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# Toward a Multi-disciplinary Business Architecture Reference Model for SMEs

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# TOWARD A MULTI-DISCIPLINARY BUSINESS ARCHITECTURE REFERENCE MODEL FOR SMES

*Complete Research*

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## **Abstract**

*Competing in a global, open and dynamic ecosystem of firms, SMEs require a strategic management tool to manage co-evolution with dynamic environments. To sustain their competitive advantages, SMEs must enhance the capacity of orchestrating and integrating resources/capabilities to adopt/shape their chosen ecosystem and meet the emergent market needs. Drawing from existing literature and preliminary interviews it has been found that SMEs need a simple but holistically comprehensive strategic management tool to help the executives implement entrepreneurial practices that have the capacity to quickly identify new resource configuration to align with the changing environments. In particular we develop a multi-disciplinary Business Architecture Reference Model (BARM) for SMEs to help SMEs create value in an open and dynamic ecosystem. Derived from SMEs' internal and external strategic requirements, we revisit conceptual model for the SME BARM by integrating diverse but interrelated disciplines including; IS, strategic management, organization, architecture and service sciences. Theoretically grounded from these diverse disciplines, the BARM provides SMEs with a new holistic approach to orchestrate their socio-technical resources/capabilities and manage their co-evolution within the dynamic ecosystem. The proposed BARM for SMEs comprises architectural components and metamodel that helps SMEs plan, articulate and execute their business strategies, resulting in a business-aligned configuration of resources to attain evolutionary fitness with the competitive environments. By incorporating organisation and strategic management theories in the BARM conceptual model, the paper also contributes to the theoretical foundation of architecture science – accentuating the socio-technical (capability-based) nature of architecture. The preliminary BARM's efficacy and usability has been validated through interviews with industry experts and SME executives.*

*Keywords: Business Architecture Reference Model (BARM), Small and Medium Enterprises (SMEs), Dynamic Ecosystem.*

## 1 Introduction

SMEs, as key drivers of a nation's economic growth (Ayyagari et al., 2007), have been a spawning ground for innovative (Lee et al., 2010), agile and flexible (Noke and Hughes, 2010) organisation design. They compete in a business ecosystem where the boundaries are fluid (Santos and Eisenhardt, 2005), market is increasingly global, complex and growing (Santos and Eisenhardt, 2009); resources and capabilities are specialized, diverse and diffused across the ecosystem (Camarinha-Matos, 2009); consequently the locus of their value creation and appropriation has been extended beyond the individual focal firm. Acting in such environments demands an architecture reference model as strategic management capability from the resource-poor SMEs, which must nimbly sense the flitting and invisible opportunities, quickly make strategic decisions (Dehbokry and Chew, 2013a) to shape and evolve into chosen ecosystem (Jacobides et al., 2006), integrate, leverage, orchestrate their limited capabilities/resources (Dehbokry and Chew, 2013b), and "appropriate value creation" (Jacobides et al., 2006).

In the organization theory discipline, the concept of architecture is being applied to different organizational domains, mainly large organizations, (Nadler and Tushman, 1997), including product (Ulrich, 1995), human resource (Lepak and Snell, 1999), enterprise/IT (TheOpenGroup, 2009, Kosanke et al., 1999, AMICE, 1993, Williams, 1998, Iacob et al., 2012, Wisnosky and Vogel, 2004), cooperation and collaboration (Fjeldstad et al., 2012, Gulati and Singh, 1998), and enterprise integration (Beeckman, 1989, Force, 1999, Williams, 1998). Existing research in architecture practice tends to orientate towards large corporations, making them over-complex requiring a substantial investment in organizational resources in terms of time, people, and financial (Harishankar and Daley, 2011) unaffordable by SMEs. Also, the concept of the architecture lacks sufficient theoretical grounding from business and organization disciplinary perspectives (Tamm et al., 2011). Moreover, there is scarcity of knowledge on the requirements for and specification of an architecture framework for SMEs and how they may enhance SMEs' strategic management capability to adapt with their business environmental dynamics (Dehbokry and Chew, 2013b). Addressing this gap requires reconceptualization of business architecture from a lens of multi-disciplinary socio-technical capability-based analysis.

Derived from SME business requirements for strategic management capability (Dehbokry and Chew, 2013b), in this paper, we aim to develop a comprehensive and simple capability-based Business Architecture Reference Model (BARM) for SMEs. This is achieved by revisiting the current architecture development method and synthesizing (integratively) a new conceptual model from IS, strategic management, organization theories and principles. BARM model will allow SMEs to shape or evolve with their chosen ecosystem and create value for customer/partner and themselves, e.g. through integrating, orchestrating and managing outside-in and inside-out capabilities/resources. From architecture literature (Alberti and Bartoli, 1986) and current business architecture frameworks (TheOpenGroup, 2009, Zachman, 2007, Guild, 2014), in conjunction with SME business literature (Chiu et al., 2006, Lee et al., 2010) we investigate SMEs business architecture's requirements (Dehbokry and Chew, 2013b). From strategic management discipline such as resource based theory (Grant, 1991), and dynamic capability theory (Teece, 2007) and, from organization science discipline such as modularity theory (Schilling, 2000, Pil and Cohen, 2006), evolutionary theory (Volberda and Lewin, 2003), and contingency theory (Donaldson, 2001), service science (Maglio and Spohrer, 2008), together we synthesize the requisite BARM that satisfies the SME architecture requirements for simplicity, elegance, understandability and ease of use (Dehbokry and Chew, 2013b).

