

**Relation between the characteristics and business incubators performance in three countries: Chile, Israeli and Italy**

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## ÁREA TEMÁTICA: Empreendedorismo

Title: Relation between the characteristics and business incubators performance in three countries: Chile, Israeli and Italy

**ABSTRACT:** This research examine the relation between the characteristics and business incubators performance in three countries: Chile, Israeli and Italy. The business characteristics are in the context of: corporate mission, plans and strategies, leadership/management, staff competence and expertise, facilities and resources and technology. The performance measures in this study drawn from literature: graduation of businesses incubated; success of businesses incubated; jobs created by incubation; and salaries paid by incubator clients. Integrates theory and empirical data to investigate links between characteristics and business incubators performance. Structured interviews and questionnaires will be used to develop the research. Provides a concise description of the Chile, Israeli and Italy business incubators program and presents the characteristics of the data available. The data collection includes formal and informal open interviews. Incubators contribute to the international economy and play a vital role not only in the economic recovery but also in smart growth and economic development. These findings will assist incubator managers, policy makers and government parties in successful implementation of incubator policies.

**Keywords:** Business Incubator; Characteristics; Performance; Chile, Israeli and Italy

Título: Relação entre as Características e Performance dos Negócios em três Países: Chile, Israel e Itália

**RESUMO:** Esta artigo examina a relação entre as características e performance das incubadoras de negócios em três países: Chile, Israel e Itália. As características consideradas neste contexto são: missão da corporação, planos e estratégias, lideranças e gestão, staff e expertise, facilidades, recursos e tecnologias. As medidas de performance deste estudo são: graduação das empresas incubadas, sucesso dos negócios incubados, empregos criados, e salários pagos. A pesquisa integra teoria e prática para investigar as características e performance das incubadoras de negócios. Os dados foram coletados de especialistas por meio de um questionário estruturado do tipo matriz escalar. Os resultados mostraram-se satisfatórios, validando os procedimentos metodológicos. Espera-se que estes resultados possam assistir gestores de incubadoras, gestores políticos e parceiros governamentais em suas decisões sobre implementação de programas de incubadoras.

**Palavras-chave:** Incubadoras de Negócios; Características, Performance; Chile, Israel e Itália.

## 1 INTRODUCTION

Entrepreneurship and innovation have been widely accepted as essential sources of business success, high value added job creation and national economic development. A wide array of mechanisms is being promoted to support innovative entrepreneurship. The most researchers seem to agree that incubation is related to the early phase of a venture's life (Temali and Campbell 1984; Allen 1985; Smilor and Gill 1986; Allen and Levine 1986; Hisrich and Smilor 1988; Campbell et al. 1988, Aernoudt, 2004; Bhabra-Remedios and Cornelius, 2003; Grimaldi and Grandi, 2005; Hackett and Dilts, 2004a; Lindelöf and Löfsten, 2004)( Bergek and Norrman, 2008). Among these mechanisms business incubators and related enterprise support systems have emerged worldwide as highly popular methods for promotion of economic development not only in industrialized countries but also industrializing and restructuring countries, although the discussions have been continuing about their impact or performance. The most incubators take on ventures in early phases, whose ideas are immature, i.e. have not yet been fully developed into business ideas (Klofsten, 2005), and help develop them into viable companies. The first incubator was established in 1959 in Batavia, New York in the United States. From the 1970s onward, business incubators have spread out all over the world (Albert and Gaynor, 2001). Although it originated in the US, incubation is now a worldwide phenomenon that has spread to countries as diverse as the UK, France, Sweden, Italy, the Philippines, China and Brazil (Rice and Matthews, 1995; Kalis, 2001).

Business incubator programs have become a central element of support infrastructure for SME and entrepreneurship (Aernoudt, 2004; Amirahmadi and Saff, 1993; Barrow, 2001; Bergek and Norrman, 2008; EC, 2002; Hackett and Dilts, 2004; Hansson et al., 2005; IASP, 2002; NBIA, 2007; Quintas et al., 1992; Rice, 2002; Smilor and Gill, 1986; UKBI, 2007; UKSPA, 2006; Vedovello, 1997). These programs exist widespread worldwide as a popular entrepreneurship policy intended to help new businesses avoid the risks of failure and generate economic growth in worldwide (Amazcua 2010a; Chan and Lau, 2005; Lindholm-Dahlstrand and Klofsten, 2002; Lyons and Li, 2003). They receive tremendous subsidies from governments and a great deal of government funds is directed to them both in developing and developed countries (Ozdemir and Sehitoglu, 2013). Four components have received particular attention in previous research (see Aernoudt, 2004; Allen and McCluskey, 1990; Bollingtoft and Ulhoi, 2005; Brooks, 1986; Chan and Lau, 2005; Clarysse et al., 2005; Collinson and Gregson, 2003; Colombo and Delmastro, 2002; Hackett and Dilts, 2004a, b; Hansen et al., 2000; Hsu et al., 2003; Lyons and Li, 2003; Mian, 1996a; Nolan, 2003; Peters et al., 2004; Phillips, 2002; Rice, 2002; Rothschild and Darr, 2005; Smilor, 1987; von Zedwitz, 2003):

- shared office space, which is rented under more or less favourable conditions to incubatees,
- a pool of shared support services to reduce overhead costs,
- professional business support or advice (“coaching”) and
- network provision, internal and/or external.

