ANALYZING BUSINESS MODEL COMPONENTS USING THE SENSITIVITY MODEL[1]

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Abstract
The article deals with the business model and its components as well as the analysis of the relationships between these components using the sensitivity model. For this purpose we define the concept of a business model, paying special attention to its classification and components. Then we discuss the sensitivity model as a practical tool enabling us to define the problem and its elements, to analyze its impact and to explain the possibilities of influence. This research focuses on assessing the relative influence of business model components on each other, thus filling a gap in the literature having to do with the dynamic relationships between business model components.
Keywords: *business model, business model components, sensitivity model, dynamic relationships.*

1. Introduction

Much of the existing research on business models tends to view them as static phenomena that can be mapped (e.g. using the business model canvas proposed by Osterwalder and Pigneur, 2010), yielding depictions of fixed realities. Furthermore, given the prevalence of a component-based approach to business models, the notion that changing the contents of one component will impact other components is largely neglected. This research focuses on assessing the relative influence of business model components on each other, thus filling a gap in the literature having to do with the dynamic relationships between business model components.

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2. The business model and its components

In the literature, business models are generally viewed as a tool for describing the economic activities of a company or a vehicle for selling products or performing services. Various authors, in their research and interpretation of business models, point at their variety, especially as far as components of a model are concerned (Morris, et al., 2005), nevertheless, one of common features of the existing taxonomies is the so-called functional aspect directed at creating value for the producer, the customer and a company as a whole (Amit and Zott, 2001; Chesbrough, 2010; Osterwalder, et al., 2005; Teece, 2010).

According to Zott, Amit and Massa (2011) a business model is a new unit of analysis, different from a product, a company, an industry or a network. Although the model focuses on a company, it is wider, as it also comprises its business partners. A vital element of this approach is to explain to both how value is created. Another popular definition of a business model, offered by Johnson and his co-authors (2009) assumes that a business model consists of related elements, that is value propositions for a customer, a profit model, key resources and processes, which all contribute to creating and delivering value.

The multitude of definitions justifies the analysis of business models from determined perspectives, such as economic, operational or strategic ones (Morris et al., 2013). The decomposition of business models then refers to sub-processes related to creating value, profit in time and how a company defines its position in the market, its growth opportunities, choice of customers, or whether it differentiates its offering. Another division contrasts literature on business models from the perspective of e-business activities and strategies and management of innovations and technologies (Zott et al., 2011).

Table 1. Six key elements of a business model (Kujala et al., 2010)

Customers: Chesbrough and Rosenbloom (2002), Hedman and Kalling (2003), Magretta (2002), Morris et al. (2005) and Tinnila (2007)
Value proposition for the customer: Chesbrough and Rosenbloom, (2002), Magretta (2002), Morris et al. (2005) and Tinnila (2007)
Competitive strategy: Chesbrough and Rosenbloom (2002), Hedman and Kalling (2003), Morris et al. (2005), Tikkanen et al. (2005) and Siggelkow (2001)
Position in the value network: Chesbrough and Rosenbloom (2002), Hedman and Kalling (2003), Tikkanen et al. (2005) and Tinnila (2007)
Supplier's internal organization and its key capabilities: Normann (2001), Hedman and Kalling (2003), Morris et al. (2005) and Tikkanen et al. (2005)
Logic of revenue generation: Slywotsky et al. (1998), Chesbrough and Rosenbloom (2002), Hedman and Kalling (2003), Magretta (2002), Morris et al. (2005) and Tikkanen et al. (2005) and Tinnila (2007)

Business model components have been classified by a large number of authors. Zott, Amit and Massa (2011), when creating their classification, differentiated first-order and second-order themes among the components of e-business models. In another classification, proposed by Lambert (2012) the main elements of a business model are value proposition, value return, customer, channel, other entities, and value adding processes. Kujala et al. (2010) argue that attention should be paid to six key elements of a business model in project-oriented companies. See Table 1 below.

For the purpose of this analysis a business model is defined as a set of components and relationships between them, and various resources and activities used by an enterprise to generate a value proposition for customers. The configuration of these resources and activities makes up a business model. The taxonomy of adopted business model components includes the following:

Content (the value proposition)
Structure, activities and processes
Human capital
Partners and channels
Customers

The value proposition (or content) dominates as a key element of a business model next to clients, partners and channels. The above taxonomy also emphasizes human capital, understood as internal human resources, or broadly understood staff (Nielsen, Montemari, 2012). A vital element of a business model is its structure, activities and processes stressing the functional aspect of activities taken in a given business model and the way a company is organized.