Our first contribution is to apply capability view in line with resource based view (RBV) and dynamic capability (DC) theories to the SMEs architectural requirements (comprehensive and easy to use) helping them to easily orchestrate internal and external socio-technical resource/capability in order to execute their strategies. We identified and positioned outside-in and inside-out requisite capabilities and unambiguously mapped out interrelationship between different business components. In addition to applying DC and capability view on how to best orchestrate capabilities, we also built on the SME's external requirements that define their role as well as responsibilities within the chosen ecosystem. Following evolutionary and contingency theories we mapped institutional (partner, customer, competi-

tors, and industry) and macro (social, political and technological) environmental contingencies that shape the firm's architecture reference model. Mapping the chosen ecosystem and other environmental contingencies in the firm's various architecture components we believe this first, opens up SME's boundaries in ways that extend the SME's locus for value creation and appropriation; and second, creates a roadmap to guide SMEs through environmental/technological changes to manage its limited resources and to determine appropriate technology solutions, e.g. cloud computing transformation. The sensibility and efficacy of BARM's field application is illustrated using interview (from both E/BA expert and SME's managers).

The remainder of this paper is organised as follow. Section 2 describes the conceptual foundation of proposed BARM based on both architecture science and business design and organisation and strategic management perspectives. Section 3 outlines our research methodology. In Section 4 we outline BARM and explain how the discussed disciplines are adopted and used in its architecture components and elements. In the fifth section we sum up the findings of our interview and present some feedback from experts and SME managers/owners. Finally, section 6 concludes the paper with a summary of our research and its limitations.

## 2 Conceptual Foundation of BARM for SMEs

### 2.1 Architecture Science and Business Design

Our first stepping stone for this research is drawing on architecture definitions and principles as guide to develop the proposed reference model foundation (Williams, 1998, Zachman, 2007, AMICE, 1993, Force, 1999). The expression of architecture in enterprises and businesses was inflated through IT people in the IT industry that was used back in the 1980s to reduce the complexity of IT systems and applications and enterprise integration (Kosanke, 1995, Beeckman, 1989). In essence architecture in general defined as a "set of descriptive representations that are required in order to create an object" (Zachman, 2007). Whatever the object may be, architecture means a basic design approach to map a system's functions to its structures and to interconnect the elements of the system (Ulrich, 1995). The central principle of architecture is aligning the model or form of an object with its use or function as well as with creating order, consistency, uniformity and economy (Alberti and Bartoli, 1986).

The term of architecture in business design, refers to structures, metamodel and methodologies that enables business functioning as a socio-technical system. Business Architecture (BA), as applied in this research, is "the organization logic" of business components/building blocks which provides requirements for their "integration" and orchestration, as well as operationalizing the value proposition (Ross et al., 2006). Looking at business design from an architecture perspective, it determines "how" efficient a business delivers services, in "what" ways business delivers to meet its customer requirements, "who" are its actors (partners, customers and staff) "where" they are located. BA is an ongoing process (Hoogervorst, 2004) that represents the real world aspect of the business and integrates the fundamental concepts of an organization to guide its transformation to the target or new organizations (Josey, 2009).

BA is a model for articulating and formalizing organization structure and the way an organization operates in terms of capabilities<sup>1</sup>, processes, knowledge/information in line with its business strategies (Glissmann and Sanz, 2010). Customers and dynamic market should be the main attributes in BA in which business strategic goals are aligned with the decision regarding key initiatives, products and services, partners and suppliers. Since business model of a firm formalizes business concepts

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<sup>1</sup> The capability-based view is consistent with the resource-based view of a firm and with the resource view in ISO19440 (2007).

(Osterwalder, 2004) which emphasizes on the role of customer and focuses on the business value proposition (Magretta, 2002), we argue that reflection of business model in business architecture practice helps to manifest customer/stakeholder requirements in company's operation level. This even will be best facilitated by applying value co-creation principle from service science (Maglio and Spohrer, 2008) to the integration of BA and business model which is the key to innovative business design and development (Teece, 2010, Cavalcante et al., 2011).

## **2.2 Strategic Management Theories and Organizational Science**

With our first "stepping stone" in place, we move to our second conceptual foundation which is based on elaboration of organization science and management theories that address the firm's dynamic environments such as, resource based view (Grant, 1991, Wernerfelt, 1984), dynamic capability (Teece, 2007), evolutionary theory (Lewin et al., 2004), and contingency theory (Donaldson, 2001). Together they support SME's architecture adjustment to the environmental contingencies and identify the outfit and interrelationships between business external and internal elements that interact to co-create value.

