The Strategic Requirements for an Enterprise Business Architecture Framework by SMEs

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Abstract—**Small and Medium Enterprises (SMEs) have inherent resource and capability constraints. Competing in a dynamic, collaborative, global environment, SMEs need a strategic management tool to help develop the requisite capabilities, structure, and integrate and leverage the underlying IT resources in line with the dynamic market and environmental conditions. We argue that the SME's combined internal and external environmental challenges call for the support of an Enterprise Business Architecture (EBA) framework – a new strategic tool to facilitate the SME development and management of resources and to capitalize on the environment opportunities. From an extensive exploratory literature review, this paper highlights the limitations of existing IT architectural frameworks for SMEs and explicates the underlying drivers of SME requirements for an alternative business-oriented architectural EBA framework as well as the in-built SME barriers to using EBA. The SMEs need for and associated inherent barriers of EBA are also confirmed by industry expert's feedback through a preliminary semi-structured online survey.**

Index Terms—**enterprise business architecture, small and medium enterprises, collaborative network organizations.**

I. INTRODUCTION

SMEs are a key driver of a nation's economic growth [1]. Through different collaboration models of heterogeneous and networked organizations, SMEs are capitalizing on their individual resources and leveraging other participant's capabilities [2]. While these environments are revealing opportunities for SMEs, operating globally as part of the network of organizations, the need to be flexible and proactive in business and technological dealing is growing increasingly crucial. In order to successfully use the network opportunities and operating in the dynamic collaborative environment, SMEs need to significantly improve, promote, and manage their capabilities and resources in terms of business structure, strategies, governance, processes, information technology and knowledge [3]. More importantly the emphasis has been on management and promotion of ICT and its related capabilities through adaptation of variety of IT management solutions [4]. However a wide range of the extant SME research has shown substantial problems for SMEs (a) to define and govern the implementation of IT strategy to realize

technology changes in alignment with their business [5], (b) adapt their structure [6] and (c) to leverage IS competencies in order to deal with environments which is increasingly dynamic and globally focused [7]. Consequently they require strategic capability development aid to structure their IT resources and business strategies which simultaneously enable them to capitalize the environment opportunities and threats.

In this context Enterprise Business Architecture (EBA) may seem to be ideal solution as a strategic management framework to help manage and structure business, IT systems, information and knowledge and to facilitate the IT decision making process and alignment to the business goal [8]. Architectural approaches for organizations enable them to manage resources and capabilities in terms of business processes, IT, information and people and skills, manage networks relationships to quickly adapt to new market environment [9]. There have been resistance by SMEs in applying Enterprise Architecture generally and EBA in particular [10] as it is not clear how SMEs can gain benefits from EBA and what are the costs (skills and efforts required) in applying such a strategic tool. This paper investigates and discusses the significance of EBA for SMEs from various perspectives including internal and external environments. In particular, we investigate their characteristics in management structure, IT resources, strategies and architecture and consequently the underlying EBA requirements of SMEs.

The paper is structured as follows. First, we review the organizational characteristics of SMEs that influence their strategic management capabilities. Second, the strategic organizational purposes of architecture generally and EBA in particular are explained to set the context for exploring the SME requirements for EBA. Third, we unpack the SME requirements for EBA to enable sustained value creation by (a) examining the extant work on SME IT architectural frameworks (internal requirements) highlighting their lack of business-strategic alignment as a key limitation, (b) examining the critical characteristics and influence of the dynamic external environment on SME business performance. We then sum up, in the next section, the purpose of the EBA framework as a strategic management tool for SMEs; and this is followed by the examining the rationales for SMEs' barriers to using EBA. Both our findings of the SME purpose of and barriers for EBA are shown to be congruent with the surveyed views of industry experts in

these two sections. Finally, we conclude the paper with a summary of the SME requirements for EBA and a proposal to develop the SME EBA framework as a future research.