Thus, the number of Business Incubators has been rising rapidly around the world as an evidence of the importance attributed to the Business Incubators (Udell 1990, Ratinho 2011, Ratinho and Henriques 2010, OECD 1997, EC 2002 Schwartz and Gothner 2009). Many governments has been devoting considerable amount of resources to establish and operate business incubators. More recently, several researchers have attempted to more

specifically address the incubator performance issues (Lichtenstein 1992; Rice 1993; NBIA 1993b). Considerable amount of researches have been conducted on the performance of Business Incubation programs for a decade due to this increasing interest (Aernoudt, 2004). Business incubators constitute an environment, especially designed to hatch enterprises. They provide their tenant companies with several facilities, from office space and capital to management support and knowledge. The success of an incubator depends on the performance of its tenants and thus an incubator benefits from limiting the tenant failure rate. One way of minimising the number of tenant failures is to subject potential 'clients' to a severe assessment process (Aerts, Matthyssens and Vandenbempt, 2007). This allows the incubator to evaluate the presence of characteristics that are deemed essential to develop enterprises (see e.g. Merrifield, 1987; Lumpkin and Ireland, 1988; Peters et al., 2004; Hackett and Dilts, 2004). In this perspective, considering the great credence for—and the large amounts of money invested in—incubators by governments, universities, research institutions, municipal agencies and other interested parties, the question of what return society gets on these investments has been raised. Consequently, and in line with a general demand for more rigorous evaluations (OECD, 2006), the evaluation of incubator performance has attracted some attention (cf. Aernoudt, 2004; Allen and McCluskey, 1990; Bhabra-Remedios and Cornelius, 2003; Chan and Lau, 2005; Grimaldi and Grandi, 2005; Hackett and Dilts, 2004a; Lindelöf and Löfsten, 2004; Mian, 1996a, 1997; Nolan, 2003; OECD, 1997; Pena, 2004; Phan et al., 2005)(Bergek and Norrman, 2008). In fact, many researches have been conducted to assess their performance or impact.

Since the seminal works of Birch (1979, 1987) that provide evidence about the impact of new and small firms on creating new jobs in USA, small businesses have been increasingly viewed as the primary sources of job creation and critical to economic development. Considerable amount of researches have been conducted all over the world generating evidence that support the argument that small businesses, particularly the high growth small businesses create most of the jobs and wealth (Stokes and Wilson 2010; Thurik and Wenneker 1999). Yet researches also demonstrate that despite their positive impact on economy, these small and new businesses are very fragile and vulnerable especially during their first years. Majority of those fails soon after being started and only a small proportion of survivals are succeed to growth (Stokes and Wilson 2010). In line with the acknowledgement of their fragility as well as significance, the efforts to create more conducive environment for new ventures have increased substantially and several forms of government incentives and business assistance mechanisms provide them necessary support in order to improve their survivability has emerged and proliferated all over the world (Autio and Klofsten 1998, Udell 1990, Ratinho 2011, Amezcua 2010b).

In this perspective, among a broad array of mechanisms, programs and incentives, Business Incubators have been particularly receiving an increasing interest as a tool to promote new business formation, prevent business failures and establish a vibrant entrepreneurship sector not only in developed countries but also developing and less-developed countries in recent years (Bergek and Norrman 2008, Scillitoe and Chakrabarti 2010, Bruneel et al. 2012, Schwartz and Gothner 2009, Udell 1990, Aerts et al. 2007, Allen and Rahman 1985, Grimaldi and Grandi 2005, OECD 1997, Ratinho et al. 2010). Generally similar measures have been used in these researches related to a wide array of countries ranging from most developed to less developed countries. However according to Po (Acs and Szerb 2010). Therefore the measures should be different when assessing the success of Business Incubators. This study on discussing the assessment of business incubator

programs can only be the first step towards rigorous evaluation efforts. In fact, an incubator is justified based on superior innovation performance (Barbero et.al., 2012); as studies have been inconclusive, we argue that performance differs according to the characteristics of incubator. In summary, the literature gap we address is the study of how different types of incubator perform based on whether the characteristics meet the objectives for which they were set up. In this study we will try to find out some more appropriate characteristics of as to understand better how incubator program can be assessed better. With a special focus in Chile, Israeli and Italy. This paper studies the characteristics and performance of business incubators within the Chile, Israeli and Italy context. Hence, it tackles the following research issues:

- a profile of the characteristics of the business incubators in Chile, Israeli and Italy;
- a description of performance practices by business incubators;
- an exploratory link between characteristics and performance of business incubators.

