Framework to Develop a Business Synergy through Enterprise Architecture

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ABSTRACT
New enterprises face several challenges in keeping their customers and keeping up with the dynamic growth of services and products. On the other hand, enterprises are generating Petabytes of data and managers don't know how to use this invaluable data. Some big enterprises are growing quickly because of the right use of information as a key factor in their decision-making and market intelligence. Business is developing rapidly and in unpredictably. The rapid evolution of the Internet is opening up opportunities to create new kinds of business like e-business, smart factories, and virtual enterprises (VE). In this context, based on Enterprise Architecture (EA), VE, and synergy in business integration, we propose to develop a research framework, which details the formal process to achieve a fluid business synergy in business collaboration processes. The proposal consists of a conceptual model with three factors: EA, VE, and Synergy in Business Integration and Collaboration (BIC).

CCS Concepts
• **Information systems → Mediators and data integration.**

Keywords
Business Synergy; Enterprise Architecture; Integration; Collaboration; Virtual organization; Ontology.

1. INTRODUCTION
With the evolution of technology, organizations are facing various problems in maintaining their market reputation and continuous growth of services and products. The information of the organization plays a vital role in decision making and market intelligence [16]. Therefore, is evident that technological evolution is bringing opportunities to improve the interoperability and integration of enterprises. The authors [13] develop a model-based integration of business, including the business architecture (BA), business model (BM), processes architecture (PA), total quality management (TQM), and EA.

Enterprise architecture is a productive research area to help virtual organizations achieve current and future business goals. In this context, the authors propose formalizing the integration processes among organizations, based on the EA concept, focusing on data, processes and technology analysis. The aim won't be only creating and enhancing flexible products and services but improving delivery time and saving resources.

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1.1 Research Problem
The present project contributes to the sensitization of the use of integration of enterprise architecture to create value in an organization based on EA data, technology and processes, when using them strategically. Currently there is a waste of resources and data owned or produced by organizations. Applying analysis in the enterprise architecture concept [9], data can be converted into valuable information, so decision-makers can know with certainty the characteristics of each organization, its roles and functions [19]. Organizations that intelligently use their data have a competitive advantage in production because of its potential uses in the organization's productive activities. In this context, in this proposal, the use of value adding by data based on EA is studied, its application in the integration between organizations to improve profitability; for example, in the management of inventories, resources and roles, among other things, while drastically reducing delays and expenses.

1.2 Related works
In Enterprise Architecture research has shown how business strategies are linked with data, processes, technology and people [3]. Therefore, nowadays, data analysis has become basic for knowledge discovery from the data collected from various sources. There is now a significant need to develop strategies, mechanisms and methodologies for facilitating their usage in various contexts.

Experts have been dedicated to the subject with varying success since 1987, when Zachman [28] proposed the idea of design for the arrangement of IT with the business technique. During the 90s and until 2005, numerous referential structures were produced, advanced by innovative individuals, mostly as part of the American open organization, as IT government devices.

Schœnherr [22] displayed an exploration in the universal meeting TEAR (Trends of Enterprise Architecture Research), where he broke down in excess of 126 articles until 2008, identified with the term "business design". His paper showed that, of the 126 articles, 56% related to scholastic commitments; with the rest spread among counseling organizations 21%; open segment, 6%; IT organizations, 7%; and others, 10%. In this specific circumstance, it is worth noting that 36% of these articles were centered around dissecting best practices and ideas to present BA in the associations.

Around the integration of enterprise architecture to achieve a Virtual Enterprise topic, this author identified seven papers relevant to this paper´s proposal. The first, by Beshilas [4], describes a formal guide to extend EA through Agile, Lean, and Enterprise 2.0. The challenges are studied, and the more

appropriate tasks of the techniques mentioned before are associated with EA in order to achieve an effective collaboration between organizations. Drews and Schirmer [8], describe the challenges related to implementing business ecosystem architecture management (BEAM) from the EA and EAM concepts. Although the authors detail all solutions found in previous works and describe four cases from industries, where they identified five stages to achieve BEAM, they don't apply these stages in a real case and don't define a clear model. In the same year, Hao, Shamsuzzoha and Helo [12], outline a design for an Enterprise System as a platform to create virtual factories in the business environment (ESVF). This paper describes a significant methodology to improve manufacturing processes and increase skills to collaborate through enterprises information effectively. Here too there's no an application and the systems are fed by a common database. Another important contribution is made by Mvelase, Dlodlo, Sithole and Adigun [18], who propose a virtual enterprise model in cloud for small and medium organizations, that can't afford a private cloud infrastructure. Their results show that the final cost of a Cloud service as partners is 17 times more economical than a private cloud service.

