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BUSINESS ECOSYSTEMS ARHITECTURE

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***Abstract* —** This paper aims to present an overview of the business ecosystem and it will describe the evolution of this concept. Also there are highlighted the most representative existing conceptual models for different ecosystems and the most important business ecosystem's features. This literature analysis led to creation of conceptual model of the complex business ecosystem. Based on a case study, this paper is illustrating the implementation of this model in organisations.

***Keywords*—**Business Ecosystems, Co-evolution, Business Ecosystems' elements, Complex ecosystem

I. INTRODUCTION

BUSINESS ecosystem represents a new concept and it is recently adopted in economical domain. Initially this concept was defined as an economic community, structured as a network between economic agents, based on strong relationships and common foundation [1]. This definition was based on biological analogy of business ecosystem. Basically Moore had compared biological and business ecosystems and he stated that in business ecosystems as in biological also exists a community who survives or works in specific environmental condition and relies on fair relationships between the partners.

The same approach was adopted by Iansiti and Levien in 2004. They also tried to link or compare the business ecosystem with biological one. The only difference is that last two authors went further and have paid special attention to ecosystem's health. They said that if an ecosystem is healthy, then its community will flourish [2]. In 2005 Iansiti and Levien bring in front the idea that in a healthy ecosystem the relationships between its components can contribute to business success [3].

To understand better this concept there are four main types of ecosystems which are widely used in scientific world.

Biological Ecosystem – as it was mentioned before, it represents a community of species who interact with water, soil and air [4]. According to Stanley J. and Briscoe G. a community represents a large number of species or small populations who are divided in small niches [5].

Digital Business Ecosystems (DBE) – this concept appeared as result of introduction of digital network as component of business ecosystems [6].

In 2002 Nachira Francesco has defined the DBE as a digital environment, which can be sustained and which adapts itself to different conditions inside business ecosystem [6]. According to Briscoe (2009) *DBE* represents a complex system, based on Informational Technologies which are integrated in socio-technical aspects of business ecosystem [7]. He also specifies that this system is characterized through self organizing capacity and sustainability. Also DBE could be seen as the infrastructure necessary to create the digital environment [8].

Industrial Ecosystem (IE) – for the first time this type of ecosystem were presented by Frosch and Gallopoulos (1989). The authors sustain that industrial ecosystem is almost the same as biological one, except that it includes aspects of sustainable development [9]. It means that the actors (manufacturers and consumers) from industrial ecosystem should be aware about ecological issues of industrial processes. Also IE can be seen as waste management solution for firms and consumers at individual or collective consumption level [10].

Social Ecosystem (SE) – In this type of ecosystem the organizations are seen as key elements. Social ecosystem can be defined as a community of interconnected institution and organisations, which is based on collaborative relations [11].

II. BUSINESS ECOSYSTEM MODELS

An important aspect in modelling business ecosystem is to identify and define the components, the relationships between them and their placement in a specific environment.

In the scientific literature, there has been developed a variety of business ecosystems' models from which the most important are: Moore's, Iansiti and Levien's and Power and Jerjian's business ecosystems models. In the table below (TABLE I) it is presented key structure and aspects of representative models.

Biological analogy is the starting point in defining and graphical representation of business ecosystems and it could be seen the most in Moore's model. According to this author a business ecosystem is composed from different type of species (market players, government, customers, etc.) which develop strong relationships in a friendly environment based on specific activities a

TABLE I. BUSINESS ECOSYSTEMS MODELS [12]

Business Ecosystem	*Stakeholders*	*Environment*	*Key aspects*
Moore (1993, 1996)	• Customers • Lead producers • Competitors • Leadership companies • Suppliers • Governmental institutions	• Core activities • Business networks	• Replace the word "industry" • Self-organizing and independent • Decentralization decision-making • Co-evolution • Four stage life-cycle
Iansiti and Levien (2004)	• Niche players • Dominators • Hub landlords	• Business networks	• Interconnected participants • Mutual effectiveness • Individual and healthy • Fragmentation, cooperation and competition • Productivity, robustness • Ability to create niches • Deliver innovation and competitive advantage
Power and Jerjian (2001)	• Websites • Software • Communities • Employees • Customers	• World Wide Web (www) • Virtual habitat • Informational channels	• Technological connectedness • Efficient use of resources • Adaptability to new informational channels • Technological changes and innovation

business networks [1]. This model is based more on enterprise' vision and reveal the internal or external structure of a company.

