

Article

Social entrepreneurship in the conduct of responsible innovation: Analysis cluster in Mexican SMEs

Irene L. Bahena-Álvarez¹, Eulogio Cerdón-Pozo² and Alejandro Delgado-Cruz³, *

¹ Doctorate in Economics and Business Administration, University of Granada, 18010 Granada, Spain; lilibahena@correo.ugr.es

² ISDE Research Group, University of Granada, 18010 Granada, Spain; eardon@ugr.es

³ Professor, Faculty of Tourism and Gastronomy, University of the State of Mexico, 50100, Toluca, State of Mexico, Mexico; adelgadoc@uaemex.mx

* Correspondence: lilibahena@yahoo.com.mx

Received: date; Accepted: date; Published: date

Abstract: Responsible innovation combines philanthropic and economic aspects and it is common to refer to entrepreneurs who lead it as "social entrepreneurs". The present study of 100 Mexican SMEs, provides knowledge of exploratory nature about what the models of organization are conducive to SMEs in the generation and development of responsible innovations. Through the statistical technique of cluster analysis, this study identified and characterized four models of organization according to the level of social entrepreneurship reached: (1) "The techno-scientific organization", (2) "The techno-social organization", (3) "The capitalist-social organization" and (4) "The capitalist organization". While in Europe the dominant discourse about responsible innovation focuses on the control of the risk of social rejection of the advance of science and technology; in contexts such as the Mexican, the phenomenon is configured as the mechanism through which entrepreneurs articulate its technological and scientific capabilities to solve priority and specific problems of the society, however, the social impact does not crucially affect their business initiatives. The techno-scientific organization (50% of studied SMEs) is proposed as the model of organization with greater viability for Mexican entrepreneurs.

Keywords: Social entrepreneurship; responsible innovation; sustainable management; Mexican SMEs.

1. Introduction

Business organizations seem to agree with the idea that its activity cannot ignore the expectations of different interest groups calling for ethical business with reputable business practices, covering new concepts of risk and of opportunity. Responsible Innovation (IR) is the concept that aims to collect the interaction between innovation and social values. It challenges a better understanding of the effects of human actions and how the multi-level innovation system affects society in general.

In most developed countries, first attempts have emerged to promote and regulate the concept legally, designating a total budget of 91 million euros in support of research and implementation of responsible innovation [1].

Even though it is difficult assuming that, small and medium-sized enterprises (SMEs) are willing to invest time, money and intellect to lead a responsible innovation, either creating new businesses or reformulating the current management of their businesses. However, several studies have endured that, by offering innovative solutions to multiple environmental and social problems, SMEs are being rewarded with profitability, new knowledge and talents [2], breadth of social capital [3] and attraction of new financial resources [4]. In Europe as an example, SMEs may receive funding through grants, loans and guarantees to start responsible, generating entrepreneur projects of urban and regional development, employment, social inclusion, research, innovation and humanitarian aid [5].

While the concept is increasingly being studied the most in the field of large companies, there is a limited literature that defines the criteria and processes in the context of SMEs-related [4]. His speech has been tackled from two points of view: (1) as a tool that leads to SMEs towards sustainability, and (2) as a business opportunity to make social and environmental commitments.

Since IR combines philanthropic and economic aspects, it is common to refer to entrepreneurs who lead it as "social entrepreneurs". Trying to support the theory of social entrepreneurship, the following study of 100 Mexican SMEs, tries to be a pioneer in Latin America, providing knowledge of exploratory nature, which aims to make light about what are the models of organization according to the level of social entrepreneurship that leads to SMEs in the generation and development of responsible innovation.

The rest of this paper is organized as following. First, a review of the literature of the theory of social entrepreneurship and responsible innovation in the context of SMEs is discussed; in the next section, the research method is described, followed by results that give rise to a discussion section, and finally, conclusions and possible lines of research which could enrich the field of knowledge are exposed.

2 Theoretical background

2.1. Creating new businesses that add social value

The concept of social entrepreneurship (SE) emerged at the end of the 90's in the United States [6, 7, 8, 9, 10, 11] and in the United Kingdom [12, 13, 14, 15]. However, recently it has been the subject of academic discussion [16, 17, 18, 19, 20, 21].

SE includes different concepts for different people and research communities. One school of thought referred to SE as the management of scenarios to create social value [22, 23]. A second group of researchers define SE as a socially responsible business involvement in practice [24, 25]. Finally, a third line of thought describes it as an instrument to solve social problems and means of social transformation [26].

As part of the effort to provide an integral concept of SE, the researchers Mair and Marti, [18] (p. 37) defines it as: A process of creation of value by combining resources in an innovative way to produce opportunities for social change, satisfying social needs.

Literature that refers to the process of social entrepreneurship includes the supply of goods and services and the creation of new organizations. However, the conceptualization of the term "social" is the most important challenge within this field of study. This term, added to the concept

of "entrepreneurship", theoretically separates it from the normal venture and transforms it into a field of knowledge in itself with conceptual premises and its own research methods.

Several researchers, supported by the argument that the primary purpose of social entrepreneurship is the creation of social value, proposed that "non-profit" organization model is the model of a distinctive organization that embodies it. However, this study takes a different perspective. Business models for profit successful as the Gramscense Bank, which offers at least 95% of its loans to women in extreme poverty, shows that the phenomenon of the SE can incarnate in different organization models. In this sense, it is considered that the main difference between a normal entrepreneurship and social entrepreneurship rests on the level of priority that is assigned to the expectation of generating social value as opposed to economic value. In a normal venture, the social value is the residue of the achievement of the economic value [27]. On the theory of social entrepreneurship, the main focus of business is to obtain social value, although Mair and Marti argue that [18] (p. 39), the social entrepreneurship initiatives can design strategies to produce economic value as a critical activity that guarantees the fulfilment of its mission and financial self-sufficiency.