In order to give an economic solution to partner selection in virtual enterprises, Zhou, Bu, and Zhou [30] proposed an improved genetic algorithm (IGA). The results of their experiments prove that the IGA is better that the traditional genetic algorithm for resolving partner selection problems. So far, the authors only concentrated on integration and collaboration and have not touched on the issue of the strategy and the business model of the companies. This review of the literature has revealed significant gaps:

These works don't include a deep analysis of the complexities of enterprises [4]. There is a lack of a clear model or a mapping to goal a virtual enterprise architecture [8]. There's no an application in a real case. It would be a good contribution to extend the current works to access more available resources as EA frameworks [12]. Another good contribution would be improving the partner selection not only based on organizations tasks, but adding as parameters the components (data, application, and technology) and the lines of business in an EA [30]. In order to provide a systematic procedure toward a transparent integration, a business and processes architecture ontology based in a semantic metamodel would also be valuable [13].

Finally, a deep analysis of enterprise architectures is needed to provide better knowledge about each participant so they can share processes and information to improve the services [18].

2. PROPOSAL

Organizations require formal procedures that make it possible for the collaboration process between them to be carried out expeditiously, reliably and in real time. The collaboration strategy could be defined as the long-term plan that allows focusing efforts and aligning resources productively of a set of business processes, subordinated to operational tactics (model of business) adapted to the business characteristics [29]. Organizations currently face major challenges to meet their objectives, so it is possible that, given the hostility of the environment, they find it difficult to meet those challenges alone and require partnerships and collaborations. The link between different types of organizations fosters a collaborative environment of harmony and prosperity, which, today, characterizes the most advanced and productive societies in the world. In this sense, in the future, virtual organizations that respond to specific needs of society can be built in a natural way [25]. In conclusion, it is proposed to create virtual enterprises that generate synergy and satisfy the strategic needs of organizations, making a profit from handling data, and processes. The present paper proposes to study integration between organizations, through the concept of Enterprise Architecture, using the knowledge obtained from the processes, data and technology. The result of the study will be a conceptual and theorical framework as a formal procedure of integration between enterprises, in order to get a business synergy and improve the answers to the current and future changing demands of the customers.

2.1 Conceptual Framework

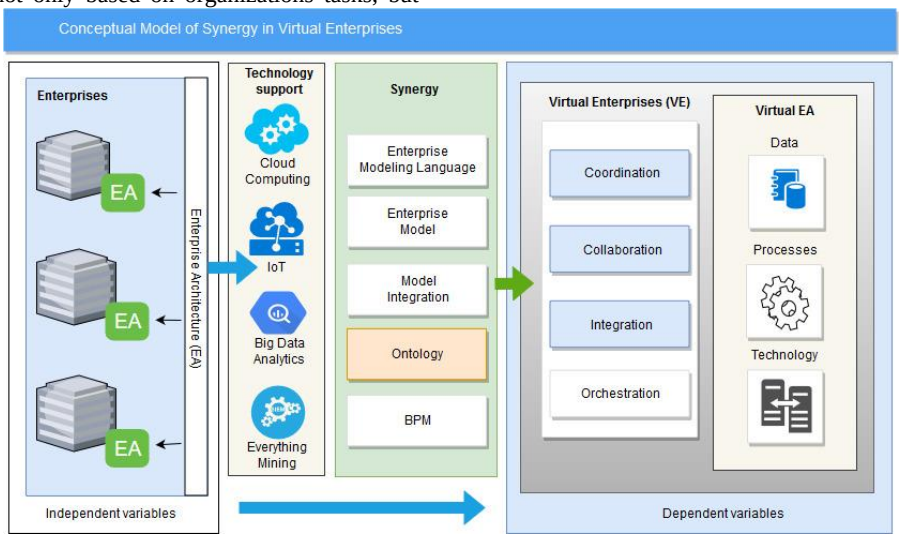

Figure 1. Conceptual model framework.

Figure 1 shows the graphical conceptual model which contains three main components: EA, VE and Synergy in Business Integration and Collaboration (BIC). It shows the independent and dependent variables for the creation of a VE based on the synergy model. The EA means describing all the important relationships and elements of the organization constitution [23]. The VE architecture proposed in this study, is a concept that is integrating all artefacts of the enterprise's architecture of business [10]. It is perfect for collaborating multidisciplinary collaborative development of products and services [31]. Therefore, the VE is a