3. Research question and methodology

The fundamental research problem was to try to determine how the components of business models influence each other. In answering such a question we have the opportunity to discuss the overall dynamics in business models. Within the concept of a company's business model, we used the sensitivity model (Vester, 2012) in order to identify key components allowing us to control and manage a business model, simultaneously indicating it's most important and influential components. The choice of case studies for our research was purposeful. We studied three companies, referred to with the pseudonyms X, Y and Z.

Our goal was not to compare companies and their business models, taking into consideration the differentiated nature of identified components of a business model, although admittedly, such an analysis would be desirable.

However this would require developing research focused on standardizing identified components of business models across multiple cases. In this research we gave our respondents freedom to identify elements which are of key significance in their business model. Table 3 presents the business model components identified by case company respondents.

Sensitivity model

This stage of analysis consists of self-assessment of a company related to identified components of a business model. In order to achieve this, we needed to build a matrix of the levels of influence between the business model components, whose weights will allow us to rank components as influential and less influential in the context of their influence on how a business model functions. Using influence matrixes (Vester, 2012; Ujwary-Gil, 2012) it was possible to determine the strengths of relationship. For the purpose of our research, the assessment was expressed on a three-degree scale, where 0 denotes lack of influence, 1 denotes weak influence and 2 denotes strong influence. Summing up all influences of a given business model component we obtain its active sum, that is the force with which it influences other components, as well as its passive sum – the force with which other components affect it. Using Vester's model in analyzing influences between particular components of a business model expressed on a three-degree scale, we developed a portfolio matrix of components and determined relationships between components. Table 2 below presents the starting point for the analysis by means of the influence matrix.

Table 2. Influences between components of a business model

What influence does x have on y?	Component$_1$	Component$_2$	Component$_3$	Component$_4$	Component$_5$	Component$_n$	Active sum
Component$_1$							
Component$_2$							
Component$_3$							
Component$_4$							
Component$_5$							
Component$_n$							
Passive sum							

The measure of the influence exerted by a particular component on the system (here, a business model) is the so-called active sum determined as a sum of the line devoted to this component. The higher the value of active sum, the greater the influence of the component on other components of the business model. The measure of the influence of the components of business

model on a given component is the so-called passive sum, being the sum of points in a column referring to this factor. The higher the value of passive sum, the greater the influence exerted on the component. Having transferred the scores onto the map of influence intensity, we obtain a portfolio consisting of four groups of components of a business model (Figure 1). The variation ranges of active and passive sums should be plotted onto the co-ordinate system, where the Y-axis represents active sum, whereas the X-axis shows passive sum. Such matrix, in form of a portfolio, allows us to divide particular groups of business model components into:

Active components (exerting strong influence, not susceptible to external influence)	**Critical components** (exerting strong influence, susceptible to external influence)	
Marginal components (exerting slight influence, not susceptible to external influence)	**Passive components** (exerting slight influence, susceptible to external influence)	

(Y-axis label: Active sum (exerting influence); X-axis label: Passive sum (susceptible to influence))

Figure 1. Portfolio of business model components

We are looking at the influence the components of the business model exert on each other, however the business model itself is just the sum of its components. In order to do so we must determine the so-called quotient and product. The quotient is a measure of a relation between the power of influence exerted by a given component on a business model, calculated by multiplying the active sum determined for a given component by 100 and then dividing the result by the passive sum of this component. The product, on the other hand, is a measure of significance that a given component has in a business model. In order to calculate it for a given component, we must multiply its active sum by its passive sum. High value of the product of a particular component informs us that it is significant for the model, and the other way round.

4. Data analysis

Three companies took part in our research, their components (resources and activities) are listed below:

Table 3. Taxonomy of business model components

Companies Business model components	X	Y	Z
Content (what is the value proposition)	Product and service sales Direct sales	Design concept	Design Intellectual property
Structure, activities and processes	R&D	Co-creation Used-based research Office Equipment	Personal meetings Project acquisition Emails/telephones
Partners and channels	Personal contacts Investors Non-technical universities Freelancers Technical universities Hardware suppliers	Industry partners Networking Social capital Producers	Other professionals
Customers	Education and public Universities Technical universities	Large businesses City/community	Public sector customers Private sector customers Users
Human capital	Corporate Staff		Human resources

Particular components of a business model were then subjected to evaluation. A vital element of the research was to identify the power of influence exerted by a given component (resource) on other elements in the matrix. The outcomes of influences between business model components, together with calculated scores of active and passive sums as well as their positioning in particular portfolio squares are shown in Tables 4 and 5 below.