According to the resource based view, heterogeneity of capabilities is a source of competitive advantage and a key factor that grants competitive advantage (Teece, 2007). Being the source of competitive advantage, the underlying capabilities need to be defined; and they must be viable economically, performable with measurable outcome (Helfat and Winter, 2011), and aligned with the business strategy (Collis, 1994). A related concept is dynamic capability (DC) which is initially defined by Teece as "company's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (Teece et al., 1997). Later he reconceptualised "sensing", "seizing", and "reconfiguration/transformation" as the micro-foundation process model of DC (Teece, 2007). Organisations with dynamic capabilities (a "meta competence") are said to be able to dynamically orchestrate their resources and capabilities in organisation level, institutional boundaries as well as amongst its ecosystem to maintain internal and external fitness in response to environmental contingencies (Helfat et al., 2007).

The co-evolutionary nature of a firm (Volberda and Lewin, 2003) requires its adaptation to the environmental contingencies. This perspective also provides the foundation for developing an evolutionary business architecture practice, which incorporates the contextual conditions under which a business is effective and enables the firm to co-create value in the chosen ecosystem. Organizational design and architecture play a vital role in comprehending and responding to environmental contingencies that confront organizations (Ethiraj and Levinthal, 2004). In essence business architecture is determined and shaped by path-dependent evolution of firm's socio-technical capabilities as well as its ecosystem contingencies. Contextual environments for SMEs are defined in social/political, technological, collaborative network/partner, and customer/market. According to contingency theory, organizations are able to accomplish their objectives when their structures and strategies are aligned to particular elements of their contextual technological and institutional environments (Donaldson, 2001). Contingent strategies (Ginsberg and Venkatraman, 1985) and modular architecture (Pil and Cohen, 2006) are defined best to facilitate the intended architecture alignment.

## **3 Research Methodology**

In this research we aim to develop and evaluate a novel architecture reference model that assists SMEs plan and execute their strategies in dynamic environments. As its problem solving nature, we follow the design science research method (R Hevner et al., 2004) so the proposed reference model is preliminary validated by interview of its field application (March and Smith, 1995). This research includes a set of interviews with E/BA experts and SME's executives/owners that have been proven to be very interesting regarding BA use and have insofar contributed to BARM's evaluation as they have revealed the SMEs and practitioners interest in the concept. The result of this evaluation can give an impression of the BARM appropriateness.

## 4 Toward a Business Architecture Reference Model (BARM) for SMEs

This section ties the pieces of our discussions together in a new reference model which is proposed as a capability-based strategic tool in a set of architecture components and their internal and external fitness. BARM consists of two parts which are presented in sections 4.1 and 4.2. First we provide graphical and textual view of the proposed architecture reference model and its components. These components that are explained further below, consist of strategy, business capability, service, organization, knowledge/information views. Second, we illustrate how the pillars of the reference model are linked to SME's business model (Osterwalder, 2004) and ecosystem (macro and institutional environments).

In the first step we used architecture interrogatives to orchestrate and combine SME's business architecture components. Using these abstractions allows us to simplify business architecture concept and explain architecture of SMEs in an organized way. It also allows SME's managers to be involved in defining business architecture, to concentrate on selected business requirements and related scenarios, without losing sight of the overall enterprise context<sup>2</sup>. Basically, the five components of the proposed model cover all the BA building blocks presented by the well-known BA frameworks identified by (Glissmann and Sanz, 2010). In addition we split the architecture components in to 12 interrelated sub-components to reflect SME's requirements in each architecture view. Next, in order to provide an adequate architecture view, we focus on business capability as a core in our architecture design, which is believed to present "a fine grained" view in organization design (Crick and Chew, 2014). The advantage of capability-based approach in our BA conceptualization is threefold. First, it helps to simplify the BA practice and demonstrates the business value of the subsequent architecture practice to the firm executives (Blosch and Burton, 2013). Therefore it makes the engagement of the firm executives with the BA practice easier. Second it helps to orchestrate business components into specific and identifiable capabilities. This is the case that BARM is used to initiate some series of incremental changes and promote on-going adaptation (Helfat and Peteraf, 2009, Winter, 2003). Third, it provides a powerful tool to model and define relationships within ecosystems (Burton and Allega, 2014). BARM is proposed as a firm's capability orchestration capacity, hence it outlines fundamental relationships between business components, as a socio-technical system, internally as well as within ecosystem of firms. We define the internal and external fitness of the architecture components in line with the theory of dynamic organizational evolution (evolutionary theory and contingency theory). Furthermore this allows us to first exert the environmental dynamisms and competitive pressure on business components and second to sense, leverage and integrate external opportunities.

### 4.1 BARM Components

Figure 1 illustrates the graphical view of the proposed BARM which outlines its components. It defines the key relationships between the components and provides the architectural contents to support capability orchestration function as well as value co-creation. The interdependencies guided by architecture principles, co-evolutionary, contingency, DC theories as well as service science, allow for unambiguously mapping between the components/views, business model and external contingencies. They help to identify consistencies between components and provide guidelines for consistent architecture design.

#### Strategy View-Why

Business strategy view focuses on "why" aspect of BARM and provides clarity and direction to business requirements and focuses on "Motivation" of businesses in respect to the SME's internal and external environments (Zhou and Li, 2010). The strategy orientations were defined emphasizing on dy-

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<sup>2</sup> <http://pubs.opengroup.org/architecture/togaf811-doc/arch/chap39.html>

dynamic competitive strategies developed by Thomas in 2009 (Hutzschenreuter and Israel, 2009) which comply with “contingency theory” (Donaldson, 2001). The contingency approach to enterprise strategies tailors the strategies that guide organization to manage uncertainties within dynamic environments (Ginsberg and Venkatraman, 1985). This aligns with the necessity of flexible strategies in small and medium enterprises which determines the form of collaboration and facilitates value creation within a dynamic ecosystem (Aragón-Correa et al., 2008, Noke and Hughes, 2010).