II. SMALL AND MEDIUM ENTERPRISES (SMEs)

Although SMEs are commonly defined by IFC[1] as registered businesses with less than 250 employees, the definition varies from country to country. As a consequence of the 2008 global financial crisis, there has been increased attention on SMEs as effective players in nation's economic growth. According to some researchers, SME contribution to economy growth is estimated at greater than 50 percent of GDP in high income countries [1]. Likewise they play a significant role in creating and providing jobs in many economies [11]. According to the SMEs Performance Review in 2009 they are more innovative than large organizations [12].

SMEs are different from their large counterparts not only in the size of employees and capital but in the way they organize, manage and accumulate their resources and capabilities in terms of knowledge, technologies[13]. The main characteristics that distinguish SMEs from the large organizations are their management, decision making processes, and organizational structure [4]. The short and ad hoc training mechanisms limit SMEs management awareness and knowledge. The limited number of trained and experienced people within their organization causes the small team of managers to be responsible for many tasks and perform a central role in their decision making process. These small, centralized and multifunctional management roles are more intent to take short term decisions without adequate planning procedures [14]. In some SMEs the business goals and strategies are derived by the owner as manager and firm decisions are affected by his/her desires and initiatives [4].

III. ENTERPRISE BUSINESS ARCHITECTURE (EBA)

The Architecture concept for enterprises has been defined since 1980s as an Enterprise Architecture (EA) to emphasis on mapping, managing, unifying and governing information technologies as one of the main enterprise resources and also their supporting resources such as information, knowledge, people and skills [15]. EA provides a holistic view of the organization by designing its elements and their relationships aiming to design and implement systems and optimize IT usage in organizations [15]. It can be considered as a tool to help the organization to create capabilities to be flexible and react to the environmental changes and meet the market demands. It defines the "logic" for designing business and IT structures reflecting organizational strategies, requirements and operations [15]. EA contains four perspectives of architectures: Business, Data, Application and Technology [16].

Enterprise Business Architecture (EBA) is a multidisciplinary concept which integrates the fundamental disparate concepts of an organization to guide its transformation to the target or new organizations. It presents the core functions of enterprises, the way they operate and their relations with each other's [17]. Using EBA concept enables organizations describe current and future states, the relationship between its internal entities and environmental elements, define strategies and roadmap to articulate these strategies in measurable and actionable ways [18]. EBA is an ongoing process to manage internal and external changes and to re-engineer organizational structure in terms of business processes, knowledge, and strategy and business capabilities to adapt to the new environment. It gives a clear picture of target plan and underpins decisions regarding rules and management responsibilities [19]. Having clear picture of organization helps to re–design current structure in order to manage internal or external changes [15]. Implementing EBA enables IT to create more value for organization internally as well as within collaboration and customers [20]. It builds organizational elements as interrelated components and presents "dynamic roadmap" for target goals [20].

EBA has been successfully applied to large enterprises. However, to our best knowledge, currently there has been no EBA framework defined for SMEs yet. EBA seems to encompass the important strengths and advantages for large organizations by creating a clear view of the current and future states of their business and help to manage their resources and capabilities. The general value proposition of EBA is likewise significant for small and medium sized enterprises. But due to the nature of SMEs with their idiosyncratic characteristics and requirements, further investigations require to explicate the specific EBA benefits to SMEs.

IV. SMEs REQUIREMENTS FOR AN ENTERPRISE BUSINESS ARCHITECTURE

A. SME Internal Requirements for IT Strategic Alignment

The significance of using information and communication technologies within SMEs has been underlined by various scholars. In fact utilizing information systems decreases process's costs, improves quality of products, services and reduces delivery time, cost and ultimately improve their performance [21]. Information technology also affects decision making processes [21] by improving enterprise communication and transparency in both external and internal environments [22]. Although the advantage of IT adaptation within SMEs is clearly illustrated, one should be aware of various external and internal factors that have critical impacts on design and development of ICTs solutions. With the short-range manager's perspective and commitment, SMEs are more intending to focus on day to day operational IT improvements [23]. They are suffering from lack of ICTs strategy and proper infrastructure [24].