Thus, the present study aims to assess the effects of the characteristics on the performance of business incubators in Chile, Israeli and Italy. Here incubator is conceptualized as a facilitation method, not physical premise. In our opinion, this is an important addition to the literature on this issue. Business incubation in Chile is still in its nascent stages, with approximately 27 incubators supported primarily by a coalition of government and universities. Chilean business incubators tend to capitalize on regional resource strengths and have a strategic focus on high growth, high innovation, high impact businesses as a result of a government mandate to focus on developing business with high potential for economic development and job creation (Chandra and Silva, 2012). Since the 1990s, Israel has emerged as a global center of innovation and growth (Saxenian, 2006; Senor and Singer, 2009). At the end of the 20th century, around one million Eastern European Jews, mainly from the former Soviet Union, started arriving in Israel. In response to this large influx of immigrants for which job opportunities needed to be provided, Israel's government created an environment that would be conducive of entrepreneurship. Government established about thirty incubators and at the same time, it stimulated the establishment of a venture capital industry to encourage financial investments in the budding start-ups. It also created a budget for the Chief Scientist Office, which in turn allocates funds to subsidize the development of applications of new technologies. Through the Israel Export Institute, it funded many consultants who helped entrepreneurs getting started (Almor and Heilbrunn, 2014). The propensity towards entrepreneurship is especially high in Italy (see for instance Blanch flower and Oswald, 1999) and small firms account for a disproportionately high share of total employment. In this perspective, the Business incubation has been acknowledged as an effective support infrastructure for SME and entrepreneurship in Italy. Thus, systematic evaluations are needed to understand whether business incubation is an effective and efficient policy tools in those countries (Ozdemir and Sehitoglu, 2013). The research plan is organized as follows. Section 2 guides the reader through the relevant theoretical background. Section 3 describes the conceptual model framework. Section 4 describes the empirical application: the Chile, Israeli and Italy. And References.

The literature on Business Incubators has been substantially developing due to growing popularity of new business formation as a means of economic development and job creation for approximately three decades (Phan et al. 2005, Hackett and Dilts 2004, Tamasy 2007). In fact, business incubators have been established around the world to stimulate new business creation (Bruneel et.al., 2012). Within this context, this paper is

structured according to the following sections: methodology, results and underlying analyses, the paper concludes with the final conclusions and implications.

## 2. METHODOLOGY

### 2.1. Conceptual Model: Constructs and hypotheses

This section examines the conceptual model (Figure 1) and presents the hypotheses to be tested throughout this work.

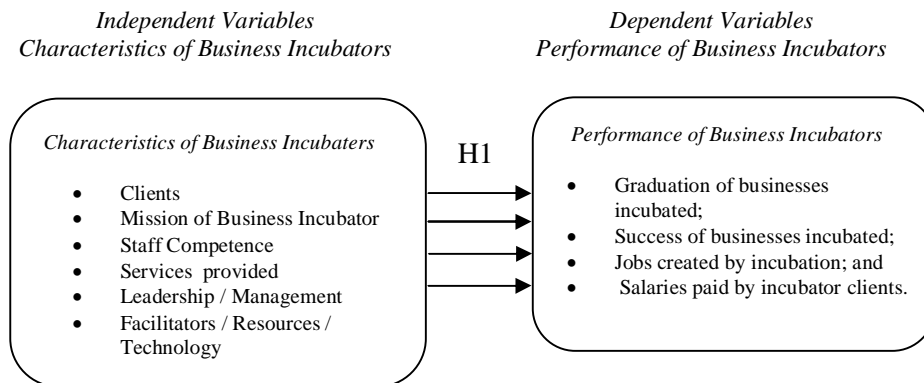


Figure 1: Conceptual model

Entrepreneurship and innovation have been widely accepted as essential sources of business success, high value added job creation and national economic development. A wide array of mechanisms is being promoted to support innovative entrepreneurship. Among these mechanisms business incubators and related enterprise support systems have emerged worldwide as highly popular methods for promotion of economic development not only in industrialized countries but also industrializing and restructuring countries, although the discussions have been continuing about their impact or performance (Özdemir and Sehitoglu, 2013). Business Incubators have been particularly receiving an increasing interest as a tool to promote new business formation, prevent business failures and establish a vibrant entrepreneurship sector not only in developed countries but also developing and less-developed countries in recent years (Bergek and Norrman 2008, Scillitoe and Chakrabarti 2010, Bruneel et al. 2012, Schwartz and Gothner 2009, Udell 1990, Aerts et al. 2007, Allen and Rahman 1985, Gribaldi and Grandi 2005, OECD 1997, Ratinho et al. 2010; Özdemir and Sehitoglu, 2013). The business incubators are influencing economic competitiveness, creating new jobs, attracting investments, implementing effective public policies, boosting entrepreneurship. An incubator provides resources like space, goals, marketing, management, structure and financing to knowledge- and technology-intensive new technology-based firms. In other words, an incubator is an environment for initiation and growth of these firms (Aerts et al., 2007; Chan and Lau, 2005; Lo" fsten and Lindelo" f, 2001; Lindelo" f, 2002; Mian, 1994; Aaboen, 2009). There are many definitions used by both researchers and practitioners to define business incubators (Aernoudt, 2004; Amirahmadi and Saff, 1993; Barrow, 2001; Bergek and Norrman, 2008; EC, 2002; Hackett and Dilts, 2004; Hansson et al., 2005; IASP, 2002; NBIA, 2007; Quintas et al., 1992; Rice, 2002; Smilor and Gill, 1986; UKBI, 2007; UKSPA, 2006; Vedovello, 1997). The concept of business incubator has been evolving since the 1970s, when initially emerged among other small enterprise support initiatives as a low-cost space and management training provider to entrepreneurs (Barrow, 2001). With the increasing interest towards the Business Incubation, the debates on the benefits, effectiveness, success as well as the economic and social contributions of the Business

