO’s were asked about their drivers to adopt SOA, 62% answered ‘the need to support new, agile processes’ as a top pressure driver, 44% of the respondents thought their current ERP system or best-of-breed supply chain solution insufficient to provide the desired functionality. In effect, vendors of various Business Process Management systems make use of SOA technologies, such as web services, to address these new organizational requirements. This narrow focus of BPM suites and technologies on process automation has blurred the traditional BPM approach. The holistic approach for the processing of processes has changed towards a focus on business process integration and has evolved towards an orchestration niche (Fingar 2008). Instead of bridging the gap between business and IT with a focus on strategy, it has become an IT process management approach with a tactical focus and limited scope (Fingar 2008). These new technologies and suites also have effect on the perception of organizations with respect to SOA. As vendors propagate a lot of opportunities and benefits by leveraging SOA technologies, organizations expect a one-size fits all solutions. The full complexity of implementing and adopting an enterprise-wide SOA is overlooked and not fully understood, resulting in common misconceptions about SOA as an architecture paradigm (Lewis & Morris & Simantra & Wrage 2007). Establishing such an environment requires much more than merely implementing BPM technology together with a SOA technology like web service support. Our proposition is that alignment is required between a holistic BPM approach and a true SOA vision in order to establish a business-driven service-oriented enterprise to be truly agile and flexible. Our approach is to create a model that addresses maturity and alignment of BPM and SOA.
The last two decades, maturity is used as a measure to evaluate the capabilities of an organization with regard to certain disciplines (Rosemann & de Bruin 2004). Since the Capability Maturity Model (CMM) proposed by the Carnegie Mellon University (Paulk & Weber & Curtis & Chrissis 1995) maturity models have extended the CMM model to suit the scope and discipline of for example IT infrastructure Management, Enterprise Architecture, BPM and SOA. Yet, to our knowledge there are no models focusing on measuring the alignment and maturity between BPM and SOA to establish a business process-driven service-oriented enterprise. We define the following research question:

“What is an appropriate model for assessing the existing degree of maturity and alignment of BPM and SOA in an organization, which also supports an improvement roadmap?”

The contribution of this paper is 1) The BPM/SOA Alignment Maturity Model, which 2) considers a holistic perspective of organizational aspects that concerns the BPM and SOA approaches and the alignment between the two, as well as Enterprise Architecture, business/IT alignment and IS/IT governance. 3) It provides a questionnaire as assessment tool for the model and a roadmap consisting of key activities that can support the organization in their evolution from the As-is towards To-be maturity state. 4) This research bridges several disciplines to construct a model focusing on the alignment of BPM/SOA and business/IT with the aim to establish a truly agile and flexible business driven enterprise, namely Enterprise Architecture, business/IT alignment and IS/IT governance. Currently, there is little research about achieving a BPM/SOA synergy or alignment and no maturity model is available for this purpose.

This research is based on a literature review to identify and analyze BPM and SOA approaches and best practices and maturity models, in order to identify the key factors, frameworks and models. In addition, semi-structured interviews are performed with experts in the field of BPM and SOA adoption and implementation. These interviews provided possible success and failure factors of BPM and SOA initiatives as well as a ‘practical’ vision of such an optimal environment. In addition, the model has been assessed at a large financial organization in the Netherlands to validate its applicability in practice. More on related research is described in section 2. The model itself is elaborated upon in section 3 and section 4 describes the validation. Finally section 5 ends with some conclusions and discusses the shortcomings of the research.

2 RELATED WORK

2.1 Business Process Management

According to Ferguson and Stockton (2006), BPM differentiates itself from other approaches to application development and process execution by ‘iteratively and coherently describe and implement the business model through the development stage into running systems’. This is supported by Werth, Leyking, Dreifus, Ziemann and Martin (2006), who define BPM as a requirements engineering approach in the business domain with a high focus on information technology. Although several parts of the BPM lifecycle focus on business process automation, and controlling and measuring business process performance in order to define improvement projects, BPM can also be used without any IT involvement. This is emphasized by Zairi (1997), who state that ‘BPM is an approach for cultural change and does not result simply through having good systems and the right structure in place’. In BPM, there is high emphasis on improvement of business processes, in order to increase the quality of the output, time-to-market and decrease costs (Elzinga et al. 1995, Zairi 1997). In effect, determining performance measures of processes, e.g. cost, quality, time and customer satisfaction, is vital to maximize their performance (Papazoglou 2007, Chang 2006).