Sub-components in this view are defined in line with co-evolutionary theory (Volberda and Lewin, 2003). It is proposed to adapt business to the environmental contingencies which occur in three levels: first organization level which links capabilities and strategies, second level that links company to institutional boundary/nation state, and third level which adapts the company to “macro” environments (Lewin et al., 2004). The strategy view sub-components represent SME strategies in three levels of:

- Organizational Contingencies; are categorized in business model and organization’s capabilities (Hutzschenreuter and Israel, 2009, Noke and Hughes, 2010).
- Institutional Environment Contingencies; which have been categorized as collaboration networks, market, industry, and competitors contingencies.
- Macro Environmental contingencies; reflect social, political and technological contingencies. This element stresses on firm’s “legitimacy” and “efficiency” to change its structure and strategies to maintain alignment with changing technologies.

### **Business Capability View-What**

The business capability view which is considered as the core of BARM, explains “what” aspects of the architecture and exposes company’s business competencies and the processes that perform them. For this purpose we have adopted the notion of capability that is presented in strategic management literature as a “firm’s strength or proficiency of bundle of interrelated routines for performing a specific task” which has its root in resource based view (RBV) (Peng et al., 2008). In this definition “routines” represent organizational processes that utilize and perform business capabilities to deliver value (Teece et al., 1997, Grant, 1991, Crick and Chew, 2014). Mapping business capabilities with associated business processes facilitates applying principles of modularity (Merrifield et al., 2008), which is believed to be an enabler for companies to enhance competitive advantage (Pil and Cohen, 2006). We also follow the three features identified by Hefat to define SMEs business capabilities (Helfat and Winter, 2011, Helfat and Peteraf, 2009);

- Each capability has a specific and intended purpose
- Each capability has an ability to perform particular activities
- The performance driven by the capability is repeatable and reliable

Influenced by capability topology presented by Day (Day, 1994), we split the capability view to the second level into three main sub-capabilities. We categorized SME’s “critical” capabilities identified by (Rangone, 1999, Lee et al., 2010, Jacobides et al., 2006) within these sub-capabilities. “Inside-out” capabilities refer to capabilities from inside the firm in response to market requirements and opportunities which include production capability and service/product delivery capability. “Outside-in” capabilities refer to externally oriented capabilities in order to sense and anticipate environmental contingency. They include market sensing, market relationship management, ecosystem sensing, and ecosystem relationship management. “Spanning” are the capabilities that integrate the company’s inside-out and outside-in capabilities which are including Learning and new product development.

### **Business Service View-What**

In business service view we represent business services which are defined as “application of specialized knowledge and skills through deeds, processes and performances for the benefit of another entity or the entity itself” (Vargo and Lusch, 2004). The business service view also represents an adaptive

system of people, processes, systems, and applications and infrastructures that are working together to create value to different levels of stakeholders (business units, customer, suppliers and networks) (Vargo and Lusch, 2008). The business services as presented in BARM, encapsulate specific business capability or sub-capability, group of capabilities or business processes performing the capabilities. Therefore the size and scope of the logic that is represented by the services can be varying.

This view also requires stakeholders' feedback for which the services provide value. This enables a firm to establish "collaborative processes" with different firm's stakeholders and institute value co-creation process (Lusch et al., 2007, Vargo and Lusch, 2004). The business service view provides the foundation for designing ICT services.