Having established the power of influence exerted on particular components, we need to analyze the influence exerted by other components.. In this case we need to focus on the active sum determined as a sum of points from a particular line devoted to a given component. The higher the value of active sum, the stronger the influence exerted by a component on other components.. The measure of the influence exerted by other components on a particular component is the passive sum, calculated as the sum of points in a column corresponding to a particular component. The higher the value of the passive sum, the stronger the influence exerted on it by other components. Table 5 presents a defined matrix of components. In companies X and Z we have not identified any active components.In case of company Y these are producers. In company X the critical components are: R&D, product & service, sales, personal contacts, staff, direct sales, corporate, education & public. For company Y, these are: industry partners, design concept, user-based research, human capital, social capital, co-creation, networking, office, large businesses, city/community, while for company Z: other professionals,

design, public sector customers, human resources. Apart from the fact that these components strongly affect other components, they are also considerably susceptible to influence from other components, which means a risk of uncontrolled feedback. Passive components do not have much influence on other components while being highly susceptible to influence from other components. Our analysis conducted in company X revealed that these are investors, while in company Z they are project acquisition and personal meetings. Characteristic features of marginal components are small influence on other components and low suceptibility to influence from other components. These are: technical university, hardware suppliers, freelancers, universities in company X, equipment in company Y and users, private sector customers, emails/telephone, intellectual property in company Z.

Table 6 presents calculations of the product and the quotient for particular groups of components. The calculations included in the table demonstrate that components of company X, such as technical university, investors, R&D, freelancers, and education & public influence other components more than they are influenced. For company Y these are: to user-based research, networking, large businesses and city/community, while for company Z, components in this group are users, other professional, design, project acquisition and personal meetings. The product is a measure of significance of components for the model.

Table 4. Profiles of components forming the active and passive sums

Components of business model	X AS LI	X AS HI	X PS LI	X PS HI	Components of business model	Y AS LI	Y AS HI	Y PS LI	Y PS HI	Components of business model	Z AS LI	Z AS HI	Z PS LI	Z PS HI
technical university	5		4		producers	10			14	users	10		4	
hardware suppliers	1		6		industry partners		18		18	other professionals		12		11
Investors		12	8		design concept		18		18	design		16		14
R&D		16		14	user-based research		15		13	project acquisition		11	6	
product & service sales		18		20	human capital		19		21	public sector customers	10			12
personal contacts		13		15	equipment	9		10		private sector customers	9		9	
Staff		14		14	social capital		15		18	personal meetings		13	10	
Freelancers	10		5		co-creation		15		17	emails / telephone	4		10	
direct sales		13		13	networking		19		16	human resources		11		17
Corporate		12		16	office	11		12		intellectual property	4		7	
education & public		15		14	large businesses		20		16					
Universities	10		10		city / community		19		15					

X, Y, Z = companies. SA = active sum. SP = passive sum. LI = low influence. HI = high influence.

Table 5. Portfolio of components

X		Y		Z	
Active components:	**Critical components:** R&D, product & service sales, personal contacts, staff, direct sales, corporate, education & public	**Active components:**	**Critical components:** industry partners, design concept, user-based research, human capital, social capital, co-creation, networking, large businesses, city/community	**Active components:**	**Critical components:** other professionals, design, public sector customers, human resources
Marginal components: technical university, hardware suppliers, freelancers, universities	**Passive components:** investors	**Marginal components:** equipment	**Passive components:**	**Marginal components:** users, private sector customers, emails / telephone, intellectual property	**Passive components:** project acquisition, personal meetings

X, Y, Z = companies.