To focus on the holistic perspective of BPM, this research uses the following definition, based on the definitions of Zairi (1997), Armistead and Machin (1997) and van der Aalst, Hofstede and Weske (2003):
BPM is a holistic approach to manage organizations, focusing on processes and process improvement activities on an ongoing basis with a sound focus on culture change and strategy development.

2.2 Service Oriented Architecture

‘Service Oriented Architecture is recognized as a way to improve business flexibility, adaptability and better align IT through the breakdown of technology-driven barriers among internal and external organizations’ (Maurizio & Sager & Jones & Corbitt & Girolami 2008). Today, the SOA paradigm is embraced as a new way to achieve a level of interoperability among systems and agility in business practices which was previously unfeasible. Although in practice there is an emphasis on the IT side of SOA (Lewis et al. 2007), the conceptual vision of SOA does not only incorporate business and IT, but also architectural goals, governance models and policies to foster enforcement of standards and technical requirements of SOA over time (Marks & Bell 2006). In effect, there is a wide range of scientific studies, researching new conditions, methods and approaches in adoption, implementation and practice of SOA within and between organizations (van der Aalst & Leymann & Reisig 2007, Papazoglou & van den Heuvel 2006, Zimmermann & Doubrovski & Grundler & Hogg 2005).

Within SOA the main focus is to decouple business processes from applications and systems (Deb & Helbig & Kroll & Sherdin 2005). As a result, business models and applications can evolve independently. A vital role in this process is played by business services, which are services used by (high-level) business processes (Deb et al. 2005, Erl 2005, Dow & Ravesteijn & Versendaal 2008). Because these business services can employ other business and/or application services to serve a specific business function, discovering and creating suitable business services is one of the key success factors in achieving the main goals of a business-driven SOA (Deb et al. 2005).

Within this research the following definition is used to emphasize on the conceptual vision that SOA propagates:

‘SOA provides a set of guidelines, principles and techniques in which business processes, information and enterprise assets can be effectively (re)organized and (re)deployed to support and enable strategic plans and productivity levels that are required by competitive business environments’ (Papazoglou & van den Heuvel 2006).

2.3 Differences between BPM and SOA

According to various authors, aligning BPM and SOA can be seen as a synergy. Although they can be implemented independently, their combination is seen as ‘two sides of the same coin’ and ‘more powerful than either is in itself’ (Woodley & Gagnon 2005, Gopala & Behara 2006, Kamoun 2007). According to these authors, SOA and BPM can act as natural partners in situations where new applications are assembled in a service-oriented environment.

However, achieving this synergy is not as straightforward and easy as it seems (Kamoun 2007, Gopala & Behara 2006, Woodley & Gagnon 2005). On a strategic level, the main difference between BPM and SOA is that BPM is primarily a management discipline, where decisions are taking top-down (Rosemann & de Bruin 2005, Kamoun 2007). A SOA strategy however, can be performed from bottom-up, top-down or meet-in-the-middle (Deb et al. 2005, Perepletchikov & Ryan & Tari 2005, Schepers & Lacob & van Eck 2008, Arsanjani 2004). Another important aspect is the difference in perspective between BPM and SOA. BPM has a process-centric view, while SOA takes a service-centric perspective. This often results in different goals and interpretations among domains. For example, where a web services designer would aim to achieve more flexibility in the utilization of services, process management systems designers would focus on designing systems where all services are visible and available in a common environment to be reused in processes (Smith & Fingar, 2003). Maurizio et al. (2008) supports this facet by mentioning that the combination of process modeling with SOA often result in differing opinions between analysts and consultants about best practices. Yet
another aspect is the difference between processes and services, where business processes change very often, the business services remain relatively stable over time (Woodley & Gagnon 2005).

A consequence is that the methodologies, tools and practices of BPM are not easily integrated in a service-oriented environment (Woodley & Gagnon 2005, van der Aalst & Pesic 2006).

3 CONSTRUCTION OF THE BPM/SOA ALIGNMENT MATURITY MODEL

To construct the BPM/SOA Alignment Maturity Model (BPM/SOA AMM) several separate BPM and SOA maturity models were evaluated. The separate BPM and SOA models are described in table 1.