huge challenge to the future business. The VE makes it possible to do business using the new technologies like IoT, Cloud Computing and Bigdata, etc. in order to offer the capacity to interchange models, architectures and environments [7]. In this context, there will be a lot of progress in dealing with product development lifecycle problems in manufacturing industry collaboration as well. The main challenge is to find the best way to integrate EA, lines of business, and business strategy so that the products and services time and cost are reduced, and the quality is improved [5]. The purpose of this conceptual model is to offer a detailed overview of the generation of a virtual enterprise by integrating the enterprise's EA and defining the origin, type, advantages, applications, future, and challenges. The nature of competition in business has changed [12]. It is no longer about the mass production archetype but more about flexibility and quick responsiveness [21]. Enterprises are paying a lot of attention to enterprise architecture so that they can improve flexibility and adapt to changes in the business environment [6]. Enterprises can target a business synergy and handle different kinds of dynamic association with the help of enterprise architecture [15].

The factors, subfactors and variables selected in the conceptual model are focused on achieving an appropriate synergy, keeping a high performance and quality of collaborative processes of enterprises. It makes sure that there is no communication gap between the enterprises that are looking to collaborate and ensuring that good and reliable working relationships are built.

2.1.1 The independent variables:

In the conceptual model shown in figure 1, there are 10 independent variables.

2.1.1.1 *Technology support:* The first step is to make the best use of technology so that the process is supported [21].

2.1.1.2 *Cloud computing:* This is most helpful in enterprise architecture. It is a great technical support that has many benefits to offer. It is a cost-effective technology and there are no hardware or computing resources weighing on the balance sheet to worry about. Cloud computing allows the enterprise architecture to implement an efficient planning support [18].

2.1.1.3 *IoT:* There are many changes that companies must make in enterprise architecture so that they can introduce the internet. IoT has so many great things to offer to business and the amount of data that is created [24].

2.1.1.4 *Big data analytics:* The big data has made a lot of impacts and changed the way organizations understand and use the increasing volume, value and speed of the enterprise data [27]. With the right approach, the enterprise architecture is useful in helping business in targeting the right market activities. It allows you to improve sales, marketing, and business [11].

2.1.1.5 *Mining everything:* The mining of all the resources and data is also an important part of technological support [26].

2.1.1.6 *Synergy:* Synergy can be accordingly defined as the additional value that is generated by combining two companies [29].

2.1.1.7 *Enterprise modeling language:* It is the model language that brings together business process modeling, structural modeling, goal modeling with other things like resource modeling and goal hierarchies [19]. The purpose of the enterprise modeling language is to bridge the gap between goals and approaches.

2.1.1.8 *Model integration:* This involves integrating different actions of the enterprise and allowing various independent variables to work together. It helps in coping with the challenges thrown up by the synergy model of enterprise architecture [16].

2.1.1.9 *Ontology:* Accordingly [31], the ontology applied in enterprise architecture helps in overcoming the integration problems and finding the best way to collaborate and produce great results.

2.1.1.10 *Business Process Management*: BPM focuses on keeping up with and improving the business processes so that the efficiency of the business is improved. To achieve good results, it is important that a business starts with capturing the current-state end-to-end process of an organization and documenting all the steps in a process map.

2.2 The dependent variables:

By combining all the different components of technological support and synergy you can successfully identify dependent variables. The virtual enterprises make sure that there is coordination between the different variables involved. There should be no communication gap and all the actions should be able to function properly. It also opens doors for collaboration. VE provides the perfect platform to work together and achieve the goals [16]. Pairing up technical support and synergy helps with the all levels of collaboration as integration and coordination.

2.3 Theorical Framework

Figure 2 shows the matrix that details the factors, sub-factors and variables that give context to this theorical framework. Anaya and Ortiz [1] explain how business architectures can support integration, through a common vision of the basic artifacts of a company such as data, processes and technology, and how they are integrated to achieve a synergy in a virtual company. The authors emphasize that the monitoring of business information is a key factor of business management. In this way, Anaya and Ortiz establish different types of alignment relationships between the artifacts of a business architecture. Norta, Ma, and Duan [19] propose a choreography language to support business collaboration between organizations. They start with ECML as a base language and improve it through additional schemes that analyze the coincidence of processes, the company and monitoring to achieve the necessary synergy. For this they use patterns of configuration and interaction of the collaborating companies. Related to business synergy, Ivanochko, Gregus, Urikova and Alieksieiev [14] show a perspective with several points of view. The authors focus on classifying according to the Enterprise Architecture concepts and Data Governance framework. However, they describe a lack of standards and definitions of levels of synergy that prevent real application. Drews and Schirmer [8] develop a Systematic Literature Review about EA, EAM, challenges and solutions to aim a BEAM system. Moreover, in this context Katinszky [15] proposes a collaborative EA management system. Related to VE, Goel, A. Schmidt, and Gilbert [10] develop an Enterprise System as a platform in order to simulate a virtual enterprise. The authors propose a simple methodology to create a collaborative process environment and improve the skill to integrate different enterprises.