Iansiti and Levien (2004) created another model, based on Moore's theory and biological analogy but different in the categories of components. They considered three major categories of players in an ecosystem: dominators, niche players and hub landlords, whose activities and relationships are based on characteristics of business networks [2], [14]. Their vision is based more on external environment of a company. Key aspect of their model is business ecosystem's health.

The last model provides an approach for describing the digital ecosystem. If the previous models had described company's environment and players, the Power's and Jerjian's model (2001) is the most suitable for virtual organisations. The authors sustained that new technology and usage of internet provides a modern environment for those companies whose main activities are based on electronic transfers [13].

III. CHARACTERISTICS AND PRINCIPLES

According to described ecosystems models, each of them provides a set of key aspects for better understanding of relationships between ecosystems' actors and their environment. From this point of view it will be provided a short classification of key aspects and principles.

1. Ecosystem's health:

- *Robustness* – proposed by Iansiti and Levien (2004), it has the meaning of achieving sustainability. According to the authors healthy ecosystem should adapt easily to environmental changes so that it could meet the conditions of sustainable development [2]
- *Productivity* – key aspect which shows ecosystem's effectiveness. Going further and by analogy with a biological ecosystem, in case of business ecosystems this aspect reflects the ability of actors to transform existing resources into significant result and to create value for business. This characteristic can be easily observed in an industrial ecosystem, where the main objectives are to establish relations between actors and to realize profitable transactions.
- *Innovation* – as it was mentioned by Iansiti and Levien it is not enough to measure only the robustness and productivity of an ecosystem to reveal its state of "healthiness". A significant contribution is provided by innovation characteristic through adaptability of ecosystem's actors to final consumers needs, so that it could deliver multiple choices or decisions [14].

2. Ecosystem's type / organising principles:

- *Interconnectedness* – this feature involves the type of relationships established between ecosystem's actors. Interconnectedness aims to reveal the bilateral relationships between actors, through cooperation between different organizations [2], [14]. In agreement with this theory, there was considered that interconnectedness of actors could provide specific information or data about complexity of business ecosystem [15].
- *Diversity* – this principle represents the involvement of technological processes in organisational activity and indicates stability of a system [16]. Another opinion about this term

is about the existence of business ecosystem through different type of species (SMEs, governmental organisations, etc.), cooperation and data.

- *Complexity* – it is important to understand how complex a business ecosystem could be [15]. This principle emerged as result of a complex and systemic analysis based on interactions between business ecosystems elements [15].

IV. BUSINESS ECOSYSTEM MODELLING PROCESS

Designing of business ecosystems involves a complex and staged process, a good knowledge of components or those elements that could be incorporated, and specific delimitations of relationships between these. Such an approach involve that it is necessary to elaborate theory and transposing it into the practice. There have been identified two important modelling theories, presented in TABLE II [16], [12].

TABLE II. THEORY VERSUS PRACTICE

Theoretical Modeling [16]	*Description*	*Practice Modeling [13]*
Theoretical Stimulation	• Usage of analogy with biological ecosystem • Observation of network type organisations and market strategies of competition	*Creating Future Value of Business Ecosystem [12]*
Finding potential components	• Establishing of ecosystem's components • The ability of business ecosystem to create value • Find components according to ecology theory • Resources and competition analysis • Defining of type, stock and flow of resources in organisation	
Retrieving potential relations between ecosystem's elements	• Creating of conceptual model • Resources flow analysis • Establishing relationships between actors and resources of ecosystem	*Establish Business Ecosystem Boundaries [17],[2]*
Internal selection of components	• Identifying potential elements outside ecosystem • Internal selection of potential elements • Create value for business network	
Theory versus Practice	• Translated theory into practice analysis • Complexity analysis of resources and data flow between competitors • Create complex relationships and value inside business ecosystem	*Value Distribution [18]*

V. BUSINESS ECOSYSTEMS PROPOSED ARCHITECTURE

The proposed conceptual model of business ecosystem is based on Moore (1993; 1996) and Iansiti and Levien (2004) approaches [1], [3], [14], [17]. In order to realise a graphical representation of complex business ecosystem model, there were considered a few stages of theory development.