2.2. Responsible innovation: new contract between science, technology, innovation and society

Innovation is a multidimensional process whereby organizations transform ideas into new or improved products, services or processes, to grow, compete and differentiate themselves successfully in their markets [28]. Despite being designed as a business tool to achieve growth and economic prosperity, it is not a completely virtuous concept. Through the theories of innovation management, the concept has evolved to finding space for the recognition within the scientific, business and political communities of the importance of adding ethical considerations and including social concerns between the innovation process and adoption of new technologies. As a result of discussion of the public rejection in recent advances in the field of nanotechnology, the EU focused its public policy on the notion of the concept IR [29], to support projects for research and innovation through Horizon 2020 program.

Although the academic discussion of the impact on society of the advancement of science and technology is not a new theme, there is a recent interaction of a research community that aims to join, strengthen and criticize the prospects of the role of responsibility in the research and the process of scientific development, to solidify its elements and implications in academic and industrial laboratories. A clear attempt in this way is the scientific publication *Journal of Responsible Innovation (JRI)*, whose first issue, was reported at the beginning of 2014 and which has presented texts focused on the concept of IR and its institutionalization. A widely quoted definition of IR is the proposal by Von Schomberg [30] (p. 50), who define IR as: interactive and transparent process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products. For his part, Owen [31] distinguishes four dimensions to the government's science, innovation and institutionalization of the concept: (1) inclusion, (2) anticipation, (3) responsiveness and (4) reflexivity.

About 90% of IR research has been published from the year 2011, coming from various disciplines such as: science, technology, engineering, computer and information technology, innovation, sociology, psychology, politics, ethics and business [32]. Initially the empirical research was focused on topics of nanotechnologies, geo-engineering, biomedical technologies, public involvement and dialogue processes. However, the research has expanded its focus with business

themes such as adoption and implications of IR organizations [33]; academic spin-offs [34]; SMEs [35]; implementation IR in finance [36, 37, 38] and automotive sector [39]. It can be assumed that the IR concept involves a set of assumptions that make it a concept of multidisciplinary nature: (1) focus on research and product innovation to benefit social and environmental; (2) involvement of society in the early stages of the innovation process, including non-governmental groups as spokespersons of the public value; (3) evaluation and effective prioritization of social, ethical and environmental impacts at all stages of the innovation process; (4) regulatory mechanisms to anticipate and handle problems and opportunities, and give immediate response to adverse circumstances, and (5) openness and transparency as integral components of the research and innovation process.

2.3. Responsible innovation: New strategy for development of SMEs

SMEs are mostly defined by the number of workers employed. The limit is 250 workers. SMEs represent 99% of the business world. According to the OECD [39], they are essential for the economic growth of any nation contributing 50% to 60% of employment. There is a limited literature that defines the processes and criteria related to the IR in the context of SMEs [4]. Responsible innovation in SMEs research, has been dispersed across different disciplines and research communities, such as the management of innovation, sustainable entrepreneurship, clean production, sustainable management, and more recently, social innovation [5]. From the line of thought of sustainable management, there are terms proposed to define an innovation that seeks to solve a social or environmental problem as sustainable development innovation [41], sustainability innovation [42], CRS-driven innovation [43], sustainability-related innovation [44], sustainability-oriented innovation [4] and responsible innovation [35].

With a prior design of systems, the SMEs can develop new value propositions for social and environmental impact including its inseparable aspiration of business [45]. On the other hand, the literature suggests that while large companies develop their innovation process managing a diversified portfolio of innovations, giving priority to the realization of projects with the greatest potential for commercialization; SMEs instead, concentrate its efforts and limited resources on a small number of products and/or services, even only one. For many SMEs, a responsible innovation is its main product, service or business model and, therefore, operation centre [35]. It is not difficult to imagine that SMEs will play a decisive role in future responsible innovation cycles, generating a healthy interaction between large and small companies. Due to its characteristics of flexibility and ability to adapt to changes more quickly and with greater independence, the design of IR can generate in the bosom of SMEs. On the other hand, the development of IR could be dominated by large companies, being those more robust financially and with powerful marketing channels.

2.4. Reasons influencing social entrepreneurship

Of the collection of data from a sample of Mexican companies located in the North, Centre and South of the country, it was determined to identify and characterize groups of companies according to the level of social entrepreneurship that played a role in the development of responsible innovation. The study proposes the following research question.

What are the organizational models through which SMEs lead responsible innovations?

Traditional entrepreneurship literature considered two traditional prerequisites in the process of creating a business venture [46].

- (1) Perceived desirability
- (2) Perceived feasibility

However, in the literature of Social Entrepreneurship, Mair and Noboa, [47] argue that entrepreneurs aspiring to social change are influenced also by additional values.

- (3) Emotional empathy
- (4) Cognitive moral development

In this context, while around the world there are people with the characteristics necessary to innovate responsibly, a few make concrete decisions to undertake a sustainable business. For this reason, Hocker [42] proposes to add two elements to the personality of a social entrepreneur.

- (5) Self-efficacy
- (6) Social support

Based on these characteristics and their level of influence on the personality of the social entrepreneur, Hockerts [43] proposes to define three profiles:

The activist entrepreneur: It is defined as the type of entrepreneur who has the ability to "feel the pain" of people and the environment. Personal experience from unjust causes is channelled as inspiration to engage in social adventures, which proclaims its ideas and commitments to contribute to the construction of a world better.

The social technopreneur: This profile defines the enthusiasm to study, develop and implement a technology that adds value to society. Their main motivation is the belief that social problems can be solved with appropriate technological arrangement. Emotional empathy does not affect their motivation, however, social problems can be, a source that have an impact on their creativity and development of sophisticated technologies.

The social venture capitalist: Refers to "entrepreneurs with extensive knowledge in business". Their main motivation is "the market". They commit themselves to launching social business, convinced that the market calls for goods and services that positively impact society. Their performance is measured by the return on investment from their innovations. Social venture capitalist entrepreneurs, are more willing to accept vocational guidance and support of social investors and business incubators.

On the other hand, Hockerts [43] suggests that there are different approaches to drive an innovation that generates a social value. These approaches explain what entrepreneurs intend to achieve, prioritize, and their means used to achieve their goals, defining three types of organizations (Figure 1).