Incubators have also received considerable attention from the researchers and policy-makers (Bergek and Norrman 2008). Many empirical studies have been applied to assess the Business Incubators. All of these researches tend to reflect different perspectives, patterns and assessment criteria in the literature which are focused on measuring performance of Business Incubators throughout the world (Phan et al. 2005). In the literature survival measures has been widely used as indicators of incubator performance, since the (Adegbite 2001, Allen and Rahman 1985, Schwartz and Gothner 2009). Recently, Al-Mubaraki and Schrodl (2012) studied and proposed a measurement model that concerned the international context. The four measured indicators were: (1) graduation of businesses incubated; (2) success of businesses incubated; (3) jobs created by incubation; and (4) salaries paid by incubator clients. In fact, incubator successes survey, indicate that in order for business incubators to be inclusive and promote smart sustainable growth (AL-Mubaraki and Busler, 2014): clear incubator goals can significantly increase the rate of graduation companies from incubation programmes; high survival rate of companies ranged from 81 to 90 per cent which leads to the sustainability of companies in the market; high rate of employment creation leads to economic development; and active role of cooperation of R&D contributes positively on technology transfer and increment in the rate of patents. Others incubator performance measures used by literature (Barbero, 2012) are presented as follow: Bigliardi et al. (2006): Patrimonial structure; Internal development; Repercussion in the territory; Economic and financial aspects; Human resources and technical-scientific productivity; and International and interregional relationships; Mian (1997): Goal approach (4 measures); System resource approach (7 measures); Stakeholder approach (4 measures); and Internal process approach (5 measures); Westhead (1997): a) Input R&D - Proportion of qualified scientists and engineers (QSE); Radical new research; R&D spending/Sales; and Gross R&D investment/Sales; b) Output R&D: Number of patents; and Introduction of new products or services; others.

Thus, from the theoretical excerpts, the following variables and hypotheses of this study were raised.

*Independent Variables:* from the findings in the literature the following characteristics of business incubators were identified: Clients; Corporate mission; Plans and strategies; Leadership/management; Staff competence and expertise; Facilities/Resources and Technology.

*Dependent Variables:* The dependent variables were extracted from the specialized literature and assessed by experts for confirmation. The following independent variables were identified: Graduation of businesses incubated; Success of businesses incubated; Jobs created by incubation; and Salaries paid by incubator.

From the conceptual model, the following hypotheses were made:

*Hypotheses: The characteristics have effect to a greater or lesser degree on the Business Incubators Performance, in perspective Chile, Israeli and Italy.*

The sample and data collection are described below.

## *2.2 Sample and Data Collection*

The aim of this study is to evaluate the relation between the characteristics and business incubator performance in the perspective of the: Chile, Israel and Italy; i.e., how business incubator characteristics affects results? The business characteristics of: Clients; Mission Statement; Staff Competence and Expertise; Services Provided on by Incubators; Leaderships and management; and Facilitator, Features and Technology, were described

for the business incubator each country. The characteristics were extracted from the theoretical excerpts, in which more than 272 titles were selected in the period between 1948 and 2014 on incubators, not exclusively from Chile, Israel and Italy, i.e., the research was initially conducted based on the specialized literature, which extracted the data regarding the characteristics of business incubators. Thus, used a survey with expert (specialist) and managers of business incubators and staff, policy makers (government) and academics. The data were extracted using an assessment matrix (questionnaire scalar). The interview instrument for the semi-structured, in-depth interviews was developed after a thorough literature review. The instrument was pre-tested with business incubators managers. The pilot interviews served as a pre-test for instrument validation and changes were made to the interview instrument based on the findings and comments. To reduce subjectivity in the results achieved the following methods were used complementarily and in combination: Law of Categorical Judgments psychometric scaling method (Thurstone 1927), and multicriteria analysis. Next, these procedures were detailed.

### **3. RESULTS AND UNDERLYING ANALYSES**

The results and underlying analyses are structured according to the following phases:

*Phase 1: Determination of the characteristics of the business incubators in the perspective of: Chile, Israel and Italy*

*Phase 2: Effects of the characteristics on the business incubators performance in Chile, Israeli and Italy*

The procedures are detailed as it follows.

*Phase 1: Determination of the characteristics of the business incubators in the perspective of: Chile, Israel and Italy*

The characteristics of the business incubators of the Chile, Israel and Italy were extracted from the theoretical excerpts and specialists, combined with several methods (Leidecker e Bruno, 1984; Williamson, 1981; Coram, 1967; Vaupel e Curhan, 1974; Dunning, 1958; Dunning, 1983), in which more than 300 titles were selected. The data were extracted by means of a scalar-type matrix of judgement/questionnaire, in which the experts put their impressions, establishing priorities by importance, designating values to the characteristics. The research was oriented to business incubators in Chile, Israel and Italy. It should be highlighted that the intervention made by experts was determinant in the judgment of the characteristics. After the procedure, the prioritization of the characteristics of the business incubators was conducted by means of the Thurstone's LJC psychometric scaling method, i.e., this procedure is developed using the Law of Categorical Judgments psychometric scaling method (Thurstone 1927). The Categorical Judgment method is understood as the modeling of mental behavior that aims to explain the structure of the experts' preferences regarding a set of stimuli. In this work, the choice of Thurstone's Law of Categorical Judgments method is justified as a strategic tool to be tested in order to prioritize, by importance, the characteristics of the business incubators. The procedures to apply the instrument are systematized in the following steps:

*Step 1: Determining the frequencies of preferences for pairs of stimuli (characteristics), where  $O_i$  is equal to characteristics and  $O_j$  to the experts –  $O_i/O_j$ . The systemized data were extracted from the experts' preference regarding characteristics (through field research using an assessment questionnaire/matrix). Characteristic appears as stimuli submitted to the ordinal categories.*



Step 2: Determination of the frequencies of ordinal categories, based on the data extracted from the previous step. The matrix  $[\pi_{ij}]$  of the cumulative relative frequencies is then calculated. The results are classified in ascending order of importance. To better understand the technique, we recommend the following literature (Souza, 1988; Thurstone (1927)).