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[1] International Finance Corporation

The uncertainty faced by small and medium enterprises is considerably more than that faced by large firms. To reduce uncertainty, they need to adapt business strategies, structure and technologies more often than large enterprises [25]. Resource and capabilities allocation and utilization especially for ICTs require lasting SMEs commitment and substantial investment. Therefore the decision on developing ICTs capabilities should be considered in the strategic objectives and planning [26]. More specifically developing strategies around IT as an enabling capability for SMEs, will enable SMEs to identify new technologies, improve applicability of new systems, obtaining data and evaluating the data accuracy [24]. Their strategies at the operational level and also in alignment with business strategies, directly affect SMEs performance [27].

SMEs have been utilizing IT architecture for their technology, infrastructure, systems and processes for different purposes. They have developed a structured and methodical approach to meet dynamic market demands and adapt to the environmental changes, and each structure is an important subject of study. Applying an architecture model for SMEs systems can give a clear vision of current processes and systems within small and medium organization [28]. Table I provides a comparison of various proposed IT architectural frameworks for SMEs. The aim is to evaluate the extent to which SMEs use architectural approaches to design, implement and manage their business processes and ICTs.

As illustrated in Table I, different architectural views have been proposed and applied within SMEs. Enterprise systems and processes have been structured in their value chain using ERP, CRM and BPM [29]-[31]. Virtual Enterprise Architecture is applied within the SMEs systems and applications in order to operate in virtual environment [32] and facilitate cooperation, collaboration and B2B models [33]. In the meantime Service Oriented Architecture (SOA) has emerged as a cost effective and easily adaptable technology for SMEs [34]. These studies have tried to identify the benefits of architectural approaches to leveraging ICT resources. They have found that architectural views are useful to achieve business agility and flexibility as well as to integrate business processes and information system within SMEs [35].

Form prior limited studies around development of architecture in different enterprise levels, a few limitations have been found for SMEs. Different studies have been trying to define information, system and business process architecture for SMEs for different purposes, but the alignment between the different levels of the architecture and enterprise strategy have not been addressed properly. In previous studies special attentions has been paid to the IS and technological architectures and not to underpin the roles of business architecture and strategy [36]. However developing IT architecture without regard to the firm business model is less likely to bring expected advantages [37]. The firm needs to align its business structure with their business strategy to improve functionality of organization capabilities [37]. Likewise SMEs are applying these solutions without a

clear strategic framework and there have been hesitations in applying enterprise architecture [10]. They have declared system and technology architecture projects as "overhead cost" or non-value adding [28]. Indeed the need for an Enterprise Business Architecture has been called for in order to articulate the structure of business processes, governance, information systems strategies and align IT solution to business strategies [18].

TABLE I.   SUMMARY OF ARCHITECTURE VIEWS APPLIED WITHIN SMEs

Proposed Architecture	Purposes/Drivers	Resources
Virtual and Collaboration Enterprises	• information sharing • decision synchronization • alignment with the collaboration • interoperability • production efficiency • readiness for growth and transformation • access to the new markets • reducing technology costs	[32, 37-40]
Service Oriented Architecture (SOA)	• adaptable and flexible architecture • cost effective architecture • business agility • information and systems integration	[29, 34, 41]
BPM, ERP, CRM	• managing processes performance • processes Integration and consolidation • increase productivity • customer satisfaction • concrete and in-time information	[29-31]

B.   Dynamic Environmenal Requirements for SME EBA

Over the last decade there has been a systematic and fundamental change in the way enterprises with different sizes are operating. Surviving in the competitive and fast-moving environments has caused changes in the structure of enterprises and their initiatives. Collaboration of networked organizations has been introduced as a new shape of business model for a number of interdependent enterprises. The collaborative networks contain numerous autonomous enterprises and peoples which are "geographically distributed" and can be combined together to achieve a certain joint-goal [42].

SMEs have been introduced as the main participant in the collaborative networks [43]. There are many reasons for the increasing tendency of SMEs to participate in collaboration networks. The principal reason is the combined challenge of SMEs having to compete in diverse market environments with their inherently limited, albeit highly specialized, resources. Limited resources in terms of financial, knowledge and people (capabilities) strongly motivate SMEs to leverage external complementary resources to build the requisite competitive capabilities (by integrating with their own

resources) [44]. They are engaged in information exchange, resource acquisition and technology transformation which help them to overcome the lack of internal resources and challenges that they are facing in the dynamic environments [45].