Profit as a goal	The profit from principles business	The social purpose business
Profit as a means		The missionary business
	Social impact as a means	Social impact as a goal

Figure 1. Typology of CSR-driven innovation business ventures by Hockerts. [43]

3. Methodology

3.1. Sample and data collection

Unable to study to all Mexican companies, this study chose a non-probabilistic sample and the technique by voluntary respondents. The databases of the national registry of institutions and scientific companies and technology (RENIECYT), Venture Institute and the directory of hatcheries of the University of the State of Mexico, were used because their relevance for having the information necessary on economic entities. On the other hand, the information of each SME was verified on official pages of Facebook and their Internet portals in order to obtain a representative number of companies involved in responsible innovation. Thus, e-mail was the mechanism used to invite companies; it was the link for access to the measurement instrument.

The period of data collection covered the months from January to July 2017. Interested firms delivered their answers, achieving a participation rate of 12.55%. However, we used control questions to identify those who acknowledged that they had used responsible innovation, in other words, new improved products (goods and services), or a business model whose implementation resolves an environmental or social problems [35, 48]. In this way, the final sample for this study is composed of 100 SMEs (88.64% of respondents).

3.2. Instrument

The sections of "social entrepreneurship" (section a) and "General information" (section f) from survey data were used. In the first paragraph, items were located to estimate the degree of social entrepreneurship (Table 1), at the same time, items were evaluated through a scale Likert type of seven points, where (1) was "extremely poor" and 7 "excellent" (Table 2).

Table 1. Items motivate social entrepreneurship.

Orientation	Code	Author	Item
Perceived Desirability	ES_01	Shapero y Sokol, 1982	The main reason which prompted us to create our responsible innovation was the desire to create a transformation in society using our extensive knowledge of business.
Perceived Feasibility	ES_02	Shapero y Sokol, 1982	From the beginning, we had the conviction of the social change that we could generate with our innovation, it was feasible.
Emotional Empathy	ES_03	Mair y Noboa, 2006	Our innovation arose from the primordial desire to mitigate the pain of people or nature.
Cognitive moral development	ES_04	Mair y Noboa, 2006	We believed that it was our responsibility to create new solutions to attack social problems, not to do so, our morality would be questioned.
Self-efficacy	ES_05	Hockerts, 2009	We feel enthusiasm for further study and to implement a technology that produces a benefit to society.
Social Support	ES_06	Hockerts, 2009	We were encouraged by the success stories of other innovations and networks of entrepreneurs.

Table 2. Scale of assessment of social entrepreneurship.

1	2	3	4	5	6	7
---	--	-	-+	+	++	+++
Is not carried out (is null) 0%	Is not carried 1 - 14.28%	Is not carried 14.29-42.85%	Is performed more or less 42.86 - 57.13%	Is performed 57.14-71.41%	Is performed 71.42-85.70%	Is performed always 85.71-100%
Extremely poor	Too poor	Poor	Regular	Good	Very good	Excellent

With respect to the construct of social entrepreneurship, items were subjected to a reliability test to analyse internal consistency using the Cronbach's alpha (α). As shown in the Table 3, was obtained a value of 0.810, exceeding the minimum of 0.700 recommended in the literature [49].

Table 3. Reliability of the construct of social entrepreneurship.

Code	Average scale if the item has been deleted	Variance of scale if the item has been deleted	Total correlation of elements corrected	Cronbach's alpha if item has been deleted	Construct	Cronbach's alpha (α)
ES_01	26.93	44.470	0.683	0.756	Social entrepreneurship	0.810
ES_02	26.62	44.985	0.674	0.759		
ES_03	26.77	44.300	0.647	0.763		
ES_04	27.38	44.884	0.515	0.793		
ES_05	26.37	46.074	0.622	0.770		
ES_06	27.53	47.383	0.362	0.834		

Additionally, to determine if the scale of measurement of Social Entrepreneurship is valid and reliable, was used the confirmatory factor analysis (CFA) technique. Analysis was performed using Mplus statistical package [50, 51]. Since in the model analysed indicators are ordinal in nature, we use WLSMV estimator available in Mplus software, which is a robust estimator recommended when analysing ordered categorical data [52]. The WLSMV estimator was developed by Muthén, du Toit and Spisic [53] and it was designed specifically to be used with small and moderate sample sizes.

Following recommendations of the literature on validation technique using Confirmatory Factor Analysis (CFA), we calculated Construct Reliability (CR) and Average Variance Extracted (AVE) for scale [54]. Values close to or above 0.700 for composite reliability and 0.500 for average extracted variance were used as indicators of the internal consistency of the scales (in the case of the scale analysed, CR had a value of 0.868 while AVE reached 0.535). The criterion of all factor loadings being significant ($p < 0.050$) was used as indicator of convergent validity [55].

Regarding indicators of goodness of fit for model, Table 4 shows the results obtained after estimating the model. These results allow us to affirm that the scale used is valid and reliable.

Table 4. Model fit information.

Indicator	Results
Chi-square test of model fit	Value (WLSMV estimator) = 14.892 Degrees of freedom=9 P-value=0.0940
RMSEA (Root Mean Square Error of Approximation)	Estimate=0.080 90 Percent C. I. 0.000; 0.151 Probability RMSEA <= 0.050 = 0.216
CFI	0.991
TLI	0.985
SRMR (Standardized Root Mean Square Residual)	0.028
Cronbach's α	0.810
McDonald's ω	0.831

On the other hand, the "General information" section included a section of questions to better describe attributes that may occur in the form of social entrepreneurship (Table 5) and another section sector (SECT), economic activity (ACT_ECON), state (STATE), city (CITY), is a legal (FORM_JUR), year of operation (YEAR_OPE) and number of workers (NUM_WORK) of the company for their characterization.

Table 5. Questions of characterization of SMEs.