Step 3: To determine the matrix  $[\pi_{ij}]$  of the cumulative relative frequencies from the results of the frequencies of ordinal categories we calculate the matrix of the cumulative relative frequencies.

Step 4: To determine the inverse of the standard normal cumulative frequencies (ISNCF), from the results obtained in the previous step, calculate the inverse of the standard normal cumulative frequencies. The results reflect the experts' preference probabilities in relation to stimuli (characteristics). The result of preferences is then presented in order of increasing importance ( $\mu_i = -\sum_{j=1}^4 Z_{ij}/4$ ). The scale showed the experts' intensity probability of the preferences, by importance, regarding the characteristics of the business incubators. Thus, the result of preferences is then presented in increasing order of importance (Oliveira and Trento, 2014) in Figure 2.

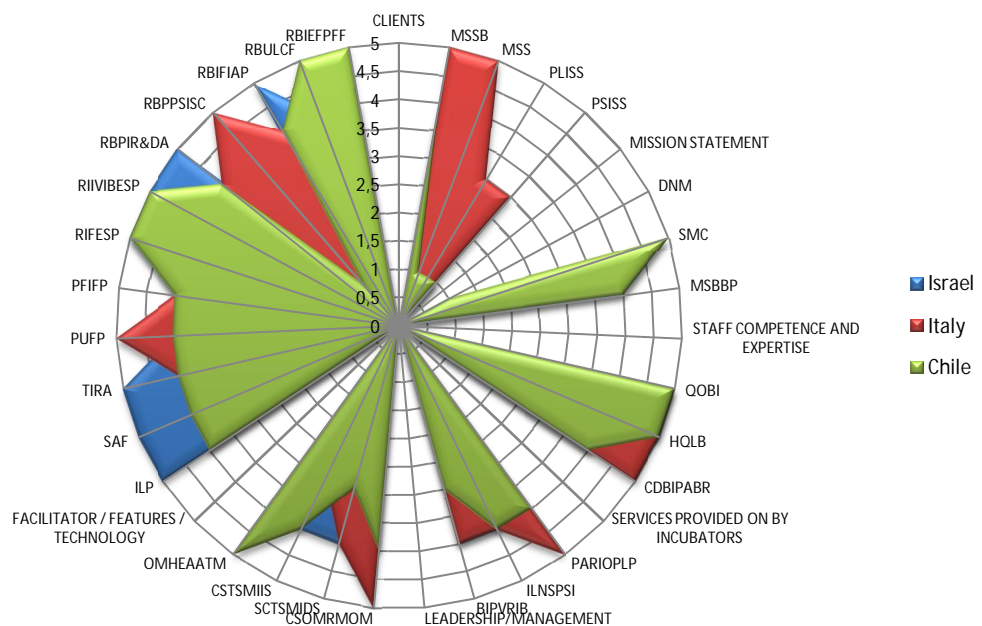


Figure 2: Characteristics of the business incubators of Chile, Israel and Italy

The prioritization of the characteristics of the business incubators was conducted by means of the Thurstone's LJC psychometric scaling method, i.e., this procedure is developed using the Law of Categorical Judgments psychometric scaling method (Thurstone 1927). The Categorical Judgment method is understood as the modeling of mental behavior that aims to explain the structure of the experts' preferences regarding a set of stimuli. In this work, the choice of Thurstone's Law of Categorical Judgments method is justified as a strategic tool and tested in order to prioritize, by importance, the

characteristics of the business incubators. This method considers the mental behavior to explain the structure of the preferences of the decision makers on the characteristics prioritized. The scale showed the experts' intensity probability of the preferences, by importance, regarding the characteristics of the business incubators. The success of a business incubator will depend on the degree to which the needs of the clients and the objectives of the incubator operator coincide (Martin, 1997). The success of an incubator depends on the performance of its tenants and thus an incubator benefits from limiting the tenant failure rate. One way of minimising the number of tenant failures is to subject potential 'clients' to a severe screening process. This allows the incubator to evaluate the presence of characteristics that are deemed essential to develop enterprises (Merrifield, 1987; Lumpkin and Ireland, 1988; Peters et al., 2004; Hackett and Dilts, 2004). Furthermore, the business incubators provide access to networks of professional contacts, facilitating the linkages between tenants and the most appropriate networks for them to build their social capital (Bollingtoft and Ulhoi, 2005; To'tterman and Sten, 2005). According to Santoro and Betts (2002), partnerships offer powerful alternatives to inter-firm collaborations especially successful organizations that frequently engage in the highly competitive environment (Shepard, 2013). The incubator can also shorten the time necessary to learn the essentials of operating a successful business and to develop the communication channels required (Bull and Willard, 1993). The managers estimated that the majority of their time was spent in direct interactions with clients (counseling and related activities). Beyond that, their time went to non-incubator responsibilities, creating and maintaining external resources and networks, and incubator operations (leases, budgets, collecting rent, staff management, hosting tours, etc.).

