Evaluation of Sustainable Competitiveness through Innovation

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Abstract

Clients' continuous expectation increase and the need to be ahead of competitors, cause a huge pressure in companies and aggressiveness into markets. Due to this fact, companies' need to be in permanent change to gain competitiveness. One way to achieve this aim is through innovation. But the question is How? Where to innovate? Innovation at any cost? What kind of impacts should be expected? Is it possible to evaluate companies' innovation skills and stablish a relation with outcomes? This paper provides a model that contributes to competitive advantage creation through innovation integrating concerns about sustainability, based on the triple bottom line principles. Therefore, the model promote innovation preserving a balance between economic, social and environmental results. The model is based on 7 competitiveness drivers, which include all key factors of a company, and allow the evaluation of companies' resources to be innovative, taking into account requirements structured in 8 proficiency levels. Additionally, the model allow the evaluation of the companies' competitive advantage, considering innovation indicators, related to each competitiveness driver. This evaluation promotes another perspective of companies' innovation capability, as well as the identification of opportunities to improvements, concerning the areas where companies have lower scores regarding innovation resources and results. This model, in this perspective is an added value tool, once it allows a more focused approach about innovation priorities, taking into account that innovation cannot be just considered "product innovation" and the fact that there are a lot of other aspects in an organization that have influence on it.

Keywords: Strategic planning, Competitiveness, Sustainability, Innovation, Evaluation

1. Introduction

The constant need to be ahead, aiming to achieve competitive advantage, is the fundamental reason that drives companies to be innovative. With this purpose it is crucial to develop capabilities to foresee new business opportunities and to create market trends, which requires strategic vision, taking into account their resources' limitations and potentialities (McManus et al, 2007). This attitude demand the ability to explore alternative strategies and the talent to lead/ manage resources to new projects (Hamel & Valikangas, 2003). In such a context, it is vital to define appropriate strategies to face this challenges and to do so, companies should integrate innovation models into their strategic planning processes, allowing the evaluation of their current competitiveness and the appropriate definition of their business goals, operational targets and actions needed to achieve their objectives in a sustainable way.

2. Problem Statement

Nowadays companies are more exposed to market changes and more vulnerable to customers' demand and competitors' aggressiveness. This fact increase companies' pressure to survive and to avoid bankruptcy or insolvency. According to (Gittleson, 2012) *"The average lifespan of a company listed in the S&P*

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500 index of leading US companies has decreased by more than 50 years in the last century, from 67 years in the 1920s to just 15 years today, according to Professor Richard Foster from Yale University, by 2020, more than three-quarters of the S&P 500 will be companies that we have not heard of yet. Also Fortune 500 has a similar view about this issue, (Perry, 2014) says that *"almost 88% of the companies from 1955 till 2014 have either gone bankrupt, merged, or still exist but have fallen from the top Fortune 500 companies."* Considering (Collins, 2009) *"Every institution, no matter how great, is vulnerable to decline. There is no law of nature that the most powerful will inevitably remain at the top. Anyone can fall and most eventually do"*.

Indeed there are a relevant number of cases that are evidences of this reality, namely big companies from different economic sectors that never imagine could fall into bankruptcy, like WorldCom (2001), Enron (2001), Arthur Andersen (2002), Parmalat (2003), Refco (2005), Delta Air Lines (2005), Lehman Brothers (2008), General Motors (2009), Blockbuster (2010), Kodak (2012), among others.

To reduce the risk of bankruptcy companies need to be prepared to face changes and to gain competitive advantage. Clayton (1997) stated that *"If you do what worked in the past, you will wake up one day and find that you've been passed by"*, and explained how innovation can be an advantage. Also in (Lendel & Varmus, 2011) perspective *"the companies try to ensure their competitiveness through innovation. To be in the company conducted effective work with innovation is necessary to adopt and implement an innovation strategy"*.