Code	Question	Scale	Answer
INN_MOT	What is the primary motivation that leads them to responsible innovation?	Nominal	1. No answer. 2. Economic result: We define to measure our performance as the economic performance and return on investment. 3. Social result: The most that motivates us is to disseminate our ideas better than protect them, for us the social impact is the central point of our success. 4. Technological result: Motivates us to know that we have helped to solve a social problem with the optimal technological arrangement.
INC_SUPP	Have you received support for the business incubation of responsible innovation?	Dichotomy	1. Yes 2. No
FINAN_RES	Have you seen any improvement of financial results by the implementation of responsible innovation?	Ordinal	1. Too much 2. Not much 3. Nothing
RES_METH	Do you have any method to measure the result of responsible innovation?	Dichotomy	1. Yes 2. No
ENT_ASOC	Are you a member of a chamber or business association?	Dichotomy	1. Yes 2. No
QUA_REC	Do you have any recognition of quality?	Dichotomy	1. Yes 2. No

Code	Question	Scale	Answer
SUPP	Are you a supplier of large enterprises?	Dichotomy	1. Yes 2. No
EXPOR	Does the company export activities?	Dichotomy	1. Yes 2. No

3.3. Statistics assessment

The cluster analysis, was used for the processing of data a statistical technique to classify elements where each of them is similar to others in the same group (homogeneity or internal coherence), but different to the elements belonging to other groups (heterogeneity or external isolation) [56, 57].

A hierarchical test data obtained from the construct of social entrepreneurship was used. As a group of similar objects procedure opted for the method of Ward, seeking to minimize the sum of errors between the two groups with respect to all variables [58]. As a measure of dissimilarity between the groups, the Euclidean squared distance was used between each pair of observations, where the shorter distances indicated greater similarity [57]. Finally, was spread the ANOVA F test to verify the reliability of the cluster solution.

The analysis of the clusters obtained was carried out from the history of conglomeration and dendrogram, as well as the descriptive statistics (means and standard deviations). The treatment of data supported the software SPSS version 25.

4. Analysis of results

4.1. Sample characterization

Mexican companies from the study, operate mostly (50%) in four cities in the Centre of the country (city of Mexico, Queretaro, State of Mexico and Puebla), the other half is diversified in the North and South of the Mexican Republic. There are also entities engaged in economic activities of food and health (16%), information (15%), industry (12%) and services (13%). In terms of antiquity, 79% are young-adult companies (11 to 20 years), 7% new businesses (1 to 3 years), 5% young entrepreneurs (4 to 10 years), 5% (21 to 50 years) adult companies and 4% mature companies (over 51 years).

By its legal form, 57% rule as a limited company, 11% limited companies promoter of investment, 11% limited liability companies, 9% individuals with business activities, 6% civil association and the remaining 6% incorporation prosecutor, cooperative society and popular financial company. The number of workers (Official Journal of the Federation, 2009), 42% are micro, medium 28% and 27% small (Table 6), so they are faithful representative of SMEs.

Table 6. Companies by size according to the number of workers.

Size	Sector	Range of number of workers*	Percentage
Micro-size	All	Until 10	42

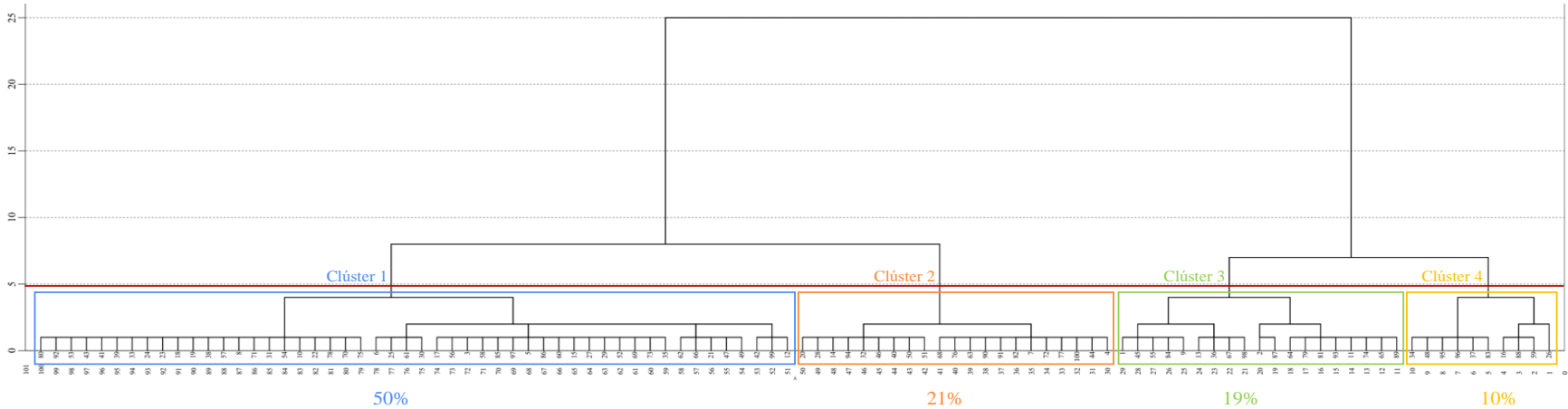
Size	Sector	Range of number of workers*	Percentage
Small-size	Shop	Until 11 to 30	0
	Industry and Services	Until 11 to 50	27
Medium-size	Shop	Until 31 to 100	0
	Services	Until 51 to 100	28
	Industry	Until 51 to 250	2
Missing value			1
Total			100

*Compilation based on the Official Journal of the Federation [59].

4.2. Clusters according to social entrepreneurship to drive responsible innovation

Reading of the dendrogram is evident the presence of two clusters defined from the point of the graphic view (Figure 2). However, assuming distances from conglomeration history and the purpose of the study, was decided to make a cut in the 93 stage, to obtain four clusters that would describe and differentiate better Mexican companies that lead a responsible innovation. This decision was supported by the ANOVA F test to find differences highly selectable between the identified cluster ($p \leq 0.010$).

Figure 2. Dendrogram of SMEs according to their social entrepreneurship.



As can be seen in Table 7, in general Mexican companies were valued as "good" social entrepreneurship ($\bar{x} = 5.38$; $\sigma = 1.32$), however, there are differences in the estimates between each identified cluster. According to the information contained in Table 6, cluster 1 is the highest level of social entrepreneurship ($\bar{x} = 6.19$; $\sigma = 0.65$), characterized by SMEs motivated by their conviction to social change and their inspiration from other activists in order to decrease the social and environmental problems through the optimal use of technologies; in addition to being aware that ethical factors should guide their actions.