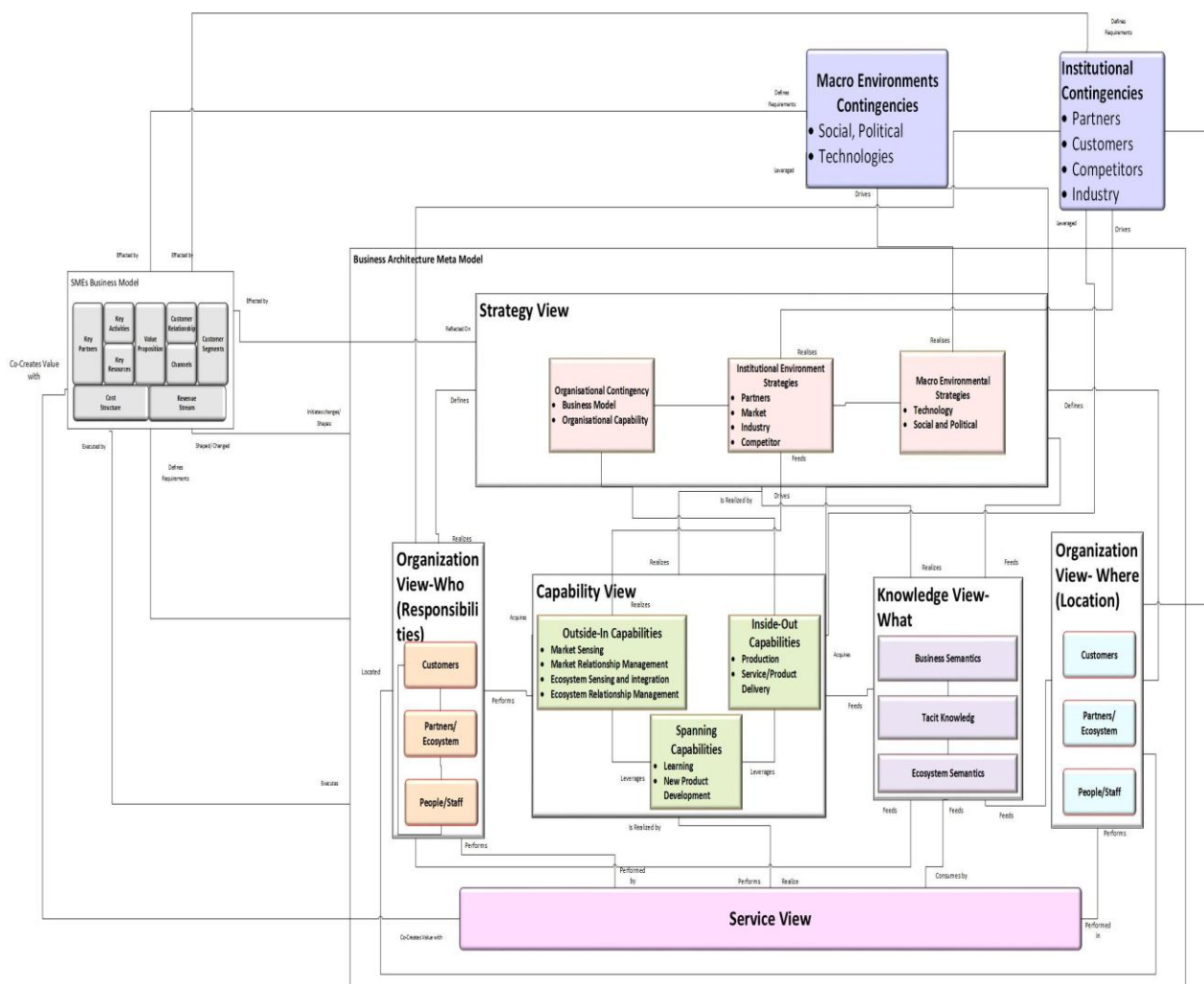


Figure 1: Business Architecture Reference Model (BARM): Components, Internal and External Fitness

### Information/Knowledge View-What

Information and knowledge are valuable resources in both large and small enterprises. Accurate and reliable information plays significant role in facilitating enterprise decision making process (Wiklund and Shepherd, 2003) and building dynamic capabilities (Eisenhardt and Martin, 2000). Furthermore information and knowledge have gained special attention in integrating organizations horizontally and within networks of organizations (Richard and Devinney, 2005).

In this view, structured information/knowledge will be used to specify, develop, and validate business semantics and ecosystem semantics. Ecosystem semantics are collaboratively congregated to be uti-



lized by the networks entities (Fjeldstad et al., 2012, Choi et al., 2008). Business semantics are including both tacit knowledge and explicit knowledge which need to be managed to support dynamic capability development and creation (Helfat and Raubitschek, 2000).

### **Organization View-Who/Where**

In the new digital economy, as global companies grew and their geographic expansion unfolds, more and more businesses are able to decentralize their resources, capabilities and market and business partners. Consequently companies need to reshape and reinvent their organizational structure in different settings and new global enterprises around the world (Fjeldstad et al., 2012). In the organization's geographical context, strategic choices of where to locate their business, resources, which target market, partners to collaborate with and whose/responsibilities/accountabilities for these locations are all important decisions that the owner/manager of a company has to make.

The organizational view represents geographical context as well as responsibilities which could influence the density of possible external capabilities and resources that might be at the company's disposal. In this view we define people/responsibility, locations in that the responsibilities are performed, as well as stakeholders and partners.

## **4.2 Interdependencies between the BARM Components (Internal and External Fitness)**

The fundamental relationships between BARM components are presented to show the organization logic of business components. These relationships are defined to guide SMEs to manage their constraints by orchestrating and integrating their socio-technical capabilities and value creation/appropriation within the chosen ecosystem. These will be achieved by aligning business model with business strategy and defining strategic fitness both internally and externally.

### **BA component orchestration and integration:**

- With the aim of enhancing external fitness, we mapped the capability view to the institutional and macro environment where SMEs can utilize adequate capabilities through partnership, sensing market requirements, linking to the customer, bonding channels, engaging in industry, and monitoring technologies. The SME capabilities may shape (or disrupt) and are shaped by market demand, industry architecture, as well as technology changes. Some environmental (e.g. government policies, technology changes) circumstances also affect capabilities which might initiate change in capability or retire the capability (Helfat and Peteraf, 2003).
- Business capabilities are driven by SMEs strategies (Stanford, 2007). At the same time performing strategies requires different types and level of capabilities (Sirmon and Hitt, 2009). Capabilities involve individual/team (organisation view/who) to coordinate and perform the related process (Helfat and Winter, 2011). The capabilities are incrementally enabled and orchestrated by business services. Service view is linked to organisational view, which reconciles internal and external stakeholder's requirements (customers, partners and internal staff) and simultaneously performed/used by them.
- The creation and transformation of information and more importantly tacit knowledge (which is not easily communicated) require constant interactions between people (including partners, customers and staff) over time (Teece, 2000). The tacit knowledge, as our main interest in this research, also co-evolves with the capability and service view to establish learning process in related processes (Winter, 2003).