<table>
<thead>
<tr>
<th>Model</th>
<th>Author(s)</th>
<th>Strength</th>
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<tbody>
<tr>
<td>Business Process Maturity Model</td>
<td>Rosemann et al. (2005)</td>
<td>Measuring As-Is as well as To-Be situation of the organization. The model has a solid theoretical foundation, as it is constructed based upon scientific literature, surveys and case studies.</td>
</tr>
<tr>
<td>The Open Group Integration Maturity Model</td>
<td>The Open Group (2006)</td>
<td>Touches some organizational aspects, discussed in BPM maturity models. With OSIMM, the Open Group wants to establish an industry-recognized adoption model and terminology based on open standards.</td>
</tr>
<tr>
<td>CBDI SOA Maturity Model</td>
<td>Sprott (2005)</td>
<td>Has incorporated the dimensions ‘Framework and Process’ and ‘Organization’, which indicates that it has some relationships with BPM maturity model factors.</td>
</tr>
<tr>
<td>Level 5 Oracle SOA Maturity Model</td>
<td>Oracle (2007)</td>
<td>The model has a high level overview and detailed descriptions with comprehensive key factors within each cell.</td>
</tr>
</tbody>
</table>

Table 1. Description of the reference models used to support the construction of the BPM/SOA AMM.

Although the SOA models incorporated some business or organizational aspects, they are too generic or too specific to serve the purpose of our research. Maturity models focusing on BPM primarily have a holistic focus on IT related aspects or briefly relate to some modular application development or infrastructure middleware aspect.

In addition, PEMM was the only model that provided an assessment tool. In effect, a scientific literature study was performed on how to achieve a BPM/SOA alignment/synergy and business-driven service-oriented enterprise. The results of this study show that achieving BPM/SOA synergy or a business-driven service-oriented enterprise that is truly agile and flexible is a comprehensive subject encompassing various disciplines, e.g. enterprise architecture, business/IT alignment and IS/IT governance. Therefore, the assumption is that simply combining BPM and SOA models will be too simplistic and results in inconsistencies and gaps. Therefore, reference models are used to extend, support and validate the construction of the model. Table 2 shows which maturity models are used to support which focus area.

<table>
<thead>
<tr>
<th>Model</th>
<th>Author(s)</th>
<th>Focus area</th>
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<tbody>
<tr>
<td>Strategic Alignment Model</td>
<td>Luftman (2000)</td>
<td>Business/IT alignment</td>
</tr>
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</table>
In addition to the scientific literature study, semi-structured interviews were performed with seven experts in the field of BPM, SOA, BPM/SOA and Enterprise Architecture. These interviews provided a practical view of success factors to reach the vision of an agile and flexible business-driven service-oriented enterprise supported by BPM and SOA characteristics. The respondents all worked for a large consulting organization within the Netherlands and had a minimum of five years of provable experience in BPM and/or SOA adoption or implementation projects. Subsequently, these results provided general key factors to the cells of the various maturity levels.

The following page depicts the model (figure 1), associated with an explanation and justification of the maturity levels and dimensions respectively.

3.1 The Maturity Levels

3.1.1 Ad hoc

In level one the organization is structured in functional silos or departments, where employees tend to focus on improving their department. The information systems within departments are typically legacy systems and no real effort is taken in sharing their information outside their own functional boundaries. IT is generally perceived as a cost or burden by the business. Still, there is some responsiveness to change as there are some functions which experiment with new technologies and frameworks, e.g. an Enterprise Service Bus. At this level individuals (‘local heroes’) or small groups of committed individuals drive process improvements that are limited to their function.

3.1.2 Integrated

Breaking down the rigid barriers of the traditional silo’s and functions is the main focus of the second maturity level. The organization starts to transform towards a horizontal structure, focusing on its (key) business processes. As information is now available through the former boundaries of departments, security, privacy, process control and manageability are playing a far larger role than in the ad hoc stage. As a result, formal governance policies, process roles and responsibilities are established to guide the transition towards information sharing and business process management. Architecture methods and standards are starting to emerge as an important driver of the evolving organization to support visibility, reliability and flexibility. The IT domain incrementally starts with the creation of data services, which should be highly reusable and could offer significant short-term benefits in order to receive top-level support and funding.

3.1.3 Collaborative

The third maturity level defines an enterprise which puts a lot of effort in trying to bridge the gap between Business and IT in order to increase their agility and flexibility. Both domains receive education of each other’s methods, principles and concepts, which could ultimately improve their understanding, awareness and cooperation. Agreements about standards and semantics are a necessity in achieving a seamless cooperation between domains.