Moreover, the cluster 2 is characterized by a high score in their items, even with values higher and convergent compared to those obtained by cluster 1. However, the difference lies in that, the cluster 2 is not inspired by the success stories of innovations and networks of entrepreneurs ($\bar{x} = 2.62$; $\sigma = 1.20$).

In cluster 3, we observe that social entrepreneurship is in a halfway point ($\bar{x} = 4.32$; $\sigma = 0.56$), meaning that to build or develop a responsible innovation, the desire for social benefit comes into the study and implementation of technology, since there is a conviction for social transformation. In these terms, this is a group of companies that do not care about their morality ($\bar{x} = 2.79$; $\sigma = 1.47$), and is not moved by the decrease of socio-environmental problems ($\bar{x} = 3.79$; $\sigma = 1.87$).

The cluster 4 is characterized for having a "poor" social entrepreneurship ($\bar{x} = 2.58$; $\sigma = 0.81$), lack of motivation to change and social commitment, inferring that are conducted under other aspects that are not included in this study, but they are exist in the Mexican sector.

Table 7. Appreciation of social entrepreneurship by each cluster of SMEs.

Item	Cluster 1 (n=50)		Cluster 2 (n=21)		Cluster 3 (n=19)		Cluster 4 (n=10)		ANOVA F	General (n=100)	
	Average	DE	Average	DE	Average	DE	Average	DE		Average	DE
ES_01	5.96	1.277	5.95	1.396	4.84	1.463	2.40	1.174	22.236**	5.39	1.705
ES_02	6.32	0.913	6.67	0.577	4.84	1.573	2.20	1.033	55.181**	5.70	1.673
ES_03	6.30	0.953	6.67	0.577	3.79	1.873	2.80	1.229	62.942**	5.55	1.789
ES_04	5.68	1.463	5.95	1.161	2.79	1.475	3.20	2.700	55.683**	4.94	2.019
ES_05	6.52	0.909	6.76	0.539	5.53	1.307	2.20	1.619	58.041**	5.95	1.666
ES_06	6.36	0.875	2.62	1.203	4.16	2.062	2.70	2.359	91.164**	4.79	2.171
ES	6.190	0.654	5.769	0.495	4.324	0.565	2.583	0.813	45.124**	5.386	1.321

Note: * value highly significant ($p \leq 0.010$).

In terms of approaches that can explain what entrepreneurs intend to primarily achieve and the means used to obtain their goals (Table 8), it may be said that the main reason to conduct responsible innovations are the technological results (47%), followed by the economic (37%) and finally, the social (14%). Also, 62% of these SMEs have received some resources or support their responsible innovations while impact on the financial results is visible in 94% of the entities (64% with 30% with few and quite a few results). In contrast, 60% of the SMEs have mechanisms or methods for measuring the results of innovations, implying that it is only for those who have been supported and have been benefited by their results.

Clusters 1 and 2, share the same technological motivation for responsible innovations, however, is observed that in cluster 1 there are fewer companies with social interests compared to group 2. In other words, the cluster 1 is more technological and less social, while the cluster 2 is

slightly less technological, but equitable companies oriented towards the social and economic aspects. In comparative analysis, clusters 3 and 4 have a greater inclination towards economic aspects. At last, in cluster 4, there is zero interest in social issues, an attribute that distinguishes it from the rest of the groups.

Regarding clusters that are supported for the business incubation of innovations, it was observed that in cluster 1 about half of the companies have some stimulus. In clusters 3 and 4, most of them do not receive and cluster 4 completely does not have support. Despite this situation, 68% of SMEs in cluster 1 are considered to have "enough" financial results generated from innovations implemented, followed by clusters 3 and 4, while the cluster 2 is characterized by failure to observe any of these good results, since 62% mentioned that they are few and 38% perceived outcomes are null.

An important situation is the lack of methods to measure the results of responsible innovations. In all clusters, more than 50% of companies do not have any mechanism for this purpose. The results are articulated with business incubation support and financial results that could be inferred that there is a relationship between such features.

Moreover, the cluster 4 stands out for being integrated in supplier chains of large enterprises (70%) and belonging of a chamber or business association (80%). While the cluster 2 is shaped by companies with the highest percentage of enterprises with recognition of their quality (71.4%), cluster 3 is the type where more entities with export activities are carried out (47.4%). Finally, cluster 1 is a combination of companies with these attributes.

Table 8. Characteristics of clusters (percentage values).

Attribute	Response	Cluster 1 (n=50)	Cluster 2 (n=21)	Cluster 3 (n=19)	Cluster 4 (n=10)	General (n=100)
Motivation that leads to responsible innovation (INN_MOT)	1. No response	0	9.5	0	0	2
	2. Economic result	28	23.8	63.2	60	37
	3. Social result	16	23.8	5.3	0	14
	4. Technological result	56	42.9	31.6	40	47
Support for responsible innovation incubation (INC_SUPP)	1. Yes	48	28.6	10.5	0	32
	2. No	52	71.4	89.5	100	68
Improvement of financial results by the implementation of innovation (FINAN_RES)	1. Many	68	0	57.9	60	64
	2. Few	24	61.9	36.8	30	30
	3. Nothing	8	38.1	5.3	10	6
Method to measure the result of innovation (RES_MET)	1. Yes	46	28.6	36.8	40	40
	2. No	54	71.4	63.2	60	60
Member of a chamber or business association (ENTER_ASOC)	1. Yes	50	61.9	57.9	70	56
	2. No	50	38.1	42.1	30	44
Quality recognition (QUA_REC)	1. Yes	54	71.4	57.9	50	58
	2. No	46	28.6	42.1	50	42
Supplier big companies (SUPP)	1. Yes	64	71.4	52.6	80	65
	2. No	36	28.6	47.4	20	35
Exportation activities (EXPOR)	1. Yes	36	38.1	47.4	30	38
	2. No	64	61.9	52.6	70	62

4.3. Type of organizations to drive responsible innovation

Once analysed the levels of social entrepreneurship and the characteristics of enterprises, clusters can be configured according to models of organizations to try to conduct responsible innovation:

Cluster 1: Techno-scientific model (50% of SMEs), this model has the highest level of social entrepreneurship with a strong conviction to change, being aware of morality and being inspired by other activists to reduce social and environmental problems through the optimal use of technologies. Technological aspects are its main motivation when it comes to the development of a responsible innovation, receiving support for this purpose. It is a group where financial results are perceived in different magnitudes, thanks to their efforts to have some method for its measurement.