We simplified the relationship between the BARM components in a two-dimensional matrix depicted in Table 1. These relationships are represented in the cells, that is, the intersection between the BARM components. Each cell represents mapping from column (e.g. strategy) to each row item (e.g. capability).

	Strategy	Capabil-ity/Resources	Information	Organization-al	Service	Macro En	Institu-tional En
Strategy		Realized by/drives changes to/ define requirements	Realized by/drives changes to/ define requirements	Realized by/drives changes to/ define requirements	Realized by/drives changes to/ define requirements	Realizes	Realizes
Capabil-ity/resource s	Realizes		Acquires	Performed by	Performed	Shaped	Shaped/Sh ape
Information	Feeds/Rea lizes	Feeds		Feeds	Feeds	Realizes	Realizes
Organiza-tional	Realiz-es/Shaped	Performs	Utilizes		Performs/ Utilizes	Realiz-es/Shaped	Realiz-es/Shaped
Service	Realiz-es/Shaped	Performs	Utilizes	Performed		Realizes	Realizes
Macro En	Drives	Shapes/Chang es/Drives	Shapes/Cha nges/Drives	Shapes/Chang es/Drives	Shapes/Chang es/Drives		
Institutional En	Drives	Shapes/Chang es/Drives	Shapes/Cha nges/Drives	Shapes/Chang es/Drives	Shapes/Chang es/Drives		

Table 1: Mapping BARM Internal and External Relationship

**Value creation/appropriation within dynamic ecosystem:**

- o In this part we elaborate on SME value creation/appropriation in our architecture reference model by defining dependencies between BARM components, to the elements in BM canvas (value proposition, customer, resources, activities, and partner). To that end we positioned BARM at the level that helps a SME first to enhance its internal and external fitness within its value proposition and second to shape, define and change requisite value proposition model for execution. Changes driven from the evolutionary BA practice (mainly on technologies, processes, services...) create new business platforms that enable SMEs to change their business models and collaborate in a powerful new ways with the chosen ecosystem. Likewise we believe that unambiguously mapping and correlating the nine component of business model to the BARM components, provides the SME with a capacity to ensure strategic alignment of BM design to business strategy, especially its internal and external fitness. Designing business model to achieve internal and external fitness is an under-researched area (Zott et al., 2011). Thus the proposed BARM provides a potential means to fill this gap. Due to size limitation, in this paper we mainly focus on mapping the value proposition element in BM Canvas to the various BARM components. The fundamental relationship between BARM components and BM canvas elements are represented and explained in Table 2.

BM Canvas elements	Mapping to BARM Components	Selected Dependencies and Relationship
Key Partner	<ul style="list-style-type: none"> <li>•Strategy view</li> <li>•Outside-In capabilities</li> <li>•Organization view</li> </ul>	<ul style="list-style-type: none"> <li>• This relationship represent contingency theory for defining partnering strategy</li> <li>• This relationship represents the requirements for evolutionary and DC theories, on the SME’s capabilities that needed to be acquired/leveraged</li> <li>• This relationship determines who is the partner and where is its location</li> </ul>
Key	<ul style="list-style-type: none"> <li>•Strategy view</li> </ul>	<ul style="list-style-type: none"> <li>• This relationship represent contingency theory for defining capabilities</li> </ul>

Acti- ties	<ul style="list-style-type: none"> <li>•Capability view</li> <li>•Service View</li> <li>•Information view</li> </ul>	<p>and services</p> <ul style="list-style-type: none"> <li>• This relationship represent RBV and DC on outside-in and Inside-out capabilities to configure and manage socio-technical capabilities to deliver the prospective “value” and determines the ability of SME to deliver “value”</li> <li>• Services driven from capabilities are performed by the activities. This is the principal area where the key activities are performed</li> <li>• Tacit knowledge defined in information view may bring competitive advantage</li> </ul>
Key Re- sources	<ul style="list-style-type: none"> <li>•Strategy view</li> <li>•Capability view</li> <li>•Service View</li> <li>•Information view</li> </ul>	<ul style="list-style-type: none"> <li>• This relationship represents contingency theory for defining capabilities and services. The strategy view identifies the strategic differentiation of each resource.</li> <li>• This relationship represents RBV and DC on capability view which determines the ability of SME to deliver “value”.</li> <li>• This relationship represents RBV and DC on capability view which determines the ability of SME to deliver “value”.</li> <li>• The resources represent the knowledge, skills, tacit knowledge, and services</li> </ul>
Value Proposi- tion	<ul style="list-style-type: none"> <li>•Strategy view</li> <li>•Capability view</li> <li>•Service View</li> <li>•Information view (tacit knowledge and learning)</li> </ul>	<ul style="list-style-type: none"> <li>• This relationship represents contingency theory for creating value</li> <li>• This relationship represents RBV and DC on capability view which determines the ability of SME to deliver “value”. The capabilities represent the knowledge, skills, tacit knowledge, processes to deliver value.</li> <li>• This relationship represents value co-creation principles on defining and delivering services</li> <li>• This relationship is built to reflect learning whereby the value delivered to customer is realigned based on the performative experience from the customer (or stakeholders), which also mapped to service and capability view to reflect the customer feedback.</li> </ul>
Custom- er Rela- tionship  Custom- er Seg- ment  Chan- nels	<ul style="list-style-type: none"> <li>•Strategy view</li> <li>•Capability view</li> <li>•Service View</li> <li>•Information view (tacit knowledge and learning)</li> <li>•Organization view</li> </ul>	<ul style="list-style-type: none"> <li>• This relationship represents contingency theory on defining strategy toward customer segmentation</li> <li>• This relationship represents service science and value co-creation in service and capability configuration.</li> <li>• This relationship represents service science and value co-creation in service and capability configuration.</li> <li>• This relationship is built to reflect learning whereby the value delivered to customer is realigned based on the performative experience from the customer (or stakeholders).</li> <li>• This relationship determine who is the customer and where its location and the people who deliver value</li> </ul>