*Israel:* The different stages of incubation are as follows: pre-incubator stage: ideas and teams were nurtured; . incubator stage: once there is a business plan prepared; and . post-incubator stage: when enterprises move out to "grow-on" space. The facilitators, features and technologies are adequate. In fact, sustaining growth in terms of adequate resource utilization will be one of the greatest challenges (Timmons, 1994; Deakins and Freel, 2003). The Incubators are located properly and the technologies and innovations ratio are adequate, reasonable and feasible. The partnerships with Universities are feasible and plausible. The relationship between the incubator and the friendly environment is suitable, plausible and feasible. The partnerships with Universities and with Financial Institutions (Banks) are feasible. In addition, the relationship between the incubator and incremental value to the industry and the business environment is suitable, plausible and feasible. And the relationship between the presence of incubator and R & D expenses is adequate. The relationship between the presence of the public sector incubator and spending by corporations in R & D is few adequate. The relationship between incubator and financial institutions is appropriate, plausible and feasible. The relationship between universities and local companies is feasible and plausible. The relationship between incubator and economic and financial performance is favorable, feasible and plausible. Sustaining growth in terms of adequate resource utilization is one of the greatest challenges (Timmons, 1994; Deakins and Freel, 2003).

*Italy:* Science and Technology parks and incubators, in narrow sense, are the predominant entrepreneurial tools present in the northern regions, while in the south the 49,40% of this entities evolve into technopole and technology clusters. In the southern regions there is a greater degree of sectorial specialization of incubators, that focus in the area of engineering, biotech and ICT. The sectorial focus decreases in the central regions, where the incubators take a multiple sectorial nature, which reveals the presence of heterogeneous

technology skills, but also the absence of a specific industrial vocation within the territory (Corsi and Di Bernardino, 2014). This shows that the research and innovation drive in a region provides ground for development and the exchange of cutting-edge knowledge, allowing the creation and expansion of incubators, especially technology-oriented ones, where technologically-oriented start-ups are incubated. Another significant positive ratio is the one between the presence of public-sector incubators and corporate R&D spending, which points out the positive synergistic contribution arising from co-operation activities implemented in research partnership agreements between companies and public-sector incubators, funded by local government policies for entrepreneurship development and local growth. By further analysing the findings for the various regional incubator types, there are significant positive relationships between financial-institution participation incubators and corporate service development, industry added value as well as the many variables linked to local research and innovation potential [R&D corporate spending, innovation potential, R&D staff] (Corsi and Di Bernardino, 2014). A aspect important is the significant positive relationship between university participation incubators and the number of local businesses, which points out the role of universities as local entrepreneurship catalysts, profiting from the connections established with the companies located in that territory, which definitely stimulate the presence of corporate incubators in order to start knowledge spill-over processes involving universities, incubated start-ups and the local area (Corsi and Di Bernardino, 2014).

*Chile:* In fact, the business incubators in Chile are supported primarily by a coalition of government and universities and have a strategic focus on high growth, high innovation, high impact businesses as a result of a government mandate to focus on developing business with high potential for economic development and job creation (Chandra and Medrano, 2012). Since the early 1990s, the government has been investing heavily in business incubators to promote entrepreneurship. Chilean incubators seek to promote job creation, economic development, innovation, and high growth by providing a wide variety of services that are typical to most incubators: physical space and infrastructure, business consulting and training, help with funding applications (government and private), patenting assistance and IP protection, technology transfer, and networking. All Chilean incubators provided basic administrative services (office space, infrastructure, secretarial and administrative services). However, incubators tended to emphasize high value services such as consulting, training and networking. However, the major focus of Chilean incubators is on networking. This is often done informally as incubators host breakfast meetings with industry experts or bring in professionals to mentor their clients (Chandra and Medrano Silva, 2012). Almost all business incubators in Chile are funded primarily by a coalition of the government, universities, private institutions, or research centers, with government footing the lion's share of the costs of incubator setup and ongoing support through different dedicated lines of funding to support the life cycle financial needs of the incubators (Chandra and Medrano Silva, 2012). The government funding through CORFO has a role important. Private funds also come usually from companies who hope later to acquire some of the technologies developed by new ventures at the incubators (CORFO, 2012; Chandra and Medrano Silva, 2012). The next step will assess / prioritize by relevance the characteristics in the business incubators global performance.

*Phase 2: Effects of the characteristics on the business incubators global performance in Chile, Israeli and Italy*

This section evaluates the characteristics on the business incubators global performance in the perspective of Chile, Israel and Italy. This procedure was developed using the multi-criteria analysis and Artificial Neural Network (ANN).