Cluster 2: Techno-social model (21% of SMEs), this type of organization sustains its quality through awards and certifications. Is not inspired by the success stories of innovations and networks of entrepreneurs, but is moved by the social and economic outcomes. It is common to receive stimuli for the development of responsible innovations, which lies in the perception of poor financial results, although they have fewer mechanisms or methods for measuring such results.

Cluster 3: Capitalist–social model (19% of SMEs), this kind of enterprise stands out for its activities of export and being guided by economic outcomes. Its social entrepreneurship is moderate, where the study and implementation of technologies take place and are indispensable for the generation and development of a responsible innovation. It is characterized by a lack of concern for whether their ethics are challenged by others, and are not moved by the decrease in environmental problems. A few companies can receive support but it is not necessary. These companies have benefited from financial results by innovations implemented, although instruments to measure them are not an activity for the majority of SMEs.

Cluster 4: Capitalist model (10% of SMEs), this model belongs to associations, companies interested in economic performance, providers of large enterprises with the absence of social motives. For this reason, the level of social entrepreneurship is 'poor' and there lacks change and social commitment-oriented motivations. In addition to this, it is a group that does not receive any kind of resource, or support for the development of responsible innovations. Apart from a few efforts, most SMEs do not have mechanisms of measurement to assess their economic results, however most of them, recognize some financial benefit; implying that they are conducted under other aspects that are far away from the social entrepreneurship.

5. Discussion

The results suggest that responsible innovation requires certain additional motivations apart from desire and feasibility of the change, empathy with social needs and a sense of morality. In this sense, responsible innovation finds its potential in the business, technological and academic abilities of entrepreneurs.

Within the sample subject of study, 95% of entrepreneurs, have higher education and 50% have done postgraduate studies. In addition, 61% refer to having information about business. The results obtained allow us to identify that in Mexico, entrepreneurs mainly develop responsible innovations driven by enthusiasm in developing its business, technological and academic abilities being the "Techno-scientific" model the greatest affinity possible to Mexican entrepreneurs.

The main driver for the “Techno-scientific model”, is the strong conviction that social problems can be solved with the optimal technological arrangement and thus tend to obtain foundation support. Although emotional empathy does not influence their motivations in a decisive way, SMEs under this model, found the problems of others, as a source that has an impact on their creativity to develop sophisticated technologies. In general, they have generated a connection articulating scientist capabilities around the solution of problems and specific challenges of society, which found root on priority needs of the country. By this, support of social activists or scientist networks is important to inspire other entrepreneurs to create and develop focused innovations.

From the Mexican experience, this study has provided evidence related to, responsible innovations within an SMEs context and can be conducted through different organizational models, even isolated from institutional systems such as the “Techno-social model”. This finding contradicts European approaches relating to responsible innovation representing a challenge that must be tackled in a collective way and foundationally. Beyond, this study gives light about the existence of a type of SME that prefers to build its own path as a symbol of leadership in the field of responsible innovation. The “Techno-social model”, although not usually inspired by success stories of other innovations or through networks of entrepreneurs, sustains its responsible innovations motivated by the explicit desire of obtaining economic benefits and developing and implementing technologies that add value to society. This simultaneous three-dimensional desire compels the integration of responsibility in central business strategy.

Identification of different models of organization to conduct solutions to social problems, can add elements that change the logic of discussion, particularly with arguments supported by current social entrepreneurship researchers, to consider that - non-profit model - is the model of a distinctive organization that embodies social entrepreneurship. In these terms, this study contends that a business initiative which is intended to create social value, might accept in the same level of priority, other kinds of expectations such as: techno-scientific progress and economic results. As explained in the previous section, these attributes are configured in the "Techno-social model" singular organization that could embody more accurately the phenomenon of responsible innovation in the context of SMEs.

6. Conclusion

The concept of responsible innovation implies that the innovative process design, is necessary to ensure its positive impact on society. From Europe proclaimed proposals, rules and governing processes have been established, however, responsibility interest is not exclusive of a geographic location or a specific organization type.

Unlike common innovations, the responsible innovation is the result of various reasons or sources of inspiration that influences the decisions of creativity of entrepreneurs to conduct and generate innovations to solve problems of the society.

Through the statistical technique of cluster analysis, this study identified and characterized four groups of companies according to the level of social entrepreneurship that has led them to the generation and development of responsible innovation. Each group represents a "model of organization" which has a different focus and are summarized as follows (Table 9):

Table 9. Organizational model based on social entrepreneurship.

Organizational model	Approach
Techno-scientific model	More technological than social
Techno-social model	Technological, social and economic
Capitalist-social model	More economic than social
Capitalist model	Totally economic

While in Europe the dominant discourse about responsible innovation focuses on the control of the risk of social rejection of the advancement of science and technology; in contexts such as Mexico, the phenomenon of responsible innovation is configured as the mechanism through which entrepreneurs articulate its technological and scientific capabilities around solving priority and specific problems of the society, even though, the social impact does not crucially affect their business initiatives. "Techno-scientific model" (50% of studied SMEs) is proposed as the model of organization with greater viability for Mexican entrepreneurs.

This discovery may contribute to the articulation of efforts to establish platforms and develop scaffolding between "responsible entrepreneurs" agenda and "strategic programs" aligned objectives of sustainable development rooted in the priority social needs of a country, to promote convergence between entrepreneurs and place of competition.

7. Limitations and future research lines

With this exploratory work of nature, reduced sample size study and transversal cutting; longitudinal studies, are proposed as future lines of research to draw conclusions of the phenomenon in this other sense; as well as researches around to variables that are related to motivation, cost effectiveness and social value within the innovation process. Being a descriptive study, is recommended to support in a better way the results with confirmatory statistical techniques.

