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# Challenges and opportunities of innovation and incubators as a tool for knowledge-based economy

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## Abstract

**Objectives:** The purpose of this research is to analyze and identify the challenges and opportunities of innovation and incubators programs and their potential use worldwide.

**Prior work:** Discussed innovation and incubators as a powerful tool for knowledge-based economy from different perspectives using different criteria to measure the key performance indicators of best practices for innovation in the United States (US), United Kingdom (UK), and Gulf Cooperation Council States (GCC). The results are part of the ongoing research project funded by a grant from the Kuwait Foundation for Advancement of Sciences (KFAS-2012-1103-01).

**Approach:** The methodology is based on quantitative approach (survey questionnaire) and literature review.

**Results:** This paper provides several recommendations for the international implementation of innovation and incubators outcomes.

**Implications:** This paper provides value-added knowledge for both academics and practitioners who are interested in the successful adaptation of innovation and incubators.

**Value:** The authors believe that this paper demonstrates an added value to the current literature on innovation and incubators and fills the gap in the case studies in the literature of developed and developing countries and presents a more comprehensive analysis of progress and challenges to knowledge-based economies.

**Keywords:** Innovation, Incubators, Technology transfer, Developed countries, Knowledge-based economy, Quantitative

## Background

Most popular international organizations include United States (US) National Business Incubator Association (NBIA, 2007), United Kingdom UK Business Incubation (UKBI, 2007), InfoDev—an arm of the World Bank Group (InfoDev, 2009), Organisation for Economic Cooperation and Development (OECD, 1997), The European Business and Innovation Network, and European Commission (EC 2002) focused on the execution of incubation and innovation programs to strengthen the successful growth of economic and social development.

Several research studies on incubators have been defined. The Business and Innovation Center is a physical place aimed at economic development through supporting start-up companies and their business development as well as existing small and medium companies (InfoDev, 2009). There are other definitions for business incubation as effective talent links, technology transfer organizations, capital movement systems, and technical know-how groups for leveraging entrepreneurial talent and accelerating the development of new companies (Kuratko & LaFollette 1987). Hackett and Dilts (2004a, 2004b) define business incubation as shared services such as office-space facility that seeks to provide its incubatees with a strategic, value-adding intervention system of monitoring and business assistance.

Further, the authors defined several key words such as: innovation is the process of making change, difference, and novelty in the products, services, add value, and business practices to create economic and social benefit (EC, 2010). The OECD (2010) defines innovation as the implementation of a new or significantly improved product, service, process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations. Technology transfer can be defined as the development of technologies through research programs of universities including research tools and formal licensing of inventions and software (Hardy, 2010). A developed country can be defined as a highly developed economy, high industrial base with advanced technological infrastructure, and a high Human Development Index (O'Sullivan et al., 2003).

The knowledge based on an economy defined by Campbell and Carayannis (2014) is a process of economic learning to catalyze and accelerate the sustainability of economic growth.

The objective of this research is to analyze and identify the challenges and opportunities of innovation and incubator programs and their potential use worldwide. The remainder of the paper is as follows: "Literature review" provides a thorough review of the literature; in "Research methodology," the authors briefly discuss the research methodology used to facilitate the objectives; "Results" shows the findings of an international survey conducted by the authors; and "Conclusion" is the conclusion of the study.

### **Literature review**

Many scholars discussed the importance of the incubator process (Al-Mubarak, 2008; Bearse 1998a; Culp, 1996; Kuratko & LaFollette 1987; Lumpkin & Ireland, 1988; Merrifield, 1987). Also, Wagner (2006) confirmed the positive impact of business incubators on job creation. In addition, McAdam and McAdam (2008) indicated the most important element of incubators in the early stages is tangible incubator services and networking. Another study (Mian, 1996b) demonstrates the added value of incubator services including tangible services such as shared offices, assistance grants, marketing, accounting, university labs, and infrastructure.

Further, Smilor (1987), Campbell et al. (1985), and Merrifield (1987) indicated that several success factors from different perspectives such as: Community: entrepreneurial community support, networking, education, and linkage with university; Incubator: success indicators, finance, follow-up for incubatees, managerial support, clear policies of

entry/exit; Incubatee: business awareness and success rate. Moreover, according to Cooper and Park (2008), incubators can be provided innovation through: (1) shaping entrepreneurs' market experience; (2) generating social capital; (3) providing information on the existence; and (4) availability of technological solutions.

Al-Mubarak et al. (2014) identified the strength of incubators in developed and developing countries: (1) incubator dependence on the government as main sponsors to meet self-sustainability goals; (2) most incubators supporting the entrepreneur successfully through providing a wide range of services, focusing on intangible and intangible services; (3) developed countries indicated a high influence level of cultural indicators such as innovation, creativity, entrepreneurship digital growth, skills, and world-class education. However, in developing countries most cultural indicators were modest to low level. (4) In developing countries, the policy implication act strongly forms different perspectives such as government and university role in incubator management and funding; however, developing countries indicated a medium level of policy implication.