*Effects of the characteristics on the business incubators global performance in Chile, Israeli and Italy using the multi-criteria analysis*

Next, these procedures were detailed. The methods used were Compromise Programming, Electre III and Promethee II. The results achieved confirm *Hypothesis 1: The characteristics have effect to a greater or lesser degree on the business incubators performance, in perspective Chile, Israeli and Italy.* The characteristics have positive effects on the business incubators performance, and assigning values to each criterion, we arrive at a matrix of Criteria x Alternatives that together with the vector weights provides the necessary support to apply the multicriteria methods. In other words, one applies the selection and classification methodology of alternatives, using the Compromise Programming, Promethee II and Electre III methods. The Compromise Programming due to its wide diffusion and application simplicity and understanding renders it an alternative to evaluate problems as referenced in this application. The problem solution compromise is the one that comes closest to the alternative. This method was designed to identify the closest solution to an ideal one, therefore it is not feasible, using a predetermined pattern of distances. In Promethee II there is a function of preferences for each criterion among the alternatives which must be maximized, indicating the intensity of an alternative to the other one, with the value ranging from 0 to 1.

Of the Electre family (I,II,III,IV and V), Electre III is the one considered for the cases of uncertainty and inaccuracy to evaluate the alternatives in the decision problem. All these methods enable to analyze the discrete solution alternatives, and taking into consideration subjective evaluations represented by numerical scores and weights. As these are problems involving subjective aspects, the methods that best fit the situation of this research are the methods of the family Electre and Promethee. It should be mentioned that although the Compromise Programming method is not part of this classification, it has similar characteristics, showing much simplicity in order to understand its operation, which makes it feasible for this application.

Within this perspective, the multicriteria methods are viable instruments to measure the performance of the business incubators. The results produced by this prioritization enable managers to better focus their efforts and resources on managing the capacities that perform best, which results in achieving the goals sought by the incubators. The structure of this prioritization (classification by hierarchical analysis) is proposed at three planning levels in a judgment matrix, in which at the first hierarchical structure level it defines the goal, which is to achieve the performance of the incubators that will feed the system; the criteria are in the second level, which are the performances of the business incubators: Graduation of businesses incubated; Success of businesses incubated; Jobs created by incubation; and Salaries paid by incubator clients. The dimensions of characteristics are in the third level, the alternatives, which are: Clients, Corporate mission, Plans and strategies; Leadership/management, Staff competence and expertise, Facilities/Resources and Technology. The prioritization process obeys the judgment of the evaluators (experts). With the results of the judgment matrix, the methods were applied: Promethee II, Electre III and Compromise Programming to evaluate the effects of the characteristics on the business incubators performance in Chile, Israel and Italy. Next, the effects of the

characteristics on the business incubators global performance in Chile, Israeli and Italy. For this ANN was used. The technique adapts to the case in question.

*Effects of the characteristics on the business incubators global performance in Chile, Israeli and Italy using the artificial neural networks – ANN*

The artificial neural networks - ANN is understood to simulate the behavior of the human brain through a number of interconnected neurons. A neuron executes weighed additions for the activations of the neurons representing nonlinear relations. The ANN has the capacity to recognize and to classify standards by means of processes of learning and training. The training of the net is the phase most important for the success of the applications in neural network. The topology of the net can better be determined of subjective form, from a principle that consists of adopting the lesser intermediate number of possible layer and neurons, without compromising the precision. Thus, in this application, the layer of the entrance data possess 10 neurons corresponding the 18 variable referring to characteristics of the business incubators (ranking 18° classifications – mean of the characteristics of Chile, Israel and Italy). The intermediate layer possesses 12 neurons, and the exit layer possesses 1 corresponding neuron in a scale value determined for the ANN.

The process of learning supervised based in the Back propagation algorithm applying software Easy NN determines the weights between the layers of entrance and intermediate, and between the intermediate and exit automatically. The training process was finished when the weights between the connections had allowed minimizing the error of learning. For this, it was necessary to identify which configuration that would present the best resulted varying the taxes of learning and moment. After diverse configurations to have been tested, the net of that presented better resulted with tax of an equal learning 0,55 and equal moment 0,86. The data had been divided in two groups, where to each period of training one third of the data is used for training of net and the remain is applied for verification of the results. The net was trained for attainment of two results' group for comparison of the best-determined scale for the networks. In the first test the total of the judgment of the agents was adopted, however only in as test was gotten better scales, next of represented for method of the multi-criteria analysis. With this, the last stage of the modeling in ANN consisted of testing the data of sequential entrance or random form, this process presented resulted more satisfactory. The reached results had revealed satisfactory, emphasizing the subjective importance of scale's methods to treat questions that involve high degree of subjectivity and complexity. How much to the topologies of used networks, the results gotten of some configurations of the ANN and compared with the multicriteria analysis, were observed that ANN 1, is the one that better if approached to the classification gotten for the multi-criteria analysis. Thus, even other topologies do not Tenaha been the best ones, it had been come however close in some characteristics of the business incubators in Chile, Israel and Italy of the multi-criteria analysis. The results can be observed (multi-criteria analysis and ANN) in Table 1 that follows.