1.Defining research questions

This stage first of all should reflect data about what a business ecosystem is and what elements it should include. Basically it should be found the answers for questions such as:

a) What is a business ecosystem?
b) What elements or actors should be included?
c) What relationships can be established between actors?
d) What kind of roles each actor performs?
e) How complex a business ecosystem could be?

2.Identifying core elements of future ecosystem. According to Moore's conceptual model an organisation already is a small business ecosystem [1], [17]. Basically this approach is based on presumption that an organisation could represent a core element for a business ecosystem. That means that all other elements which are related to core organisation and share same mission, vision and type of activity could meet the requirements of new business ecosystem. Also it is important to assign or to establish the roles that each element performs: keystone, niche players or dominators.

3. Assigning development / evolution levels of business ecosystem

To understand better the development process of a business ecosystem and looking at elements that could be included, there should be defined elements hierarchy. At this point there are 3 levels, as it can be seen in Fig.1, Fig. 2:

a) Local Level (I) – core element
b) Intermediate Level (II) – related elements inside business ecosystem
c) Global Level (III) – external influence elements of ecosystem.

Fig. 1. Graphic representation of hierarchical levels

4. Define development conditions

As it was stated by Iansiti and Levien each element from business ecosystem should establish bilateral relationships with other elements from business ecosystem [2]. These relations represent the grade of cooperation and contribution of each element to mutual development.

5. Creating general "architecture"

The last step highlights the importance of theory development in relation to modelling of a graphical representation (Fig. 2).

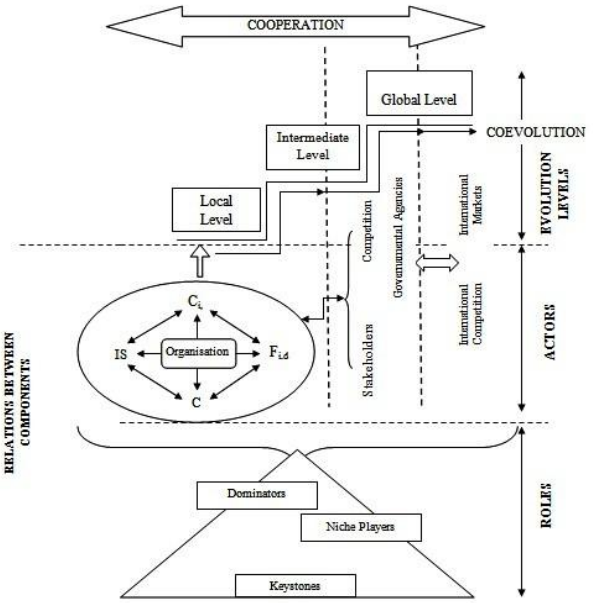

Fig. 2. Business ecosystem's architecture [2, 16] ($C_{i,d}$ – direct and indirect clients, $F_{i,d}$ – direct and indirect suppliers, *CD* – distribution channels, *IS* – standardisation bodies

VI. CASE STUDY: "QM" BUSINESS ECOSYSTEM

In order to illustrate the architecture of a specific business ecosystem the starting point is to identify its key elements. The foreseen result of this case study is to translate the business ecosystem's architecture previously presented into practice, by applying it in a company's environment.