Al-Mubarak et al. (2015a) concluded their study that successful implementation of the incubators and innovation programs can be expected to result in: (1) enhanced economic development through job creation; (2) a stronger entrepreneurship climate; (3) technology commercialization and transfer for graduated companies; (4) sustainability of graduated companies in the market with high rate of survival; (5) innovation acceleration with smart product and services; and (6) diversification of the economy from companies' outcomes such as innovation and technology.

Al-Mubarak and Schrödl (2011) indicated a model for measuring the effectiveness of business incubation. This developed model supports the work of incubator managers, policy makers, researchers, practitioners, stakeholders, and government parties for the effective execution of business incubation enterprises. This model included four dimensions: (1) the number of businesses graduated over a period of time; (2) the number of businesses still in business over a period of time; (3) jobs created by incubator clients; and (4) salaries paid by incubator clients. In another study, Al-Mubarak et al. (2012) concluded that the financial indicators are highest priority in ranking the incubators worldwide which reflect positive impact on the economic development in job creation.

Al-Mubarak and Busler (2013) indicated that successful adaptation of innovation programs leads to: (1) a high rate of networking and outcomes; (2) high potential financing and strategic planning; (3) fostering entrepreneurship and innovation, research commercialization, and supporting technological entrepreneurship; (4) high number of jobs created; and (5) successful start-up companies with high survival rates. Al-Mubarak and Busler (2010a, 2010b, 2010c) presented incubator guidelines such as incubators acting as sustainable dynamic models, fostering, supporting enterprise and innovation, and generating jobs. Al-Mubarak, Muhammad, and Busler (2015b) recommended that innovation programs strengthen tools for the modern economy based on the knowledge towards smart growth. Al-Mubarak and Busler (2014) concluded a study that incubators can be contributed to the international economy and could be played a vital role but also in smart and economic growth.

Some researchers have argued that incubator objectives can be summarized as follows: (1) economic growth; (2) commercialize technology and transfer; (3) fostering entrepreneurship climate; and (4) job creation (Abetti, 2004; Adegbite, 2001; Akçomak & Taymaz, 2007; Allen and McCluskey, 1990; Allen & Rahman, 1985; Al-Mubarak,

**Table 1** Incubators: evidence from the literature

| Year      | Citations, year of publication  | Findings   |
|-----------|---|--|
| 1988–2000 | <ul style="list-style-type: none"> <li>• Hisrich, 1988</li> <li>• Campbell et al., 1985</li> <li>• Smilor, 1987</li> <li>• Autio &amp; Klofsten, 1998</li> <li>• Smilor, 1987</li> <li>• Smilor, 1987</li> <li>• Campbell et al., 1985</li> <li>• Merrifield, 1987</li> <li>• Culp, 1996</li> <li>• Lumpkin &amp; Ireland, 1988</li> <li>• Merrifield, 1987</li> <li>• Kuratko &amp; LaFollette, 1987</li> <li>• Barse 1998a</li> <li>• Allen &amp; Rahman, 1985</li> <li>• Campbell, 1989</li> <li>• Temali &amp; Campbell, 1984</li> <li>• Plosila &amp; Allen, 1985</li> <li>• Brooks, 1986</li> <li>• Temali &amp; Campbell, 1984</li> <li>• Allen &amp; Rahman, 1985</li> <li>• Mian, 1994b</li> <li>• Allen &amp; Rahman, 1985</li> <li>• Fry, 1987</li> <li>• Allen &amp; McCluskey, 1990</li> </ul> | <p>Incubators in each community should be designed in consideration of the community's cultural values and in dialogue with community leaders to provide value.</p> <p>The value of the incubator to the incubatee relies on a needs analysis of incubatees, incubatee selecting and monitoring, access to capital, availability of network expert/support help, and more immediate learning for solutions to problems.</p> <p>The value of the incubatee to the community and incubator includes technology diversification, economic development, job creation, viable firms, and profits from successful products.</p> <p>There are several success factors from different perspectives, such as from the community standpoint: entrepreneurial community support, networking, education and linkage with universities; the incubator perspective: success indicators, finance, follow-up for incubatees, managerial support, clear policies of entry/exit; and for the incubatee: business awareness and success rate.</p> <p>These authors highlight the importance of appropriate incubatee selection, which is viewed as a process.</p> <p>The value at the community level lies in a protected environment where new ventures are able to develop, provided by incubators, and this leads to economic growth and investment in local communities. BIs will be part of a larger economic development plan, and although incubator net job creation is low, it is still significant.</p> <p>The focus of incubators could be a classification based on the nature of their primary sponsors or the focus of the incubatees. The key characteristics of incubators are low-priced rents, shared services, and the existence of entry/exit policies and university networking and support.</p> <p>The benefits from the incubatee from the incubator's perspective include the importance of incubatees paying rent at below-market prices for office space, incubatees supporting each other, including purchasing, as each of the incubatees must have all aspects of business consulting services available to them. Incubatees in university technology businesses incubators are influenced positively by that environment.</p> <p>Although 87% of entrepreneurs would have embarked on their enterprise, they agree on the usefulness of physical services, advertising and marketing, and risk management, insurance, and government grants that are available in an incubator.</p> <p>There are several services offered by incubator management such as planning, for example, business planning, mission statements, strategic plans and budgets, and only half of the incubator managers participate in the planning process.</p> <p>The occupancy rates show that 50% of incubators do not present as real estate ventures. Incubators with established expertise are the most successful. Incubators whose focus is light manufacturing tend to have more success in job creation. Job creation and firms that have graduated were not significantly impacted by the business support services.</p> |