In such an environment, enterprises with different capabilities operate as a single "entity" with respecting to the network policy and collaboration mechanism [2]. As an entity, the company operates as a particular and discrete unit in terms of goals, managerial style, resources and capabilities. As a result high numbers of "heterogeneous" and "autonomous" resources and capabilities are available to be leveraged by network participants. The nature of collaborative networks implies that enterprises not only should leverage and manage internal and network environments but also mobilize, combine and change resources to align with network changes in order to achieve marketplace success and create sustained value [46]. This openness drives organizations to develop their capabilities and capacities in order to sense and acquire opportunities from external innovations and new technologies to sustain their competitive advantage. As indicated, the enterprise success within such dynamic environments depends upon the capturing external opportunities, managing internal resources and transfers their outputs inside and within the networks [47]. Consequently in the recent organizational studies increasingly attention is being given to the development of capabilities and capacities to enable enterprises to be more adaptive and susceptible to the dynamic networks of enterprises [48].

Meanwhile collaborative network operations and performance depend on capabilities and operations of its entities [42]. Not only will the internal organization interoperability, infrastructure, technology, information, strategy and business structure determine the operation and formation of collaboration networks, but also appropriate architecture principle, ICT strategies and technology alignment are required to enhance network goal [49]. Ontologies for collaborative networks allow their participants to capture the essential capabilities of other entities and define their relationship and optimize their contribution in providing value for all parties [50]. Enterprises require discovering new capacity and managing current capabilities to be able to adapt to new network structure whether it is technology, systems or business structure [51]. They need to be consistent and compatible within networks entities in terms of business and IT, which can be the main challenges for them [52].

V. EBA AS A STRATEGIC MANAGEMENT TOOL FOR SMEs

SMEs have a vital role in nations' economic growth, innovation, and employments. Studies of their business advancement which leads to possible economic and social developments, have gained increased priorities for most scholars and practitioners. Effective contribution of SMEs is significantly associated with the competitive dynamic environments. Accelerating technological changes, rapidly changing market demands and growing globalized collaborative organizations, coupled with the SMEs' inherent limitations and constraints, underscore the need for strategic developments for SMEs to create sustained value. In order to recognize the dynamism and globalization processes, they are investing heavily in ICT solutions which reduce costs associated with operating globally and meeting new market demands. At the same time the high rate of technology changes continually put pressure on SMEs to provide dynamic roadmap and strategic planning for their IT investment decisions. Providing the strategic roadmap is likely to create opportunities to prevent spending of increasing amounts of resources, take advantages of new IT developments and to gain more overall value from their existing IT resources. The roadmap needs to drive from SMEs' business strategies and requirements. To reach this point they should define a clear and precise overall picture of their business in terms of business capabilities, business processes, and knowledge. Thus, we argue that an Enterprise Business Architecture framework would be the ideal solution to help SMEs to capture required resources (including IT) and align their business with IT operation to gain better performance.

In order to support our findings from the literature review and also compare our research construct with industry insights, we have been conducting semi-structured questions with some industry experts. This allows us to link their experiences and perceptions to the research developments. The survey took place within the professional social network of EA experts throughout a period of one month. We are reflecting the experiences of practicing EA consultants and experts to complement the literature review with their practicing knowledge from different enterprises requirement. Below are some statements of the experts in responding to the question "How does EBA help SMEs gain better value?"

"… *A business architect or business planner with BA tools can go a long way to helping structure the SMEs, set up the organization and get everyone on the same page in terms of process, roles and services."* (Washington D.C. Management Consultant)

"*EA for me is way of thinking, it is a means of humble exploring and understanding of the enterprise, business management which can be applied fully for SMBs. The more that EA wants to meet enterprise-wide context for all enterprise beings, is for SMBs and the same way for small Public Administration Agency needed to simplify EA and speed up."(Czech Republic, Enterprise Architect)*

"*…, multiple segments characterized by the maturity of industry, funding, age of company current and future growth of company, etc. that had an influenced on their efforts."(Dallas, Technology Consultant).*