Following this line of thoughts, Drucker (1985) offered a systematic approach to the creative process by the introduction of the discipline of innovation and (Dibrell et al, 2011b) introduce the concept of innovativeness, which means that firms' emphasis their strategy on innovation.

On other hand, new concepts like sustainability arise and may be of interest to be considered in the design of alternative models. In fact, sustainability can be based on the triple Bottom Line (3BL) principle (Norman & Macdonald, 2004), and according to this researcher *"The idea behind the 3BL paradigm is that a corporation's ultimate success or health can and should be measured not just by the traditional financial bottom line, but also by its social/ethical and environmental performance"*. Following (Hubbard, 2009) *"The TBL adds social and environmental measures of performance to the economic measures typically used in most organization"*. It seems to make sense to use this principle to evaluate companies' performance (results).

Considering the above, the aim of this research was to design a model to support companies on their strategic evaluation process, taking into account their current competitiveness based on their capability to be innovative and their capacity to increase their performance, measured through economic, social and environmental results (sustainability).

3. Research Methodology

Therefore the research methodology applied was a deductive approach, once this method assume empirical approaches to validate hypothesis and assumptions. Beyond the literature review, which allowed the analysis of several strategic planning approaches and tools (e.g. PESTLE[3], Balanced Scorecard, LARG[4], among others), the most worldwide recognized evaluation models and international standards (e.g. EFQM[5], Shingo Prize, GRI and DJSI[6], IS0 9000 (series)[7], 14001[8], 22400[9], ISO 26000[10], ISO 45001[11], ITIL[12]); there were involved 18 experts to obtain feedback and validations about the model's components and

[3] PESTLE – Political, Economic, Social, Technological, Legal and Environmental analysis;
[4] LARG – Lean, Agile, Resilient and Green
[5] EFQM – European Foundation for Quality Management excel award
[6] GRI – Global Dow Jones Sustainability Index
[7] ISO 9000(series) – Quality management
8 ISO 14001 – Environment management
9 ISO 22400 - Automation systems and integration -- Key performance *indicators* (KPIs) for *manufacturing* operations management
10 ISO 26000 – Social responsibility
[11] ISO 45001 - Occupational health and safety
[12] ITIL - *Information Technology Infrastructure Library*

indicators, through questionnaires and workshops.

There was a concern to select experts according to appropriate profiles to assure their suitability to reach the research objectives. Therefore, four selection criteria were established, namely: Overall business experience and vision; Years of professional experience; Current role and professional career; and Specific skills related to the research filed. The pool of experts considered had an average age of 51 years old (minimum of 38 and maximum of 66 years) and more than 485 accumulated years of experience (minimum of 15 and maximum of 41 years), covering all critical business dimensions and relevant components pre-defined at the research scope, due to their careers in management, quality, monitoring, innovation, sustainability, manufacturing and logistics and in technology.

4. The Sustainable Competitiveness Evaluation model – innovation based

The present research enabled the design of a sustainable competitiveness evaluation model, based on innovation dimension. The model assume that companies should evaluate two components to be able to define more reliable strategic goals and targets to reinforce and achieve continuously competitive advantage, through innovation, in concrete:

- Their resources or ability to manage them, in order to be systematically innovative (focused on the company's innovation efficiency); and
- If they are an innovative company (focused on the company's innovation impact or results, which means their innovation effectiveness).

According to the above, and taking into account the "Innovation S – Curve" or the innovation lifecycle framework of (Dismukes et al, 2012) it is possible to establish a relation between innovation resources management and innovation performance (Figure 1).