New technologies also are an important factor in order to achieve synergy in VE. Currently, entrepreneurs are looking for ways to take advantage of their data with the appearance of big data. For which the business architecture, EA, can be a strategic source to integrate big data with the different lines of business, artifacts of

the EA and with the business strategy [11]. In this context, a virtual enterprise based on the Cloud platform, is proposed in order to integrate small and medium enterprises, so they can reduce costs of infrastructure [18]. According to Rajabi, Minaei and Ali Seyyedi [20], "Ontology is an explicit specification of a conceptualization". However, there are other definitions of ontology. For example, Zimmermann, Sandkuhl, Pretz, Falkenthal, Jugel, and Wissotzki [31] suggest, "Ontology consists of a representational vocabulary with precise definitions of the meanings of the terms of this vocabulary plus a set of formal axioms that constrain the interpretation and well-formed use of these terms". There are some problems that come with the existing enterprise architecture methodology. Firstly, there is a lack of common understanding and an exact semantic understanding between the system and people. It can result in serious communication problems. The communication systems can occur among humans or among systems or between humans and systems [14].

Factors	Sub-factors	Variables	Norta	Ivanochko	Mvelase	Drews	Katinszky	Goel	Gong	Anaya
Enterprises	Enterprise Architecture (EA)	Lines of business				x	x	x	x	x
		Data Architecture	x		x	x		x	x	x
		Technology Architecture			x	x	x	x	x	x
		Data Governance			x	x			x	
	Synergy	Enterprise Technology Language	x			x	x			x
		Enterprise Model			x	x		x		x
		Model Integration		x	x	x		x		x
		Cross-functionality	x		x					x
		Ontology				x		x		x
		BPM	x	x	x	x				x
	Technology support	Cloud computing	x	x	x					
		IoT								
		Big Data Analytics							x	
		Everything Mining							x	
Virtual Enterprises	Levels of collaboration	Collaboration	x	x	x	x	x	x	x	x
		Coordination		x		x				
		Integration		x	x	x		x	x	x
		Orchestation	x							
	Virtual EA	Data Architecture				x		x		x
		Processes Architecture		x		x		x		x
		Technology Architecture		x	x	x		x		x

Figure 2. Comparative Analysis of Related Models [19][14][18][8][15][10][11][1].

3. DISCUSSION

As a result of the evolution of technology, changes in the social, economic and industrial environment, and the changing needs of clients, there is a need for a different way of structuring an organization [17]; Organizational processes must be flexible to respond in real time to the growing changes in the needs of the context, this makes restructuring or shaping virtually indispensable [2]. Companies are adopting different technologies to try to meet the needs of customers, based on principles of collaboration with other organizations. However, current collaborative environments have limitations. There is no way to establish an effective integration, in an agile manner, in real time, between organizations, that takes into account their different contribution possibilities [6]. Developing a framework to create Virtual Enterprises is an opportunity that reconfigures agile networks of isolated enterprises sharing common resources, including market, knowledge and customers, and thus using organizational architectures that introduces enterprises' virtual environments. But it also has the limitation of business management and process integration that results in trust, privacy and security issues of an organization [10].

Taking into account that the majority of relevant works according to the theme of this paper have been proposed between 2012 and 2015, it is considered necessary to carry out a new study that considers the technologies that have emerged in the last three years. In addition, as could be seen in the literature review, there are no concrete models that integrate or achieve an effective collaboration, through the EA of each company.

The most important characteristic of the VE framework proposed is its capacity to change according to the demand in the market and evolve with customer demands. The characteristics of the VE are determined by flexible demands, integration, cooperation, agility, and adaptability. By making use of EA components the businesses can achieve great results. It helps in making the best use of the data as it makes it easy and convenient to integrate and offer the flexible products demanded nowadays.

4. CONCLUSIONS

Data is taking an important role in the management and development of big enterprises. In this proposal we focus on integrating entities, to respond to the changing needs of customers, analyzing not only individual enterprise architecture but analyzing the whole perspective impacting the way in which strategic decisions are made and achieving business synergy in order to create a new dynamic enterprise.

In the era of electronic commerce, the art of leverage knowledge through the value chain in the virtual organization is necessary to enhance its performance. This report discusses the conceptual model of synergy in Virtual Enterprises. The report takes a close look at all the components that are a part of VE and the role synergy plays in bringing different VE together to build a healthy and good working relationship and produce great results. For the future, the legal and security aspects must also be considered.

5. ACKNOWLEDGMENT

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