**Table 1** Incubators: evidence from the literature (*Continued*)

|           |                                  |  |
|-----------|----------------------------------|--|
|           | • Mian, 1996a                    | Tangible services such as shared offices are more successful. Less useful services include assistance grants, marketing, accounting, etc. Due to the availability of student employees, university labs, and infrastructure, a university's image is a significant benefit to incubator firms. Added value contributions are influenced by incubator services. |
|           | • Mian, 1996b                    | Within four years, firms' sales increased approximately tenfold and hiring increased fourfold. The university infrastructure offers many benefits such as employing students part-time and faculty consultations. Growth and survival of tenant firms are positively influenced by the provided university incubator services.                                 |
|           | • Mian, 1997                     | The four incubation programs indicate a high rate of sales and a high rate of employment (150% and 35%, respectively). A university's image enhances incubator firms and press coverage and university campus visits impact public attention. The most beneficial aspect for firms is the availability of student employees.                                   |
|           | • Autio & Kloftsen, 1998         | The analysis of success stories will be helpful in future implementation and practitioners should adopt the policies based on the landscape of the country.  |
| 2001–2012 | • Thierstein & Wilhelm, 2001     | The main goal of incubators is economic development, for example, in Switzerland, incubators are mostly privately owned.   |
|           | • Adegbite, 2001                 | The primary goals were not met in business or technology incubators. Insufficient support services and lack of objectivity in admission contributed to weaknesses in incubators operating under the Ministry and poor funding added to their organizational hardship.  |
|           | • Shefer & Frenkel, 2002         | In the last three years, 86.4% of the projects graduated from the program and the success rate shows that 78% obtained financial support after graduation. Managing the selection and overseeing of projects and the skills of the incubator are critical for success.   |
|           | • Colombo & Delmastro, 2002      | The incubator case studies in Italy represent highly skilled entrepreneurs. The case study shows no significant differences between on- and off-incubator firms regarding their innovative output. The outcomes were job creation, education, support of EU-sponsored projects, and networking.  |
|           | • Hsu, Shyu, Yu, You, & Lo, 2003 | In comparison, tenants in ITRI incubators are more satisfied than firms in other offices. The development of incubators is reflected in industrial development leading to economic development.  |
|           | • Abetti, 2004                   | The study obtained survival rates of around 95% in Finland. The study shows the cost per job is €6450, with average sales growth rising by 160% per year during and after incubation. The government contribution will be less for funding incubators.   |
|           | • Chan & Lau, 2005               | What are essential for entrepreneurs are rental subsidies for office space in addition to training programs. However, clustering does not benefit firms.   |
| 2001–2012 | • Pena, 2004                     | The significant impact of incubators will be reflected in high sales and employment growth. Most services offered by incubators have no impact on the performance indicators.  |
|           | • Lee & Osteryoung, 2004         | The comparative study between US and Korean respondents shows the role of incubator strategies such as goals, management, entry/exit policies, and business plans. The US respondents give more importance to these factors. The critical two factors are financial support and business networking.   |