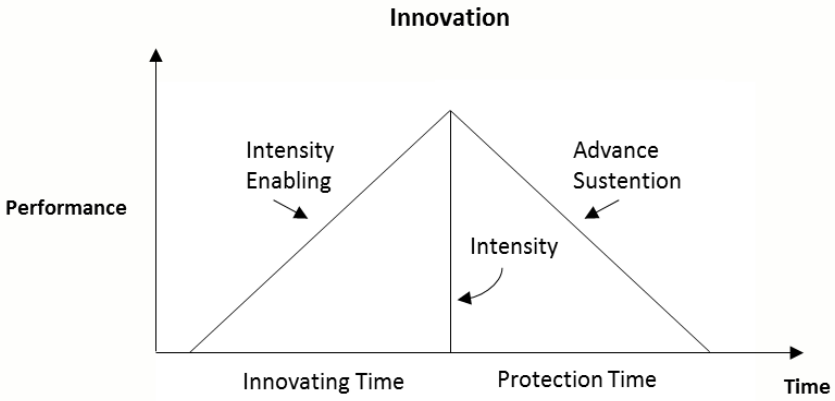

Figure 1 – Innovation Triangle

The Innovation Triangle assume two parameters that define innovation dimension, which depend on time and have impact on performance (innovation indicators allow to express innovation results in terms of economic, social and environmental values), namely:

- Intensity Enabling – which measures the resources ability to be intensively innovative, which means that a higher performance level stated is achieved faster. Thus, Innovating Time is shorter when this parameter has high values.
- Advance Sustention – which measures the resources ability to maintain longer this innovation advantage. Thus, better this parameter the longer is the Protection Time.

Considering this assumptions, we conclude that if a company has a short innovation time and a long protection time and is achieving high innovation results (performance), then the company can be considered has having sustainable competitiveness. If compared with a competitor, acting in the same economic sector,

and if its evaluation results reveal a better score than its competitor, then the company have a competitiveness advantage in terms of innovation.

Anyway, the question that should be answered now is: How can innovation resources management be measured, as well as what kind of innovation indicators should be used?

Considering the analysis of several evaluation models and strategic approaches, we define seven competitiveness drivers (Table 1), which are the foundations of the Sustainable Competitiveness Evaluation model based on innovation.

Table 1 – The 7 competitiveness Drivers of the sustainable competitiveness evaluation model based on innovation, considering a comparison analysis with other models and approaches

Criteria of EFQM model	**Principles of Shingo Prize model**	**Competitiveness Drivers**	**Balanced Scorecard Perspectives**	**PESTLE**
Leadership	Culture Enablers Leadership & Ethics Enterprise Culture Enterprise Thinking Consistent Lean Policy Deployment	**Corporate Behavior**	Learning and Growth	Political Legal
Strategy Customer Results Society Results	Quality Delivery Cost Competitive Impact	**Business Proposition**	Customer	Economic
Business Results	Business Results Financial Impact	**Financial Stability**	Financial	
People Partnerships & Resources People Results	People Deployment	**Organization Wellbeing**	Learning and Growth	Social
Processes, Products & Services Partnerships & Resources	Continuous Process Improvement Lean Ideas Value Stream & Support Processes	**Operational Leanness**	Internal Business Processes	Technical Environmental
		Technological Alignment		
		Facilities Suitability		

Once the definition of the seven competitiveness drivers and after more detailed analysis, reflections and workshops with experts, 14 competitiveness elements were established, as well as 24 evaluation criteria (sources of enhancement) – Table 2.

Table 2 – Competitiveness elements, sources of enhancement and leverage factors by each competitiveness driver of the Sustainable Competitiveness Evaluation Model based on innovation

Corporate Behavior

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Culture and leadership	**Innovative Organization**	Increase of Organizational alignment with innovation Share of innovation commitment Creation of an ownership environment (employees feel like part of the team)
	Innovative Leadership	Auto-creativity deployment Talent maximization Increase of opportunity to generate differentiation
	Society commitment	Trustworthiness increase Increased recognition by the adoption of differentiated social initiatives
Management and knowledge	**Strategic Vision**	Anticipation in the face of competition Business perpetuity Leverage of strategic partnerships
	Quality and Environment commitment	Continuous innovation improvement Reduction of environmental impacts Increased recognition and visibility among stakeholders
	Governance and empowerment	Creation of idea-generating environments Increased accountability for innovation and self-motivation Increased probability of successful innovation
	Wisdom deployment	Information exploitation improvement and increased capacity to implement competitive advantage generating strategies Increased idea sharing dynamics and the capacity to create innovation Maximizing the use of available / generated knowledge
	Shareholders and strategic partners engagement	Greater assurance of continued investments Enlargement and increased confidence and motivation of the research partner's network Research cost sharing and increased exchange of know-how