The main need for EBA as strategic tool for SMEs has been driven by the challenge of the dynamic environmental factors described above. In terms of the environmental factors and the SME collaboration networks, dynamic market demand and technological changes are the key factors to be modeled in the EBA. Participating in collaborative networks which is facilitated by globalized ICTs, increasingly is confronting

with two key issues. The first issue is concerned with managing adaptability with the networks which is demanding a strategic approach to interoperate with partners technologically and also at the business level [53, 54]. The second issue is concerned with achieving market penetration and creating value through capabilities that can synchronize networks competencies and resources. These considerations underscore the employment of capabilities that enable them to manage variety of networked organizations and simultaneously to create sustained value by leveraging environments opportunities[55]. Moreover in such dynamic environments SMEs need to think strategically in all aspect of their business and structure, bundle and leverage network and firm resources and capabilities with the purpose of creating value [44]-[56].

VI. SMEs BARRIERS IN UTILIZING EBA

Developing architectures in different levels of an enterprise can be a daunting task for any business, but more challenging for small and medium sized enterprises [10]. Specific challenges faced by SMEs are attributed to their specific characteristics, constraints and resource shortages. Lack of financial resources and ICT expertise are the most important factors that inhibit SMEs from utilizing an EBA framework [23].

Developing and employing ICTs solutions generally and more specifically deploying the requisite EBA framework will be influenced by the unique SMEs characteristics in terms of size, industry, and level of IT expertise. Thus many SME-specific environmental contingencies need to be factored and incorporated into developing a practical EBA framework for SMEs. This finding from the extant literature is supported by the industry experts feedback obtained from our semi-structured online survey. For example, below are some expert feedback and comments in response to the question: "What are the barriers and requirements for defining an EBA framework for SMEs?"

"SMEs do not have the time and money resources as large enterprises have. So you need to come in with more than a generic framework. 80% of SMEs will kill the project before a real start is actually underway, due to lack of deliverables. Most leaders within the SMEs environment are much more down to earth than staff in large enterprises, they want more tacit results."(Netherlands, Management and ICT Consultant)

"....SMEs can hire experienced consultants to work on specific initiatives who then can also train some of their qualified staff on BA/EA techniques as well. Once those initiatives are completed, SME's can reapply those techniques for future ones. All SME's don't need to do EA/BA on a daily basis employing dedicated staff."(Greater Chicago Area, Chief Architect)

VII. CONCLUSION AND FUTURE WORK

From the extensive literature review, we have identified the key factors that encourage SMEs to develop and use EBA as a strategic tool, categorized as internal organizational and external environmental factors. Due to SMEs' specific business characteristics in terms of working capital constraints, lack of resources when compared with their larger counterparts, they have a pressing need to strategically structure and manage their resources in line with the changing external environments. The EBA as a strategic tool is more likely to help them in create a roadmap for orchestrating, managing and structuring their business resources in terms of IT, knowledge, processes and capabilities and their interconnections. Besides that, SMEs are facing pressure in making decisions around three types of issues in line with the changing external environment. First, selecting fit-for-purpose ICTs aligned with their requirements that realized their constraints. Second is to make strategic decisions as to where to make an appropriate ICT investment. The third is how to utilize and integrate the new system or technology into the business in order to enhance the business (growth) performance and reduce the total costs.

The EBA framework must provide the SME with the capacity to making quick strategic decisions regarding the optimal collaboration network design (and its underlying integrated inter-organizational IT architecture) in which it plays a key role, in line with the dynamic market demand and technological changes. Business and technological integration and alignment of the collaboration network, sense-making of the external market and new technological opportunities and threats, and leveraging these opportunities are all important requirements for the SME to survive and thrive as a main participant in the global collaboration network. Having a clear strategy and roadmap to address technological changes are also SME requirements that must be addressed by the EBA framework.

In addition to addressing the significance of the EBA framework for SMEs, these findings have also set a foundation for future research. The results of this research indicate that there is a strong need in SMEs to utilize EBA as strategic tool to create value within dynamic environments. Our proposed next step is to define a simple EBA framework that can be applicable for SMEs and realize their constraints and requirements.

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