**Table 1** Incubators: evidence from the literature (*Continued*)

|   |  |
|---|--|
| • Peters, Rice & Sundararajan, 2004             | The rates for the graduation of companies are higher in incubators that offer coaching such as training, and in those that provide access to networking, e.g., consultants, scientists, customers, and other business firms. The number of graduation companies in the non-profit incubator type will be higher than in for-profit incubators. |
| • Rothschild & Darr, 2005                       | Entrepreneurs' benefits from the incubators include reputation, credibility to the firm, and access to funding and business networking.  |
| • Etzkowitz, Carvalho de Mello, & Almedia, 2005 | The incubators in Brazil create a low establishment-development cost and utilize the advantages of academic resources.   |
| • Totterman & Sten, 2005                        | The incubator offered services such as support and networking. The incubator management team should focus on strategic business networking rather than on providing tangible services.   |
| • Rothaermel & Thursby, 2005a                   | The failure rate will be decreased when linked to a university providing services such as licensed technology, faculty as senior management and informal links. The impact will affect the inventor positively.  |
| • Rothaermel & Thursby, 2005b                   | This study focused on two mechanisms: transfer by a license to a university and backward citations of incubator firm patents to university patents or publications. The firm survival rate will be higher when holding a license. The firm absorptive capacity is measured by backward citations rather than firm performance.                 |
| • Wynarczyk & Raine, 2005                       | The incubators play an active role in nurturing businesses and creating jobs. The managerial advisors' support will provide strong options for survival during the early stages of the start-up companies.   |
| • Von Zedtwitz & Grimaldi, 2006                 | The relationship between the incubator objectives and incubator services should be clear to obtain the desired outcomes. The experience of the incubator manager is an essential support for the incubatee.  |
| • Kim & Ames, 2006                              | The qualifications of incubator managers should match with the requirements of the client companies such as support services and networking. Increments in incubator growth could negatively affect the success of incubators.   |
| • Studdard, 2006                                | The incubator manager requires knowledge to interact with new product development, technological competence, and sales cost awareness. The firm's reputation requires increased credibility and marketing avenues.   |
| • Gassmann & Becker, 2006                       | In the incubator's initial phase, information flow is essential for both the incubator and the ventures. In the second phase, from the intangible services, knowledge comes from the for-profit incubators and the firms.  |
| • Chandra and Fealey 2009                       | The government funds most large incubators and high-tech-oriented incubators are dependent on government funding, which weakens their capability toward market-oriented incubation.  |
| • Avnimelech, Schwartz, & Bar-El, 2007          | Closure rates for firms are less (19% compared with 36%) for firms that received seed funding and were established in an incubator. The failure rate of VC firms is lower than for incubator firms.  |

**Table 1** Incubators: evidence from the literature (*Continued*)

|           |   |   |
|-----------|---|---|
|           | • Aerts, Matthyssens, & Vandenbempt, 2007 | The survival rate of tenants is positively correlated with the availability of a more balanced screening process. The screening process consists of market, financial, and management screening and it contributes positively with respect to failure rate. The critical role of incubators is to support the survival of the entrepreneurial spirit.   |
|           | • Hytti & Maki, 2007                      | Younger firms demonstrate more growth-potential benefit from incubator services. However, older firms demonstrate less satisfaction with services. The tenancy duration for incubation must be optimal and flexible with respect to firm needs.   |
|           | • Hughes et al., 2007                     | The study classified firms into four groups based on their capabilities, determination to access resources, to acquire knowledge, and strategic networking. The most critical aspect is strategic networking.   |
|           | • McAdam & Marlow, 2007                   | Of importance for tenants are the facilities offered by the incubator, its credibility, and networking opportunities. A critical factor is the trust that allows information exchange. In some cases, firms were hesitant in sharing sensitive information, such as secrecy and copying ideas, due to their close proximity to each other.  |
|           | • Akçomak & Taymaz, 2007                  | The main differences between on- and off-incubator firms are the sales and employment, but not innovation. The tangible services offered by incubators and funding can explain the differences.   |
|           | • McAdam & McAdam, 2008                   | The most important element of incubators in the early stages is tangible incubator services. Networking and clustering are the most important factors behind firm success.  |
|           | • Schwartz & Hornych, 2008                | The survival of media firms depends on the availability of specialized equipment and facilities including knowledge and know-how. The competition between companies in the same sectors leads to limitations in networking.   |
| 2001–2012 | • Frenkel et al., 2008                    | In the USA, private and public technology incubator firms promoted technological entrepreneurship among the immigrants in the USA and those from the former USSR. In private incubators, firms tend to benefit more from networking with international strategic partners and academia. However, the private incubator firms cannot fully replace public incubators.  |
|           | • Duff, 2004                              | This study looks in depth at eight case studies of leading BI programs to provide a detailed appreciation of program design and incubator operations. Four of these programs are Australian and four are drawn from the United States.<br><br>The study finds that incubation programs that add value most effectively are those that adopt a pro-active business-development stance based on a sound appreciation of the business needs of their clients' characteristics in these pro-active, direct intervention systems.  |
|           | • Chandra & Fealey, 2009                  | This study describes the incubation landscapes of the United States, China, and Brazil, noting the similarities and differences in incubation approaches among the three countries. The key performance indicators for the comparison are based on the incubator's sponsorship/ financial model and its impact on strategy, its service mix with an emphasis on financial services, along with key environmental/contextual influences. The role of governments and their impact on incubator strategy in the three country contexts is discussed along with policy implications. |