Business Proposition

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Customer relationship	**Trends and needs creation**	Creation of market appetence for new products / services Reduced risk of inadequate value proposals Increased market share and competitive leadership (time to market achievement)
	Customer and society recognition	Increased recognition as an entity that generates innovation Increased brand and product loyalty
Commercial focus	**Marketing and salesforce engagement**	Increased confidence and relationship with customers Increased sales Reduced marketing and sales efforts due to the differentiation of products / services

Financial Stability

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Assets management	**Investments management**	Continuous patrimony valorization Financial and business risk dispersion Return on investements maximization
Financial solidity	**Financing ability**	Increased ability to invest and to grow Increased bargaining power

Organization Wellbeing

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Human resources management	**Talent research and retention**	Increased ability to attract and retain talent Talent allocation improvement according to innovation needs Increased capacity to offer exciting challenges
	Entrepreneurship	Creation of intellectual assets Transforming ideas into business Increased personal satisfaction and self-esteem
Employee development and safety	**Talent preservation and valorization**	Incorporation of trends and best innovation practices Reduced innovation cycle time Increased self-learning and enthusiasm for innovation
Respect and Recognition	**Corporate commitment to employees**	Continuous employee engagement to innovation Increased complicity and reinforcement of team spirit Consolidation of relationships between employees and top management

Operational Leanness

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Supply chain management	**Strategic Sourcing and procurement**	Stimulus to the creation of more innovative raw materials Gains by economies of scale and by reducing processing costs Research cost sharing
	Operational logistic innovation	Incorporation of transport, handling and storage innovative solutions Increase of information integration and lead time reduction Decrease of logistic costs
Development, manufacturing and service delivery	**New product/ service research, design and deployment**	Provision of innovative products and services Placing of competitive prices Increased awareness
	Methods, time and tools innovation	Increased process efficiency and reduced operating costs Lead-time and time-to-market reduction Increase of zero-defects

Technological Alignment

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
ICT solutions	**ICT development engagement**	Active participation in research and development in ICT Incorporating innovative valences in ICT Reinforcement of the positioning in the partners network
ICT Services	**ICT services innovation**	Increased capacity to generate innovation in ICT services Encouraging innovation and entrepreneurship by way of example

Facilities Suitability

Competitiveness elements	Sources of enhancement	**Impacts of high innovation** (Leverage Factors)
Facilities management	**Facilities and security innovation**	Increased recognition as a sophisticated and innovative Organization Improvement of ergonomic issues Introduction of environmental and safety solutions

Thus, the model allow the evaluation of a company's innovation competitiveness by analyzing the level of compliance and evidences of the ability to comply with each of the requirements that express each leverage factor for each evaluation criteria (Table 2).

Even so, we still evaluating resources. In fact we just are capable to evaluate the company's ability to innovate (how the company manage their means to reduce innovation time and to enlarge innovation protection time). So, to complete de evaluation model, the innovation performance measures should also be defined. With this purpose, among a wide range of indicators applicable, we selected 18 indicators to be part of the model (Table 3), which should be measured annually.