Author Contributions: All authors contributed equally to this paper.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. European Commission. Available online: https://ec.europa.eu/spain/actualidad-y-prensa/noticias/investigación-desarrollo-e-innovacion/horizonte2020_es.htm. (accessed on 3 March 2017).
2. Brammer, S.; Hojmoose, S.; Marchant, K. Environmental Management in SMEs in the UK: Practices, Pressures and Perceived Benefits. *Bus. Strateg. & Environ.* **2012**, *21*, 7, 423-434. <https://doi.org/10.1002/bse.717>
3. Chell, E.; Nicolopoulou, K.; Karataş-Özkan; M. Social entrepreneurship and enterprise: International and innovation perspectives. *Entrep. & Reg. Develop.* **2010**, *22*, 6, 485-493. <https://doi.org/10.1080/08985626.2010.488396>

4. Klewitz, J.; Hansen, E. Sustainability-oriented innovation of SMEs: a systematic review. *J. Clean. Produc.* **2014**, *65*, 57-75. <https://doi.org/10.1016/j.jclepro.2013.07.017>
5. Vargas-Martínez, E.E.; Bahena-Álvarez, I. L.; Cerdón-Pozo, E. Innovación responsable: nueva estrategia para el emprendimiento de mipymes. *Inn.* **2018**, *28*, 69, 41-53. <http://dx.doi.org/10.15446/innovar.v28n69.71695>.
6. Boschee, J.; Social entrepreneurship. *Across the board*, **1995**, *32*, 3, 20-25.
7. Henton, D.; Melville, J.; Walesh, K. The age of the civic entrepreneur: restoring civil society and building economic community. *Nat. Civ. Rev.* **1997**, *86*, 2, 149-156. <https://doi.org/10.1002/ncr.4100860208>
8. Bornstein, D. Changing the world on a shoestring. *Atlant. Monthly.* **1998**, *281*, 1, 34-38.
9. Brinckerhoff, P.C. Social entrepreneurship: The art of mission-based venture development. New York: John Wiley and Sons. New York. USA, 2000.
10. Dees, J. G.; Emerson, J. Economy, P. Enterprising nonprofits: A Toolkit for Social Entrepreneurs. John Wiley and Sons. New York. USA. 2001.
11. Drayton, W. The citizen sector: Becoming as entrepreneurial and competitive as business. *California Manag. Rev.*, **2002**, *44*, 3, 120-32.
12. Leadbeater, C. The Rise of the Social Entrepreneur. Demos. London. UK. 1997.
13. Warwick, D. Will social entrepreneurs blossom or hit bottom? *People Manag.* **1997**, *3*, 20-56.
14. Zadek, S.; Thake, S. Send in the social entrepreneurs. *New Statesman*, **1997**, *126*, 458, 31-31.
15. SSE Background. Available online: <http://www.sse.org.uk/network/index.shtml>. (Accessed on 16 March 2016).
16. Haugh, H. Social enterprise: Beyond economic outcomes and individual returns. In *Social entrep.* Palgrave Macmillan, London, UK, 2006. <https://doi.org/10.1057/9780230625655>
17. Light, P. C. Reshaping social entrepreneurship. *Stanford Social. Innov. Rev.* **2006**, *4*, 3, 47-51.
18. Mair, J.; Marti, I. Social entrepreneurship research: A source of explanation, prediction, and delight. *J. of world bus*, **2016**, *41*, 1, 36-44. <https://doi.org/10.1016/j.jwb.2005.09.002>
19. Mair, J.; Robinson, J.; Hockerts, K. Social entrepreneurship. Palgrave Macmillan. New York, USA, 2006. <https://doi.org/10.1057/9780230625655>
20. Hockerts, K. Managerial perceptions of the business case for corporate social responsibility. CBS Center for Corp. Social Respons. Porcelænshaven DK, Frederiksberg 2007.
21. Robinson, J.; Blockson, L.; Robinson, S. Exploring stratification and entrepreneurship: African American women entrepreneurs redefine success in growth ventures. *The ANNALS of the American Acad. of Polit. and Social Scien*, **2007**, *613*, 1, 131-154. <https://doi.org/10.1177/0002716207303586>
22. Austin, J.; Stevenson, H.; Wei-Skillern, J. Social and commercial entrepreneurship: same, different, or both? *Rev. de Administração*, **2012**, *47*, 3, 370-384. <https://doi.org/10.5700/rausp1055>
23. Merging mission and money: A board member's guide to social entrepreneurship. Available online: <http://www.socialent.org/pdfs/MergingMission.pdf> (accessed on 14 March 2018).
24. Sagawa, S.; Segal, E. Common interest, common good: Creating value through business and social sector partnerships. *Calif. Manag. Rev.* **2000**, *42*, 2, 105-122.
25. Waddock, S. A. Building successful social partnerships. *MIT Sloan Manag. Rev.* **1988**, *29*, 4, 17.
26. Alvord, S. H.; Brown, L. D.; Letts, C. W. Social entrepreneurship and societal transformation: An exploratory study. *J. of applied behav. scien.* **2004**, *40*, 3, 260-282.
27. Venkataraman, S. The distinctive domain of entrepreneurship research. *Advan. in entrepren. firm emerg. and growth.* **1997**, *3*, 1, 119-138.
28. Baregheh, A.; Rowley, J.; Sambrook, S. Towards a multidisciplinary definition of innovation. *Manag. Decis.* **2009**, *47*, 8, 1323-1339. <https://doi.org/10.1108/00251740910984578>