**Table 1** Incubators: evidence from the literature (*Continued*)

|   |  |
|---|--|
| • Akçomak, 2009                         | Drawing lessons from country experiences, the appropriateness of incubators as a tool for entrepreneurship promotion in developing countries is assessed. The main weaknesses of incubators in developing countries are: (1) their focus on tangible services rather than intangible services; (2) their dependence on governments; (3) a lack of management and qualified personnel; and (4) a lack of incubator planning and creativity in solving problems.   |
| • Atherton & Hannon, 2006               | Seven generic incubation strategies were identified and developed. Four focus on a premises-driven approach to incubation and three on a more process-based approach. All seven strategies represent opportunities for tailored, and hence, targeted approaches to the development of incubators and incubation services.  |
| • Schwartz and Hornych 2008             | This study examines the survival of 352 firms from five German BIs after their graduation. The findings suggest that graduation causes an immediate negative effect on survivability that lasts up to three years after leaving the incubators. Furthermore, heterogeneous patterns of post-graduation exit dynamics between the BIs were observed. It was also found that performance during the incubation period is an indicator of the propensity for business closure after graduation.   |
| • Voisey, Gomall, Jones, & Thomas, 2006 | The study finds that if incubation facilities are to receive continuing support, the measurement of success needs to be broader than a set of statistical outputs. Applications for public funding in support of BIs as part of an overall economic regeneration strategy should be able to provide a wider evaluation of effectiveness and the paper seeks to develop a model for this purpose to assist the ongoing development of incubator facilities in Wales.  |
| • Al-Mubarak & Busler, 2010a            | The study indicated BIs can help young firms to survive and grow during their start-up years, and can play a key role in the economic development of a community or region. In developing countries, including Kuwait and the other GCC member states, BIs can be particularly valuable in helping to develop local economies, promote technology transfer, create new enterprises, and generate jobs. In addition, the survey results are used to make recommendations for how to maximize the success of incubators, including matching services offered to the needs of clients and involving a range of community stakeholders in the development of their programs. A number of options are proposed for developing and expanding the BI concept in Kuwait and the GCC member states.   |
| • Al-Mubarak & Busler, 2010b            | Three practical business incubation European models are discussed based on their adoption as case study examples: the UK, France, and Germany. These three countries contain approximately 83% of all the incubators located throughout Europe today. This study focused on: (1) the nature of incubator financing; (2) the incubator's mission and strategy; and (3) graduation that it, in turn, offers its incubatee clients. The SWOT analysis of each case study reflects the strengths of each program and complies with its mission and objectives, showing great opportunity with the future plans and performance of each program. BIs contribute to the international economy and play a vital role not only in economic recovery, but also in economic development. International adaptation leads to the support of diverse economies, the commercialization of new technologies, job creation, and wealth building. In addition, more than 7000 incubation programs worldwide are engaged in supporting the development of new high-growth businesses. Today, Europe has funding in incubators with the goal of job creation and economic recovery. |



**Table 1** Incubators: evidence from the literature (*Continued*)

|                                |  |
|--------------------------------|--|
| • Al-Mubarak & Busler, 2011b   | The case study of ten incubator organizations in developing countries is examined. The findings of this study indicate BIs are an effective and innovative tool for supporting start-up businesses. The empirical results highlight some implications for successfully developing and implementing the best practices of business incubation programs. This study makes a contribution to knowledge about the process of business incubation.  |
| • Al-Mubarak & Busler, 2011c   | This paper is based on a mixed-methods approach. This study has clearly stated that business incubation is tool for economic development based on economic indicators from incubation outcomes such as: (1) entrepreneurs; (2) companies created; (3) jobs created; and (4) incubator companies. This is evident in both the United States and the developed countries, but is still taking shape in the developing countries such as the GCC member states.   |
| • Al-Mubarak & Busler, 2012b   | The results show quantitative and qualitative responses used to determine success rates and key indicators of incubators in various countries. The best practice model based on the lessons learned from case studies indicates that the success of incubatees in terms of sustainable graduation is reliant upon: (1) clear objectives; (2) incubator location; (3) access to services; (4) employment creation; and (5) an economic development strategy. When accomplished, the best practice model can lead to a 90% survival rate for companies and reflects sustainability in the market.  |
| • Al-Mubarak, & Busler, 2012c  | The four strategic outcomes of the research findings are: (1) entrepreneurial climate (62%) was the primary purpose of the incubator, (2) commercialization technologies stood at 55.5%; (3) employment at 51.6%; and (4) innovation and diversifying local economies at 46.1%. The research adds value to the current literature on the sustainability of incubators and on outcomes. It provides a useful roadmap to both academicians and practitioners through experiences of worldwide incubator implementations.   |
| • Al-Mubarak, & Schrödl, 2012a | The study proposed measurement models in the international context. The four measured indicators are: 1) the graduation of businesses that were incubated; (2) the success of businesses that were incubated; (3) jobs created by incubation; and (4) salaries paid by incubator clients. The recommendations from the study could help to develop business incubation guidelines for best practices in the GCC, which will lead to economic development worldwide and in the GCC.   |
| • Al-Mubarak & Schrödl, 2012b  | The four dimensions discussed in the study determined the effectiveness of BIs individually and as an industry. The study recommended that: <ol style="list-style-type: none"> <li>1. Further research in this area should focus on the four dimensions discussed in this paper: (1) the number of businesses that have graduated over a period of time; (2) the number of businesses still in business over a period of time; (3) jobs created by incubator clients; and (4) salaries paid by incubator clients.</li> <li>2. As the industry grows, new and existing incubators around the world should continue to track these measures of effectiveness in order to empirically demonstrate the value of business incubation.</li> <li>3. Independent researchers, incubator funders, and governments should cooperate with practitioners in obtaining data related to these four measures of success.</li> </ol> |