Table 2: Assessment of preferences – effects of the characteristics on the business incubators performance in Chile, Israeli and Italy

	<i>Ranking</i>			
Effects of the characteristics on the business incubators performance				
(Characteristics)	Promethee II	Compromise Programming	Electre III	ANN

• Clients	2 <sup>a</sup>	2 <sup>a</sup>	3 <sup>a</sup>	2 <sup>a</sup>
• <i>Mission of business incubators/Strategy Plan</i>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>o</sup>
• Staff competence and expertise	3 <sup>a</sup>	3 <sup>a</sup>	4 <sup>a</sup>	3 <sup>a</sup>
• Services provided	4 <sup>a</sup>	4 <sup>a</sup>	5 <sup>a</sup>	4 <sup>o</sup>
• <i>Leadership / management</i>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>o</sup>
• Facilities/resources and technologies	2 <sup>a</sup>	2 <sup>a</sup>	3 <sup>a</sup>	2 <sup>o</sup>

The results produced by the methods demonstrate the mission of business incubators and strategies plan and leadership and management as the most significant ones to ensure the performance of the business incubators of the three countries, mainly in the perspective of the graduation of business incubated and success of business incubated. When comparing the results in terms of performance, the ANN and Compromise Programming and Promethee II methods did not differ in their classifications. For Electre III, the results were incompatible. And this is because the p, q and v veto thresholds, respectively, of indifference, strong preference and veto or incomparability have a discrepancy in the structure of their results (classification). Electre III presents a set of solutions with a more flexible hierarchical structure. This is due to the conception of the method, as well as the quite explicit consideration of the indifference and incomparability aspect between the alternatives. The results referenced by the ANN and Promethee II and Compromise Programming methods reflect the preference, according to the experts. In fact, the business incubator's mission were to improve economic conditions by assisting SMEs develop viable business practices through consulting, education, training and others. In general, the mission of business incubators are based on business plan. Some professional business services provided in business incubators include business plans, development support (Pen˜ a, 2004), counseling, coaching and mentoring (Chan and Lau, 2005; EC, 2002), and training (Aerts et al., 2007; Barrow, 2001).

There is a broad spectrum of objectives that are stressed in the mission statement of business incubators in Chile, Israel and Italy, allowing multiple answers: contributing to the competitiveness of the local economy and stimulating the entrepreneurial spirit. Entrepreneur is "someone who exercises business judgment in the face of uncertainty"(Cantillon, 1755) or a leader and a contributor to the process of creative destruction (Schumpeter, 1942). Knight (1921) saw the entrepreneur as an individual with an unusually low level of uncertainty aversion (Bull and Willard, 1993). Glade (1967) argues that the higher incidence of entrepreneurial activities among certain cultural minorities within a wider population may be partially explained by ethnic loyalty and support mechanisms. In this perspective of leadership or team management of business incubators, Kirzner (1973, 1979) stresses the importance of the entrepreneur, as his key strength lies in recognising or knowing things that others do not. Entrepreneurs do not have to possess specific knowledge themselves; they may be able to recognise how other people's knowledge, experience, and expertise can be harnessed and employed in a new configuration for profit. In this view, the team's capabilities are most important to a new enterprise's success rate (Aerts, Matthyssens, and Vandenbempt, 2007). The collection of companies in incubators does provide unstructured collaboration of people that are in similar situations. It is this collaboration that helps form a perspective of encouragement, networking, and information collection and sharing. This incubator environment encourages these activities by creating potential for success. In this context, the incubator

manager, directors, advisors, and consultants can create a perception in the business community. The next step will be a compared Summary of the importance of the effects of the characteristics on the business incubators performance.

#### **4. CONCLUSIONS AND IMPLICATIONS**

The aim of this study is to evaluate the relation between the characteristics and business incubator performance; i.e., how business incubator characteristics affects results? This research examines the relation between the characteristics and business incubators performance in three countries: Chile, Israeli and Italy. In this study, we attempted to take a first step in closing this gap in literature on business incubator. Assessing incubator performance results we can conclude that incubators performance are dependents of optimal combination characteristics of business incubators. How should we proceed to determine whether performance of business incubators is appropriate? Performance should be compared to incubators objectives. By identifying characteristics and their priorities on the business performance, we enable incubators to strategically manage the priority effectively and to improve the business performance. By using these priorities, managers can decide which enabling characteristics they will focus on first, next, and then last. The hierarchical structure model proposed consists to prioritize the characteristics in relation to performance dimensions. The multi-criteria analysis results reflect the relative importance of enabling characteristics with respect to the goal. In promoting the success of business incubators, the mission and leadership have the highest priority. Therefore, human resources, especially in recruiting and developing managers, should be emphasized first and most in business incubators Chile, Israel and Italy. Knowledge of the prioritization of characteristics will lead to better strategic management of business incubators. The research findings will help other initiatives and government policy makers to acquire a full knowledge of the scope and goals to be achieved. In conclusion, incubators contribute to the international economy and play a vital role not only in economic recovery but also in smart growth and economic development. International adaptation leads to the support of diverse economies, jobs creation, wealth building, the support of an entrepreneurial climate, fostering the innovation to commercialize new technologies and jobs creation. This research presents theoretical and practices implications. First, the research shows the effects of characteristics on the performance of business incubators. The obtained findings could be of potential value to future researchers in business incubation. Second, this research contains an approach to prioritize the characteristics using a hierarchical structure. Moreover, the research also contributes main managerial implications. First, it helps incubator managers' and policy makers' resource allocation decisions. An effective management can ensure that they have resources and capabilities required to serve its start-up firms. Second, the obtained priorities help practitioners understand the relative importance of the characteristics on the business incubators performance. This is helpful to establish their strategic plans. In summary, this study will be of interest to business incubation providers and entrepreneurial researchers. This study indicates a wide diversity of significant positive effects as a result of involvement with a business incubation practice in different countries. Public policy and research cannot ignore the effects produced by the business incubator characteristics. In order to refine incubator policy a mix of incubator types should be considered thoroughly.

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