29. Vasen, F. Innovación responsable: un marco aún demasiado europeo. Available online: <http://www.scidev.net/america-latina/innovacion/opinion/innovacion-responsable-un-marco-aun-demasiado-europeo.html> (accessed on 15 May 2015).
30. Von Schomberg, R. Prospects for technology assessment in a framework of responsible research and innovation. *Technikfolgen abschätzen lehren*. VS Verlag für Sozialwissenschaften. Springer Fachmedien, Wiesbaden, 2012. <https://doi.org/10.1007/978-3-531-93468-6>
31. Stilgoe, J.; Owen, R.; Macnaghten, P. Developing a framework for responsible innovation. *Resear. Pol.*, **2013**, *42*, 9, 1568-1580. <https://doi.org/10.1016/j.respol.2013.05.008>
32. Genus, A.; Iskandarova, M. Responsible innovation: Its institutionalisation and a critique. *Techno. Forecas. and Soc. Change*, **2018**, *128*, 1-9. <https://doi.org/10.1016/j.techfore.2017.09.029>
33. Pavie, X.; Scholten, V.; Carthy, D. Responsible Innovation: From Concept to Practice. World Scientific Publishing Co. Singapore, 2014.
34. Scholten, V. E.; Van der Duin, P. A. Responsible innovation among academic spin-offs: how responsible practices help developing absorptive capacity. *J. on Chain and Network Scie.* **2015**, *15*, 2, 165-179. <https://doi.org/10.3920/JCNS2015.x005>
35. Halme, M.; Korpela, M. Responsible innovation toward sustainable development in small and medium-sized enterprises: a resource perspective. *Bus. Strat. and the Envir.* **2014**, *23*, 8, 547-566. <https://doi.org/10.1002/bse.1801>
36. Armstrong, M.; Cornut, G.; Delacôte, S.; Lenglet, M.; Millo, Y.; Muniesa, F.; Tadjeddine, Y. Towards a practical approach to responsible innovation in finance: New Product Committees revisited. *J. of Finan. Regul. and Complia.* **2012**, *20*, 2, 147-168. <https://doi.org/10.1108/13581981211218289>
37. Asante, K.; Owen, R.; Williamson, G. Governance of new product development and perceptions of responsible innovation in the financial sector: insights from an ethnographic case study. *J. of Respon. Inno.* **2014**, *1*, 9-30. <https://doi.org/10.1080/23299460.2014.882552>
38. Muniesa, F.; Lenglet, M. Responsible innovation in finance: directions and implications. *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*. Wiley, London, 185-198. 2013.
39. Wodzisz, R. Case Study of R-1234yf refrigerant: implications for the framework for responsible innovation. *Scien. and engin. ethics*, **2015**, *21*, 6, 1413-1433. Doi: 10.1007/s11948-014-9612-2
40. OECD, 2017. Available online: <https://www.oecd.org/mcm/documents/C-MIN-2017-8-EN.pdf> (accessed on 30 June 2018).
41. Hall, J. Sustainable development innovation; a research agenda for the next 10 years. Editorial for the 10 th Anniversary of the Journal of Cleaner Production. *J. of Clean. Produ.* **2002** *3*, **10**, 195-196.
42. Wüstenhagen, R.; Sharma, S.; Starik, M.; Wuebker, R. Sustainability, innovation and entrepreneurship: introduction to the volume. Edward Elgar Publishing. Cheltenham, UK. 2008.
43. *CSR-driven innovation: Towards the social purpose business*. Available online: https://www.academia.edu/2837447/CSR-driven_Innovation_Towards_the_Social_Purpose_Business (accessed on 17 November 2017).
44. Wagner, M. Sustainability-related Innovation and Sustainability Management. A Quantitative Analysis. Centre for Sustainability Management. Lüneburg, 2008.
45. Adams, R.; Bessant, J.; Jeanrenaud, S.; Overy, P.; Denyer, D. Innovating for sustainability: a systematic review of the body of knowledge. Network for Business Sustainability. London/Montreal, Canada. 2012.

46. Shapero, A.; Sokol, L. The social dimensions of entrepreneurship. *Encyclopedia of entrepreneurship*, **1982**, 72-90.
47. Mair, J.; Nobao, E. Social entrepreneurship: How intentions to create a social venture are formed. In *Social entrep.* Palgrave Macmillan, London. UK. 2006. https://doi.org/10.1057/9780230625655_8
48. Bos-Brouwers, H. E. J. Corporate sustainability and innovation in SMEs: evidence of themes and activities in practice. *Bus. Strat. and the environ.* **2010**, *19*, 7, 417-435. <https://doi.org/10.1002/bse.652>
49. Nunnally, J. C.; Bernstein, I. H. Psychometric theory. 3rd. Edi. McGraw Hill, New York, USA. 1994.
50. Byrne, B. M. Structural equation modeling with Mplus: Basic concepts, applications, and programming. Routledge. New York, USA. 2013.
51. Wang, J.; Wang, X. Structural equation modeling: Applications using mplus. Chichester: John Wiley & Sons, Chichester, UK, 2012.
52. Finney, S. J.; DiStefano, Ch. Nonnormal and categorical data in structural equation modeling. *Structural Equation Modeling. A second course*. Information Age Publishing. Inc. USA, 2006.
53. Muthén, B.; du Toit, S. H. C.; Spisic, D. Robust inference using weighted least squares and quadratic estimating equations in latent variable modeling with categorical and continuous outcomes. Los Angeles: University of California. 1997. Retrieved from http://www.statmodel.com/bmuthen/articles/Article_075.pdf.
54. Hair, J. F.; Black, W. C.; Babin, B. J.; Anderson, R. E. Multivariate data analysis. Seventh Edition. Essex: Pearson Education Limited. 2014.
55. Bagozzi, R. P.; Yi, Y.; Phillips, L. W. Assessing construct validity in organizational research. *Adminis. Scie. Quart.* **1991**, *36*, 3, 421-458. Doi: 10.2307/2393203
56. Cormack, R. M. A review of classification. *J. of the Roy. Statist. Soc.*, **1971**, *134*, 3, 321-367. <https://doi.org/10.2307/2344237>
57. Everitt, B.; Landau, S.; Leese, M.; Stahl, D. Cluster analysis. Fifth edición. John Wiley & Sons, London, UK, 2011. <https://doi.org/10.1002/9780470977811.ch4>
58. Ward, J. H. Hierarchical grouping to optimize an objective function. *J. of the Amer. Statis. Assoc.* **1963**, *58*, 301, 236-244. Doi: 10.1080/01621459.1963.10500845
59. DOF. Acuerdo por el que se establece la estratificación de las micro, pequeñas y medianas empresas. México: Diario Oficial de la Federación. Available online: http://dof.gob.mx/nota_detalle.php?codigo=5096849&fecha=30/06/2009 (Accessed on 14 July 2017).