**Table 1** Incubators: evidence from the literature (*Continued*)

|                              |   |
|------------------------------|---|
| • Al-Mubarak & Busler, 2012d | The authors investigate the incubation models in Europe and the Middle East. The study finding concludes that incubators play an important role in nurturing businesses, creating jobs, and producing high graduation rates of incubatee firms, especially from programs that offered strong tangible and intangible services. Within this landscape, incubator firms are able to achieve their primary goal of economic development, technology transfer, fostering entrepreneurship, and job creation.  |
| • Al-Mubarak & Busler, 2012e | This study has clearly stated that innovation programs are designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services. The adaptation leads to: (1) the age of the innovation program producing a high rate of networking and outcomes; (2) the government as a stakeholder giving high potential financing, strategic planning, and international marketing services; (3) a clear program goal fostering entrepreneurship and innovation, research commercialization, and support for technological entrepreneurship; (4) a high number of jobs being created, which leads to economic growth; and (5) advisory and mentoring services producing successful start-up companies with high survival rates. |

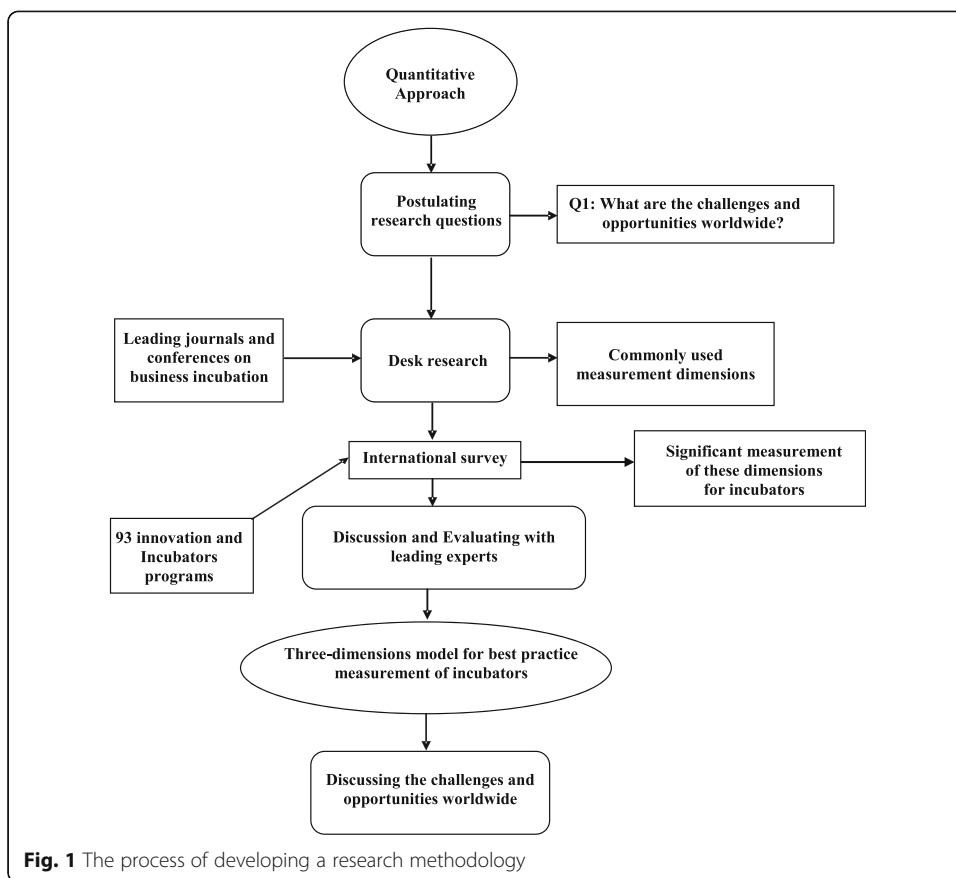
2008; Al-Mubarak and Busler, 2010a, 2010b, 2010c, 2011a, 2011b, 2011c, 2011d; Frenkel, Shefer, & Miller, 2008; Hannon, 2005; Hansen, Chesbrough, Norhoa, & Sull, 2000; Hughes et al. 2007; Lalkaka, 2002; McAdam & McAdam, 2008; McAdam, Galbraith, McAdam, & Humphreys, 2006; Mian, 1994a, 1994b, 1996a, 1996b, 1997; Phillips, 2002; Rothaermel & Thursby, 2005a, 2005b; Smilor & Gill, 1986; Sweeney, 1987; Thierstein & Wilhelm, 2001).