1. *Core Element*: "QM", a SME founded in 1994 in North East Romania with main interest in Information Technology (**IT**) field. Its successful evolution can be illustrated by their engagement into various partnerships across the time and by extending the number of departments. In 1998 the company established and has been certified by Microsoft Corporation, followed by the collaboration with IBM in 1999. In 2001 it has been established the Research and Development Department in order to provide innovative solutions to its clients [19]. The increasing necessity to extend their strategic interests, QM founded, in 2005, another four departments: IT&C Solutions (IT solutions), Senys (smart energy solution), NetDeTek (security solutions), CounTek (integrated solutions for retail) and NextClass (educational solutions). The main objective of QM is to offer clients reliable optimisation solutions.

2. Related elements – it is important at local level to illustrate the related elements to the core organisation. Because the company have a strong position in B2B market, at this stage there are identifying the clients of this company: commercial and industrial enterprises, as well as public institutions. The most important requirement is to identify the clients according to their field of activity, as it is shown in TABLE III.

TABLE III.
CUSTOMER REPARTITION BY FIELD OF ACTIVITY

Departments / *Domains*	*QM* *IT Solutions*	*NetDeTek*	*Senys*	*CounTek*	*Next Class*
Information Technology	x				
Food & Drinks			x	x	
Health Care					
Education	x				x
Petrochemical Industry			x		
Restaurants and Hypermarkets		x		x	
Telecommunications	x			x	
Construction Materials	x	x	x		
Electric & Energetic		x	x		
Pharmaceutical Industry			x		
Service Providers		x			
Automotive	x	x	x		
Hospitality	x	x			
Banking	x	x			
Textile		x	x		

Suppliers: this company acts as intermediate actor between well known corporations and other companies. In case of QM, there have been established partnerships with national and international companies, as it is presented in TABLE IV. From this point of view, company partners act also as suppliers.

Standardisation Bodies: the linkage between the core company and standardisation bodies is represented through number of implemented standards. In QM there are implemented following standards [19]:

ISO 9001:2001 – establish requirements of quality management of systems;

ISO 14001:2005 – about environmental management

ISO 18001:2008 (OHSAS) – management systems of occupational health and security

ISO 27001:2005 – standard of information security management systems.

3. *Intermediate Level Elements*:

This level is defined by strong influence of distinguished actors at the National level. From this point of view it was found that company's activity is unfolding according to national legal background (OG 22/2008 and HG 409/2009 about efficient exploitation of energy and according to adopted Law 329/2009 – authorities' reorganisation).

Main *National Agencies* are:

a. ANRE (National Authority of Regulation in Energy), main requirements about employees' certification in energy domain.

TABLE IV. QM PARTNERS

	QM			
	IT Solutions	*NetDeTek*	*Senys*	*Next Class*
Partners	Microsoft VMware IBM HP Lenovo Cisco Intel Corporation Dell ELO Digital MB Distribution Epson Motorola Toshiba Scop Computers Axiomtek Schneider	Bidepa Comandor UTC Fire and Security Helinick Honeywell Lantec Romania Molex Polycom Schneider Siel Invest HP Cisco Lenovo	Axiomtek Schneider Electric Moeller Pramac Group	eInstruction EPSON Microsoft

b. IGSU (General Inspectorate for Emergency Situations), as result QM obtained authorisation for design and installation of signalling systems, alarm and alert in case of fire.

c. IGPR (General Inspectorate of Romanian Police) – license for design, installation, modification or maintenance of anti - intrusion alarm systems.

Cooperation and Co-evolution – it is represented by bilateral relations between business ecosystem's actors. In this case, this concept is illustrated by number of partnerships established between QM and National and International economic entities, at intermediate and global level. Each relation is generated by existing supplies and demands on B2B market.

Assigning role to organisation – from this point of view QM meets the requirements of a niche player, defined by Power and Jerjian such as: usually niche players are Small and Medium Enterprises, to adopt field of interest freely and independent and to contribute to diversity of business ecosystem [13].

Fulfilled requirements of niche player by QM:

a. It is a part of Small and Medium Enterprises;

b. Independent choice of domain of activity;

c. Diversification of activities (consulting, design, implementation, training, maintenance and service);

d. Creates value for B2B market.