Table 2: BARM Components and BM Canvas Elements Interdependencies

## 5 Research Evaluation

Between Jun 2012 and November 2013, we conducted a dozen of 60 to 90 minutes long interviews between E/BA experts and SME’s executives as well as online interview through social media, aimed at investigating the SME’s architectural requirements and assessing BARM fidelity on addressing SME’s strategic internal and external requirements. The questions which target SME’s executives and E/BA industry experts were structured in two parts. The first part aimed at investigating SME’s specific architectural requirements and examining how the interviewees and their companies plan to execute strategies. This helps us to reflect SME’s requirements into the proposed model and also can serve as an indicator especially for SMEs being comfortable with the use of the concepts. Not surprisingly, very few SMEs and consultants used the architecture practice for the SMEs. One E/BA consultant explained it that “*There is a strong need for strategic planning within SMEs but I haven’t seen managers*

using the concept of architecture as it used by large organisations”. Interestingly the owner of one small recruiting company had mapped out his external and internal relationship of its business components without having any knowledge of architecture concept. This could be seen as the use of some sort of architecture concept. Some of both experts and SME’s manager impressions are shown in Table 3.

The second part consists of presenting the reference model as well as questions on evaluating effectiveness, completeness, simplicity and understandability for SMEs based on real world phenomenon (March and Smith, 1995). The general impressions from both SME’s manager and experts were all in favour of both the significance of BA practice for SMEs and fidelity of the proposed BARM. An architect and research fellow put it very clearly: “I very much agree that an appropriate BA framework for SMEs is both valuable and important. There are a few people who have been looking at E/BA as it might apply to SMEs and I’ll be keen to take a look at if the attempts overall demonstrate the expected value”. Table 3 presents the questions and an overview of their outcome (favourable is shown as P, reluctant as N, and neutral answers as E). Some of the experts/SME’s manager opinions on the model’s validity are presented in the following section.

Question Domain	Evaluation Questions	Interview Out Come						
		SME’s Manager and E/BA Experts Statements On First Part						
Questions on SME’s requirements for BA-RM as a strategic tool	How do you/SMEs plan to align business strategies to operational level?	“... I don't know how many start-ups I've seen where they have no clue what capabilities they need.” “...Our (a SME’s) systems and business structures are defined by experiences and based on new projects as well as the government policies.”						
	What are the BA-RM’s attributes that which make it applicable to SMEs?	“As you describe, SMEs often don't have the resources/time to be as formal as some larger organisations. But at the same time specific industry & associated expectations & regulations/compliance requirements should affect/influence the model all practice” “The level of BA practice can vary quite significantly. So the model needs to be comprehensive and adjustable for e.g. a business with less than ten people making 2 million a year and a local data centre turning over 10 million a year with 20 or so” “... Next comes the problem of how BA can help us (SME) deal with "changing environments". That one is tricky.”						
	How does an architecture model help you/SMEs to create/sustain competitive advantages within dynamic environments?	“...Having a set of tools with some guidance can benefit even the smallest of businesses as it helps define what needs to get done.” “...A business architect with BA tools can go a long way to helping structure the company, set up the organization and get everyone on the same page in terms of process, roles and services.”						
Question Domain	Pre-Evaluate Questions	Interview Outcome						
		Expert1	Expert2	Expert3	Expert4	SME 1	SME 2	SME 3
Questions on framework completeness and fidelity with real world and applicability in SMEs	In your opinion is the proposed model, components, relationships and related terms simple and understandable for SMEs?	N	P	N	P	N	P	P
	How could such a model help a SME define/execute strategy related to business, market and collaborative network?	P	N	P	P	P	P	P