Many international organizations serving business incubators in the United States, such as the National Business Incubation Association (NBIA, 2012), demonstrated the highest percentage of incubator characteristics such as: (1) incubator type indicated (54%) as mixed-use type; (2) incubator goal includes job creation and fostering entrepreneurial climate; and (3) incubator services such as (i) help with business basics, (ii) high-speed Internet access, (iii) marketing assistance, and (iv) networking activities. Hughes et al. (2007) demonstrate that the successful firms' based on the strategic networking do not depend on the incubator tenancy period.

Lastly, Al-Mubarak, Ahmed, and Al-Ajmei (2014) summarized the key findings of incubators in developed and developing countries. See Table 1.

### Research methodology

The research methodology that has been used in this research study is a quantitative approach, such as international survey. The survey questionnaire is an appropriate tool for collecting quantitative data (Bryman, 2007). The authors in-depth experiences will be added value when selecting appropriate methods for data collection, data gathering, and data analysis. Furthermore, there are several reasons to use the quantitative approach, such as survey method: (1) when the information sought is reasonably specific and familiar to the respondents; and (2) when the researcher has knowledge of particular problems and the range of responses likely to emerge (Bryman, 2007). In addition,



the survey consists of ten questions; each question was developed through refining the relevant questions to reach the study objectives. Furthermore, on SurveyMonkey, an online survey website, Internet-based surveys of business incubators and innovation programs were conducted with members of the National Business Incubation Association (NBIA), United Kingdom Business Incubation (UKBI), and United Kingdom Science Park Association (UKSPA). Moreover, the survey questionnaire will provide quantifiable information about three dimensions of incubators including incubators characteristics, incubators outcomes, and financial aspects. Figure 1 presents the research design.

There was a convenient sample of survey invitations: 200 selected programs as successful programs worldwide were emailed to NBIA, UKBI, and UKSPA members through the SurveyMonkey website; 107 were returned as undeliverable, leaving a sample frame of 93. The total number of survey responses was 93, representing a response rate (RR) of approximately 47%. The Statistical Package for the Social Sciences (SPSS) was used for statistical analysis and each question was used descriptive analysis.

**Table 2** Highest response

| No. | Survey questions      | Highest response (%)                          |
|-----|-----------------------|---|
| 1   | Services of incubator | Strong tangible and specialized services 67.0 |
| 2   | Goals of incubator    | Entrepreneurial climate 73.0                  |
| 3   | Type of incubator     | Technology incubators 60.7                    |

**Table 3** Lowest response

| No. | Survey questions      | Lowest response (%)        |      |
|-----|-----------------------|----------------------------|------|
| 1   | Services of incubator | Intangible                 | 5.7  |
| 2   | Goals of incubator    | Diversifying local economy | 40.4 |
| 3   | Type of incubator     | Manufacturing incubators   | 6.7  |

**Results and discussion**

**Survey results**

**First dimension: incubator characteristics**

Table 2 shows the highest percentage of incubator characteristic includes: (1) incubator services; (2) goals; and (3) type. The overview of the responses of 93 innovation centers and incubators in the survey sample. In addition, more than half (67.0%) presented incubator goals of fostering an entrepreneurial climate. Furthermore, the highest services offered by incubators focused on strong tangible and specialized services (67.0%). Finally, the majority (60.7%) of incubators type focused on technology incubators.

Table 3 shows the lowest percentage of incubator characteristics includes: (1) incubator services; (2) goals, and (3) type. First, less than half (40.4%) presented an incubator goal of diversification of local economy. Second, the lowest services offered by incubators focused on intangible services (5.7%). Third, the manufacturing incubators type was the lowest (6.7%).

**Second dimension: incubators outcomes**

Table 4 demonstrates highest incubators outcomes include: (1) number of jobs created; (2) number of graduate companies; (3) number of tenants; and (4) survival rate. First, most incubators created more than 50 jobs per incubator program (63.2%). Second, less than half (36.0%) had graduated in the range of 6–25 companies. Third, the highest of the programs reported that the number of tenants inside the incubation program was in the range of 6–25 (48.3%). Fourth, less than half (47.7%) indicated that the survival rate for the companies was in the range of 81–90%.

Table 5 shows lowest incubator outcomes include: (1) number of jobs created; (2) number of graduate companies; (3) number of tenants; and (4) survival rate. First, the lowest incubation programs created less than five jobs per year (9%). Second, less than half (30.2%) had graduated in the range of 1–5 companies per year. Third, lowest of the programs reported that the number of tenants inside the incubation program was in the range of 1–5 (16.1%). Fourth, the survival rate for the companies indicated less than 80% per year (26.1%).