From a top-level management perspective, service oriented architecture is seen as the means to achieve flexibility and is used as a driver in business strategy. Enterprise wide methods, standards and best practices now form the basis for design and development phases of BPM and service lifecycles.
New BPM and SOA projects should be sufficiently supported. Therefore, Center of Excellence or similar teams need to be established with additional authority in making recommendations and finding solutions to problems. They should align training courses, gather expertise, provide knowledge of BPM and SOA, and act as a ‘helpdesk’ for the BPM/ SOA project teams.
3.1.4 Synergetic

This final maturity level displays an enterprise where business as well as IT has seamlessly integrated service-orientation concepts and principles. People think in services, embrace change and see their work as a value-adding service to consumers. The enterprise has bridged the gap between subcultures, removing any adverse factors in the cooperation between domains. People work in teams composed of business partners from the eco-system, sharing responsibilities and resources to collaboratively increase overall performance. The systematic and problem-solving methodologies of BPM strengthen newly-designed services from business processes, reinforcing linkages between various functions and ensuring that optimum performance can be achieved on a continuous level. SOA on the other hand, ensures the strong harmony between process design (Business-driven) and IT architecture and application (IT driven). Roles and responsibilities change as decisions are taken faster and traditional business and IT roles become faded.

3.2 The dimensions

3.2.1 Architecture

The architecture dimension focuses on the coverage and usage of architectural models and methods and the architectural function within an organization (Ross et al. 2006). It should provide a long-term view of the processes, systems and technologies as well as fulfilling the immediate needs. Architectural boards and roles use organizational objectives as a basis to formulate architectural principles, consisting of guidelines in the discovery and development of services, standardization of development and processes, or the service and process design (Legner & Heutchi 2007). The architectural models should not only focus on IT aspects, but also on business artifacts and deliver KPI’s to measure their business performance (Ferguson & Stockton 2006).

3.2.2 Methods

Methodologies and best practices provide organizations with proven approaches or standard-based steps in guiding the end-to-end process or a certain problem or situation. BPM has a high emphasize on methods and techniques as it plays a large part in many definitions of BPM. Almost every organization uses some kind of method or best practices. Some have formally documented and enforced them others indirectly and informally follow a certain paths or steps in their activities. In this dimension there is a focus on which kind of methods an organization has implemented, where and how. Most organizations use standard methods in for example system development, e.g. RUP (Rational Unified Processes) or XP (eXtreme Programming), but many of those methods lack important aspects for a BPM/SOA environment. One of these aspects is the focus on process modeling, BPM and Enterprise Architecture (van Es & Gerwen & Lighthart & van Rooij & Graave 2005).

3.2.3 Governance

In BPM and SOA literature, governance is mentioned as one of the most important aspects in BPM (Zairi 1997), SOA (Chen 2008, Bieberstein & Bose & Walker & Lynch 2005), as well as in a BPM/SOA environment (Woodley & Gagnon 2005, Kamoun 2007, Strnadl 2007). Kamoun (2007) even states that ‘a proper governance model should take into account the fact that BPM/SOA initiative should endorse a new state of mind that brings business and IT closer together than any previous time before’. Maurizio et al. (2008) support this statement in the way that the governance framework should provide clearly defined roles and responsibilities. BPM generally starts with governance related activities to guide and control business processes, as it is primarily a business driven / top-down approach (Kamoun 2007). It is stated that in the early stages of SOA, governance is not a prerequisite, but as services and metadata grow, guidelines and policies are vital for its existence (Boden 2004). SOA governance should also be concerned with reviewing the architectural decisions and
incorporating the control of the enterprise model (Bierberstein et al. 2005), including clear definitions of data ownership.

3.2.4 Organization

In every organizational transformation its success depends on the support of top-level stakeholders and the tractability of the people and employees within the organization. Bieberstein et al. (2005) states that, ‘one of the critical challenges in implementing SOA is achieving the right organizational structure’. He mentions that immature organizations suffer from resistance to the SOA implementation, because of short-term focus and the lack of proper business alignment (Bierberstein et al. 2005). Mature SOA organizations are classified as ‘they span business lines and the boundaries of roles while achieving interdisciplinary coordination’ (Bierberstein et al. 2005).

3.2.5 Information & Technology

Enabling organizations to react and adapt to the changing market dynamics puts significant pressure on the underlying IT infrastructure. The infrastructure should not only facilitate the separation of day-to-day operations of users from the underlying functional infrastructure (Boden 2004), but also support non-functional requirements, e.g. security, scalability and agility (Lui & Li & Zhao 2008). Processing and transferring information correctly throughout the value chain is a necessity in a dynamic collaborative environment. The main challenge is to integrate inter-and intra-enterprise applications and information efficiently and effectively (Zhang 2004). Formal agreements about definitions, semantics and standards are the basis for any information interchange within different departments or across the ecosystem and should be well-defined and captured in contracts or information models.