How could such a model help SME's manager to structure, manage ICTs and associated capabilities?	P	P	P	N	P	N	P
How could this model enables SMEs to react in dynamic environment (Changes in ICT, market and collaborative network )	E	N	P	P	P	N	P
How such a model could serves you/SMEs as the architectural guide for integrating business/model components?	P	P	P	P	P	P	P
In your opinion what elements are missing?	P	N, Q	P	N, Q	P	P	P
In your opinion what elements should not belong to the model?	P	P	P	P	P	P	P
Indicators; P: Positive answers N: Negative answers E: Neutral answers Q: Quote							

Table 3: Interview Structure and Outcome

**Impression on BARM simplicity and understandability for SMEs:** In the first question we aimed to find out if in the interviewees opinion BARM was a suitable guideline for SMEs architecture. One SME's consultant (former architect) acknowledged the difficulties of working with SMEs due to their limited resources and added that *"the fact the you have chosen the business scenario in an iterative architecture process development is more effective in order to build required knowledge"* his major concern was that *"the level of "business architecture" you want to get into here can vary quite significantly... so their business should be understood first the model tailored based on their business and industry model"*. Another architect insisted on the *role of business/industry expert* as an important architecture team member. Three adjusted BARM (based on the initial identified SME's requirements) were presented to three SMEs manager. They all were satisfied with the presentation where they could see a sneak peek of their business architecture. A manager of a government agency, who required implementing the cloud technology, mentioned that *"although the big picture seems a bit new for us, it is very great that you can see whole and their relationship in a page. It is useful to make a decision on business priorities"*.

**Impression on BARM completeness:** According to a former architect who is providing consulting services to SMEs, *"all required elements clearly mapped out and to me it is complete representation of a business architecture. The fact that the components are broken down to meet their purposes is quite new"*. He also insisted that the model would become even more interesting if *"events"* as an environment contingency to be added to the elements that affect SMEs capability mapping as *a market opportunity*. There was a positive impression on theoretical foundation of the BARM as one of the BA experts indicated that *"I appreciate applying the different disciplines and academic review in your research that brings more business view in the architecture area"*. A medium sized manufacture owner stated that *"I would like to see the business operational level impact"*, as his major concern was *"...staying more on strategic level slows down our operational level"*.

**Impression on BARM's applicability for SMEs:** The ability to unambiguously map out business components and ecosystem elements to execute business model, seems to interest SMEs and experts. The manager of a small manufacturer that is an active member of textile community, saw the value of insti-

tutional environment in *mapping out on its business strategies and capabilities and impact on its operation*. The government agency indicated that *“I like the fact that I can see technology and network changes impact on my business, I need that to bring more advantages on my business network”*. The mentioned SME that requires to migrate toward cloud computing was satisfied to see how we *“positioned technology elements and institutional/macro environmental policies and their mutual impact on their decisions toward the disrupting technologies”*. BARM role on shaping future business also interests an E/BA architect/cloud consultant as he stated, *“I think organizations will need to develop and manage business capabilities in interesting ways based on changes in their eco-systems. That is addressed clearly in your model”*

## 6 Conclusion and Future Work

For open ecosystem and economies exposed to dynamic technology and market, the proposed BARM as a strategic tool, can enable SMEs to create sustainable value. In developing a multi-disciplinary architecture reference model for SMEs, we have sought to integrate and synthesize diverse but interrelated disciplines such as, architecture literature (Alberti and Bartoli, 1986) and current business architecture frameworks (TheOpenGroup, 2009, Zachman, 2007, Force, 1999, AMICE, 1993, Wisnosky and Vogel, 2004, Iacob et al., 2012), strategic management discipline such as resource based theory (Grant, 1991), and dynamic capability theory (Teece, 2007) and, from organization science discipline such as modularity theory (Schilling, 2000, Pil and Cohen, 2006), evolutionary theory (Volberda and Lewin, 2003), and contingency theory (Donaldson, 2001), service science (Maglio and Spohrer, 2008). In our attempt we tried to address SME's internal and external contingencies/requirements and challenges using related theories and concepts.

Regarding evaluation, the model has been presented to different SME managers and E/BA experts and its fidelity with real world phenomena (interviews) based on (March and Smith, 1995) has been investigated and endorsed by practitioners. The interviews with E/BA experts and SME's managers have shown that the proposed BARM also has potential to be further explored and examined. The main strengths of BARM concluded from the interviews were; first its relative simplicity and understandability by SME managers, second, its ability to present a transparent big picture of business components and their external and internal fitness. In addition to its contribution to the specification of a strategic management tool to facilitate SME value creation the paper also contributes to advancing architecture science. First it has developed and evaluated the propose BARM that covers and addresses the business architectural requirements of SMEs. Second it re-conceptualizes architecture with broader organization, management and service sciences disciplines to provide theoretical grounding for the proposed BARM in order to address disparate business concerns and requirements for co-evolution capabilities with subject firm's dynamic environments.

While the proposed BARM has been rigorously developed and constructively evaluated some limitations remain. First, while the efficacy of BARM has been preliminarily validated by interviews, more case applications from diverse industries are needed to confirm BARM's general applicability. Second, more evaluations require to examine its capacity to help SMEs to shape or evolve with their chosen ecosystem. Third, a formal mapping method, such as that of (Babar et al., 2010) which has been used for mapping strategic alignment, is needed to trace the interrelationship between BARM components. This would enhance BARM's theoretical foundation. These areas represent opportunities for further research.

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