Table 6. Calculation of the product and the quotient of the components of business model

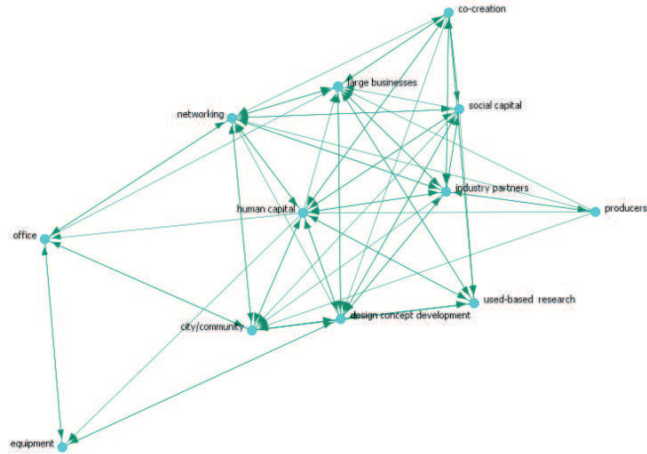| Components of business model	X				Components of business model	Y				Components of business model	Z			
	Quotient		Product			Quotient		Product			Quotient		Product	
	L	H	L	H		L	H	L	H		L	H	L	H
technical university		125	20		producers	71			140	users		250	40	
hardware suppliers	17		6		industry partners	100			324	other professionals		109		132
Investors		150	96		design concept	100			324	design		114		224
R&D		114		224	user-based research		115		195	project acquisition		175	63	
product & service sales	90			360	human capital	90			399	public sector customers	83			120
personal contacts	87			195	equipment	90		90		private sector customers	100		81	
Staff	100			196	social capital	83			270	personal meetings		130		130
Freelancers		200	50		co-creation	88			255	emails / telephone	42		38	
direct sales	100			169	networking		119		304	human resources	65			187
Corporate	75			192	office	92			132	intellectual property	57		28	
education & public		107		210	large businesses		125		320					
Universities	100		100		city / community		127		285					

X, Y, Z = companies. L= low. H = high.

In order to better depict the links between the business model components of particular companies, we used a network of links with strong impact (2.0 weight). The network presentation of the business model components allows us to depict which components influence each other and what the direction of the links is, that is whether they are the so-called out-links or in-links.
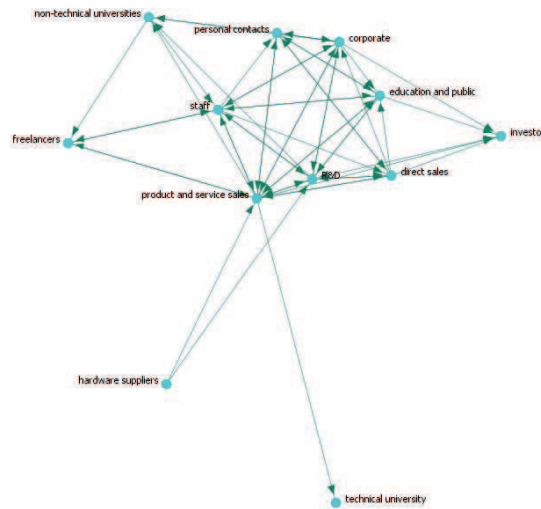
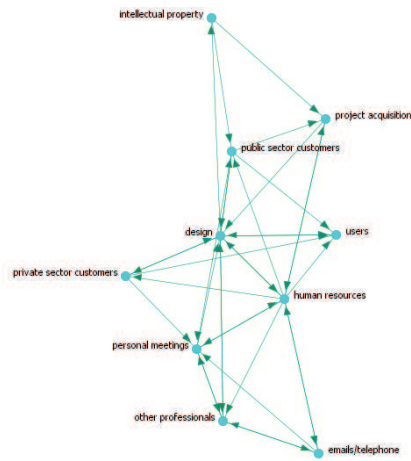**Figure 2.** Visual presentation of the components of company X.

Most components in Figure 2 are characterized by mutual influence. The only exception is that of freelancers, who are mutually linked only with staff, product & service sales and universities. Similarly, hardware does not exert substantial influence on other components, here we notice relations with product & service sales and R&D. On the other hand, technical university strongly influences product & service sales and vice versa.

Visual presentation of the business model components of company Y (Figure 3) shows that the most influential components (strongly affecting others) are: large businesses, networking, industry partners, as well as human capital. Equipment and office are seen as less influential on other components.

Figure 3. Visual presentation of the components of company Y

The network of links among the business model components of company Z is characterized by strong influence of design, human resources and personal meetings on other components of the model. Peripheral components (with weaker influence) are intellectual property and emails/telephone (tool).