4 OPERATIONALIZATION AND VALIDATION

From the model a questionnaire was derived containing statements. This questionnaire acted as an assessment tool for the As-Is situation of an organization in regards to BPM and SOA alignment and maturity. The questionnaire can be downloaded at the following URL: 
http://www.cs.uu.nl/groups/OI/BPM-SOA-tool.pdf. As a means of validation we did a case study at a large financial organization in the Netherlands (Stake 1995).

The wholesale division of the organization was at the time of the validation performing improvements to the business architecture. In this improvement project BPM and service orientation played a large role. In addition, the IT department already used SOA technology to support several business processes. Where the business respondent, a BPM Retail Architect, had a lot of knowledge of the business side of the organization and played a large role in this improvement project, the IT respondent was an enterprise architect with overall and inside knowledge of the SOA services and operations. Both respondents were asked to speak freely when they thought that questions or answers were ambiguous, inconceivable, conflicting or inconsistent. The first assessment was performed with the business respondent and provided several points for improvement. Firstly, it was evident that the questionnaire did not explicitly clarify that the respondent had to answer the questions from a business point of view solely, as he tried to provide both business as IT outcomes. Secondly, specific terminology needed additional explanation, e.g. Integrated Architecture. Thirdly, with every question the respondent would indicate the answer associated with the to-be desired state. In effect, providing not only the as-is, but also additional to-be checkboxes would offer the model an addition value proposition by reflecting the desired state of the business onto IT, and business and IT onto the executive management point of view. As a result, the initial questionnaire was restructured with as-is and to-be checkboxes with each statement and two versions were established with the same questions except with different introduction and title specific to the respondents role. This version of the questionnaire was presented to the IT respondent. A small amount of remarks were recorded and processed after the assessment, which resulted in a refined version of the assessment tool.
Subsequently, a new assessment was performed with the business respondent who completed the questionnaire within the hour.

The results of the BPM/SOA AMM assessment showed that the business was positioned in the lowest maturity for every dimension. The IT however, was primarily positioned in the second maturity level. The to-be results almost showed a complete alignment between the business and IT point of view. An interesting aspect was that business focused on the importance of a mature Architecture and Methods dimensions, where IT did not see the benefits of improving the Information and Support dimensions of Information & Technology towards the third maturity level. As a result, the as-is situation of the organization is positioned at the ad hoc maturity level and the to-be at the Integrated maturity level. As the desired state of the executive management was to evolve to the Collaborative level of maturity, the roadmap provides general activities to support the current improvement plan to evolve to the third maturity level and the difference in results between business and IT respondents and executive management could be an input for future dialogue or discussion.

5 CONCLUSIONS AND DISCUSSION

In this paper we have addressed the following research question: “What is an appropriate model for assessing the existing degree of maturity and alignment of BPM and SOA in an organization, which also supports an improvement roadmap?” Achieving a BPM/SOA alignment in order to establish a business-driven service-oriented enterprise is a complex issue. Therefore, multiple disciplines were applied to establish the model (BPM, SOA, enterprise architecture, business/IT alignment and IS/IT governance). In addition, semi-structured interviews with experts in these domains provided a practical foundation of key success factors including a vision of such an environment. Based on these activities the Business Process Management & Service Oriented Architecture alignment maturity model (BPM/SOA AMM) was developed. Together with a survey that functions as a quick scan of the organization. Based on the outcomes of the scan, a roadmap can be determined from the as-is towards the to-be positions of the organization. This roadmap provides general activities to improve the key factors that determine the maturity level of each (sub) dimension.

This research was of explorative nature with a focus on literature study and semi-structured interviews. By using maturity models that were related to the results of the literature study that focused on exploring the synergetic relationship between BPM and SOA, the scope of the model is extended beyond the factors and requirements defined in BPM and SOA models. Therefore, it is less likely that important areas or aspects in achieving the full potential of a BPM and SOA alignment are not present.

The model has been applied in practice at a large financial organization. Although only two respondents assessed the model, they provided a significant contribution to the validation of the assessment tool and application of the model. The first version of the questionnaire has been thoroughly changed to extend the value proposition of the model and making the questions as clearly defined and consistent as possible. However, as it has only been applied at one financial organization its applicability to both the Financial domain as are still to be researched further. Future research should focus on applying the model more in different domains and with a larger number of respondents to validate the usability.

References