The main finding is that the emergence of specific architecture's elements is conditioned by several factors, such as:

- Type of market in which company operates (business to business, business to consumers, etc.);
- Type of field of interest and performed commercial activities;
- Established relationships between company and its stakeholders

Governmental Agencies in this case act as keystone. They impose to the company specific rules and grant certificates and authorizations. As result, the company gain credibility in front of its partners and it can be differentiated from competition on B2B market, as it is presented in Fig. 3. Basically keystones ensure a balance between the company and competition, other niche players, in this case between QM and other niche players, with the same type of activity, or its competition on business to business market.

Not at least, there are the dominators. As it is shown in fig.3, the international partners were considered as dominators. The cooperation between them and the core company generated benefits on both sides:

- For company – ensured the quality of provided services and products by utilising modern equipment, well known brands in electric, energetic, security domain;
- For international partners – strengthened their position in Romanian markets and ensured an efficient channel of distribution.

This model allows the company an efficient visualisation of its own internal and external environment. Also, this model can be considered as instrument for comparative analysis, in case if it will be applied more than one organisation.

This case study presents general architecture's implementation of business ecosystem through translation of theoretical concepts into practice. Also its practical implications could represent the basis for future analysis of the business ecosystems' development process.

VII. CONCLUSIONS AND FURTHER RESEARCH DEVELOPMENT

This paper aims to present the importance of relation between theory development and the design of a Business Ecosystem. The foreseen outcome of this research is to create a general model which can be applied widely in business field of study. The presented case study highlights the applicability of this model within a specific organisation. Also it underlines the importance of specific factors which can influence the practical implementation of this model. As a future direction will be proposed implementing methodology of this model. It will be based on the assessment of business ecosystems' key aspects, such as: complexity, adaptability and diversity. The foreseen result will expand this model and will provide data about the efficiency of business ecosystem as a unit.

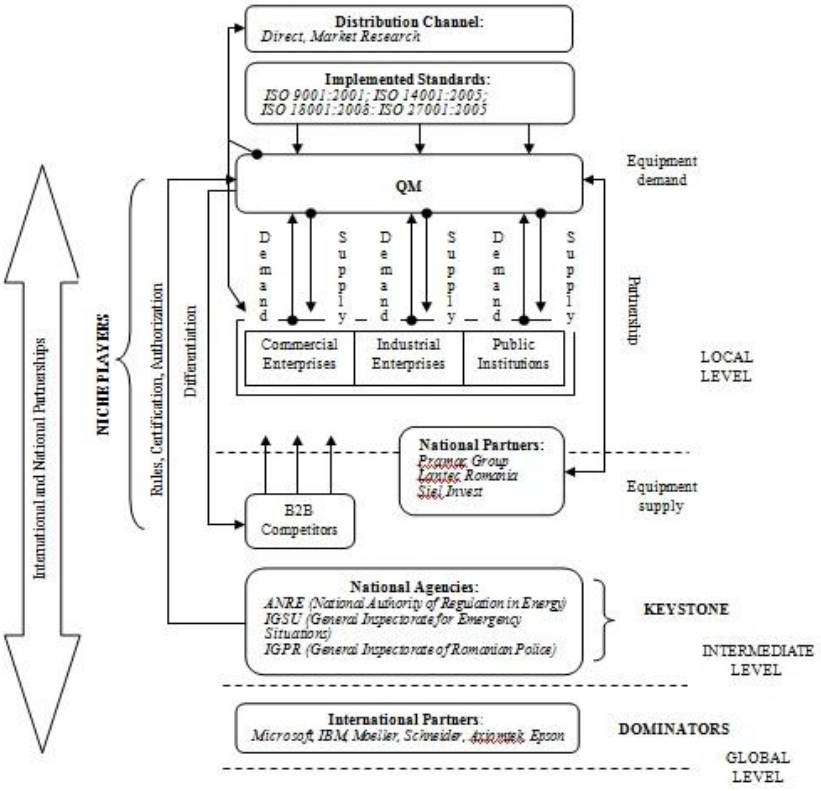

Fig. 3. "QM" business ecosystem

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