Figure 4. Visual presentation of the components of company Z

5. Conclusion

The main purpose of this research was to identify the most influential components of particular business models. The method applied here was to pin-point components, which should be of primary focus to management staff. The ideal, typical control components are those that have the highest and most immediate impact on all other components but are not strongly influenced by other components. In addition, these components should be rather stable, which means that they are not easily changeable by system dynamics but can be controlled by management (Kasztler, Leitner, 2009). From the first perspective it seems that the scores differ. In the sensitivity method in the business model of company X there is no most influential component (the quarter with active components is empty). An influential (but susceptible to external influence) component is product & service sales. Simultaneously, freelancers are the most influential component for the business model (its quotient exceeds 200). The most significant component is product & service sales (360 points). In company Y, the most influential components are producers, city/community and human capital, whereas in company Z private sector customers and design.

It still remains a challenge to measure and manage the dynamics of (non-tangible) resources, to examine how these resources are reciprocally related and how a change in one resource causes changes in another resource, leading to changes in the whole business model of a company. Moreover, an interesting area of research would be an attempt at not assessing the company value but assessing the value of the business model itself. This is an even more daunting task, as one company may have a number of business models (Linder, et al., 2001, Smith et al., 2010, van der Meer, 2007) with different values. The valuation of business models and their dynamics may improve and significantly influence the assessment of the company value.

References

Amit, R., Zott, C. (2001). Value creation in e-business. Strategic *Management Journal,* 22, 493-520.
Chesbrough, H. W. (2010). Business model innovation: Opportunities and barriers. *Long Range Planning,* 43, 354-363.
Johnson, M. W., Christensen, C. C., Kagermann, H. (2008). *Reinventing* your business model, *Harvard Business Review, 86*(12), 50-59.
Kasztler, A., Leitner, K.H. (2009). An SNA-based approach for management control of intellectual capital. *Journal of Intellectual Capital*, *10*(3), 329-340.

Kujala, S., Artto, K., Aaltonen, P., & Turkulainen, V. (2010). Business models in project –based firms – Towards a typology of solution – specific business models. *International Journal of Project Management*, 28, 98.

Lambert, S.C. (2012). *Deconstructing business model frameworks using a reference model*. Centre for Accounting, Governance and Sustainability Occasional Working Papers, No. 4, July. University of South Australia, Adelaide.

Linder, J.C., Cantrell, S. (2001). Five business-model myths that hold companies back. *Strategy & Leadership*, 29 (6), 13–18.

Morris, M., Schindehutte, M., Allen, J. (2005). The entrepreneur's business model: toward a unified perspective, *Journal of Business Research*, *58*(6), 726–735.

Morris, M.H., Malone, M., Chair, Shirokova, G., Shatalov, A. (2013). The business model and firm performance: The case of Russian Food Service Ventures, *Journal of Small Business Management*, 51(1), 46–65.

Nielsen, Ch., Montemari, M. (2012). The role of human resources in business model performance: the case of network-based companies. *Journal of Human Resource Costing & Accounting*, 16(2), 142-164.

Osterwalder, A., Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. John Wiley and Sons.

Osterwalder, A., Pigneur, Y., Tucci, C. L. (2005). Clarifying business models: Origins, present and future of the concept. *Communications of the Association for Information Science (CAIS)*, 16, 1-25.

Smith, W., Binns, A., Tushman, M. (2010). Complex business models: managing strategic paradoxes simultaneously. *Long Range Planning*, 43 (2–3), 448–461.

Teece, D. J. (2010). Business models, business strategy and innovation. *Long Range Planning*, 43, 172-194.

Ujwary-Gil, A. (2012). *Intellectual Capital Statement (ICS) as a Method of Measurement and Management of Knowledge Assets*. ECKM, Universidad Politécnica de Cartagena, Juan Gabriel Cegarra (Ed.), Spain, pp. 1211-1222.

van der Meer, H. (2007). Open innovation the Dutch treat: challenges in thinking in business models. *Creativity and Innovation Management,* 16 (2), 192–202.

Vester, F. (2012). The *Art of Interconnected Thinking: Tools and Concepts for a New Approach to Tackling Complexity*. Mcb Verlag.

Zott Ch., Amit R., and Massa L. (2011). The business model: Recent developments and future research. *Journal of Management*, *37*(4), 1019-1042.