Table 3 – Innovation indicators of the Sustainable Competitiveness Evaluation Model based on innovation

Corporate Behavior (4)

Impact Indicator	**Evaluation Purpose** (what is the company's …)	**Calculation** (metrics)	**Sustainability dimensions**			**R/I**
			Economic	**Social**	**Environmental**	
Environmental index	Commitment to global warming and climate change reduction	(Total of gas emission x total of water consumption x total of energy consumption x total solid waste produced)/ GVA			X	I
Patents and trademark index	Innovation effectiveness	0,8 x nº of patents approved + 0,2 x nº of trademarks registered	X			I
Average innovation cycle time	Innovation efficiency	$\sum^{n}{}_{i}$ time since idea till launch of the new product or service$_i$/ nº of new products or services launched	X			I
Number of scientific publications	Relevancy to innovative and scientific knowledge (innovation recognition)	Nº of scientific articles published in recognized scientific journals (ex.: ISI)	X	X		I

Business Proposition (2)

Sales of new products (and services) on total of sales	Capacity to convert innovation into business	(Sales of new products and new services/ total of sales) x 100	X	X	X	I
Sales of green products (and services) on total of sales	Ability to convert environmental commitment into business and introduce green solutions into the value chain	(Sales of green products and green services/ total of sales) x 100	X		X	I

Financial Stability (2)

EBITDA profit margin (profitability)	Ability to generate profit, through higher prices based on quality advantage, perception or branding; or through lower product costs due to production efficiency or economies of scale	(EBITDA/ Gross revenue) x 100	X			I
RoPDE (Return on product development expense)	Innovation effectiveness (ability to generate earnings by new products or services)	(Gross Margin – PDE)/ PDE x 100	X	X	X	I

Organizational Wellbeing (3)

High qualified employee rate	Commitment to excel, continuous improvement, research and innovation	(Nº of employees with doctoral or master degree/ total nº of employees) x 100		X		I
Training costs per employee	Commitment to continuous training and development of employees' skills to promote improvements and innovation	Total training cost/ total nº of employees		X		R/I
Carbon footprint per employee	Capacity to reduce carbon emission	Total carbon emission/ total nº of employees			X	I

Operational Leanness (3)

OEE (Overall Equipment Effectiveness)	Operational productivity	Availability x Performance x Quality	X			I
% of recycled material used as raw material input	Commitment to green supply chain	(Nº of recycled units of raw material/ total units of raw material used) x 100			X	I
Non conformity rate	Operational reliability	(Nº of defect units/ total units produced) x 100	X			R/I

Technological Alignment (2)

ICT investment rate	Commitment to ICT up-grading and overall performance increase	(ICT investment amount/ (total investment amount – direct innovation investment)) x 100	X			I
Number of systems integrated with other company systems	Ability to integrate ICT systems in its value chain	(% ICT suppliers integration + % ICT customers integration)/ 2	X	X	X	R/I

Facilities Suitability (2)

Ergonomic and health costs rate	Commitment to employee health and capability to avoid occupational diseases	((compensation for injury, mutilation or deformity + absenteeism costs due to diseases)/ total personnel costs) x100	X	X		R/I
Space productivity	Facilities efficiency	Gross revenue/ facility's square foot	X		X	I

5. Conclusions

The validation process handled with the experts of this research allowed to conclude that the sustainable competitiveness evaluation model - based on innovation, seems to be a value added approach. In fact, they had a unanimous opinion about the importance of the model and all assumed that it could be a helpful tool for managers to identify in what fields of innovation the company need to improve, as well as to support the definition of actions that should be implemented to drive the company to higher levels of sustained competitive advantage. In spite of the expert's opinion, the suitability of the model should be validated through its application on a real business context, through the development of cases studies.

Regarding the model's improvement, other issues could be taken into account for further research and to answer to additional aspects, namely product-related sustainability factors, such as for example at Business Proposition sales of green products should be also "social"? at Financial Stability could be another aspect

producing more intelligent or more simple products? at Organization Wellbeing the ability for problem solving and to people change themselves should be incorporated? Carbon footprint per employee should be called at Operational Leanness, too? Technological Alignment should also check the consequences of new product (medium term, long term)? Facility Suitability should also contain the investment for suitable facilities for an effective innovation process, or this is covered by Financial Stability?

It is possible to conclude that, although the developed model achieved which at this stage can be assumed as a benefit for companies as a tool to support the process of increasing their competitive advantage, there still room for improvements.

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