**Third dimension: financial**

Table 6 shows the overview of highest incubators financial data includes: (1) annual turnover growth; (2) incubator income; and (3) growth of revenue. First, the majority

**Table 4** Highest response

| No. | Survey questions                      | Highest response (%) |      |
|-----|---------------------------------------|----------------------|------|
| 1   | Jobs created from the incubator (n)   | >50                  | 63.2 |
| 2   | Graduate companies from incubator (n) | 6–25                 | 36.0 |
| 3   | Tenants inside the incubator (n)      | 6–25                 | 48.3 |
| 4   | Survival rate of tenants (%)          | 81–90                | 47.7 |

**Table 5** Lowest response

| No. | Survey questions                      | Lowest response (%) |      |
|-----|---------------------------------------|---------------------|------|
| 1   | Jobs created from the incubator (n)   | 1–5                 | 9    |
| 2   | Graduate companies from incubator (n) | 1–5                 | 30.2 |
| 3   | Tenants inside the incubator          | 1–5                 | 16.1 |
| 4   | Survival rate of tenants (%)          | <80                 | 26.1 |

(54.4%) of annual turnover growth for most programs indicated less than \$999,000. Second, more than half (50.6%) of revenue presented less than \$999,000. Third most of the program income was indicated as low income (44.2%).

Table 7 shows the overview of lowest incubators financial data includes: (1) annual turnover growth; (2) incubator income; and (3) growth of revenue. First, the lowest (9.1%) of annual turnover growth for most programs responded in the range of \$5–10 million. Second, less than one-quarter (20.9%) of revenue presented as high. Third, lowest response of the program was indicated as high income (5.9%).

Table 8 shows the ranking dimensions of incubators include three dimensions, with incubator goals such as entrepreneurial climate indicating the highest ranking followed by second rank of incubator services including strong tangible and specialized services. This was followed by the third rank as number of jobs created was over 50 jobs per year. In addition, the fourth rank was technology incubator types and the fifth rank was annual turnover growth less than \$1 million dollars. The sixth rank was growth of revenue less than \$1 million dollars and the seventh rank indicated the number of tenants inside the incubator as less than 25 companies per year. Furthermore, the eighth rank was survival rate < 90%, the ninth rank was incubator income, and the last rank was number of graduate companies from incubators at less than 25 companies per year.

The evidence from another study (NBIA, 2007) indicated that the vital goals of incubation programs are job creation, engaging the entrepreneurial climate, diversifying local economies, and accelerating growth in a local industry. In their study, Thierstein and Wilhelm (2001) stated that the main goal of incubators is economic development. The National Business Incubation Association (NBIA, 2009) demonstrated that the most popular incubator type was technology incubators, targeted by entrepreneurs, which included several tangible services: (1) physical infrastructure; (2) management support; (3) technical support; (4) access to finance; (5) legal services; and (6) networking. The most important element of incubators in the early stages is tangible incubator services, such as networking and clustering, which are the most important factors behind firm success (McAdam & McAdam, 2008).

Furthermore, the study by Abetti (2004) indicated that survival rates of around 95% inside the incubators reflect the importance of firms in joining the program of incubations. The study shows that the cost per job is €6450, with average sales growth rising by 160% per year during and after incubation. Another study by Wyncarczyk and Raine

**Table 6** Highest response

| No. | Survey questions       | Highest response (%) |      |
|-----|------------------------|----------------------|------|
| 1   | Incubator income       | Low                  | 44.2 |
| 2   | Annual turnover growth | \$100,000–999,000    | 54.4 |
| 3   | Growth of revenue      | \$100,000–999,000    | 50.6 |

**Table 7** Lowest response

| No. | Survey questions       | Lowest response (%) |      |
|-----|------------------------|---------------------|------|
| 1   | Incubator income       | High                | 5.9  |
| 2   | Annual turnover growth | \$5–10 M            | 9.1  |
| 3   | Growth of revenue      | \$5–10 M            | 20.9 |

(2005) indicated that incubators play an active role in nurturing businesses, creating jobs, and increasing survival rates during the early stages of the start-up companies. Another study by Peters et al. (2004) showed that the rates of the graduation of companies are higher in incubators through offering coaching, and that the number of graduation companies in the non-profit incubator type will be higher than in for-profit incubators.

**Conclusion**

Incubators and innovation programs have become an important topic worldwide and have contributed positively to economic growth. This paper is based on quantitative methods such as international survey, which provided a deeper insight and understanding into the phenomenon under investigation. The selection of programs was made from successful incubators and innovation centers worldwide.

In addition, the descriptive analysis of the survey results in a convenient sample of 93 incubators and innovation programs worldwide with a response rate of about 47%, which leads to the adaptation of incubators and innovation programs worldwide.

The study indicated two challenges: (1) incubator models indicated as high technology incubator types contributed positively to the extension of technology sectors in each country with new product and new services; and (2) fostering and supporting enterprise and innovation to create the best environment for growth of businesses to start-up and accelerate smart growth.

However, the two opportunities could indicate that: (1) the sustainability of incubation and innovation programs is based on the high survival rate (81–90%) of small- or medium-sized firm per fiscal year; and (2) the sustainability of incubation and

**Table 8** Ranking dimensions

| No.  | Survey questions                      | Highest response (%)                       | Rank |    |
|--|---------------------------------------|--|------|----|
| First dimension: incubator characteristics |                                       |  |      |    |
| 1  | Incubator services                    | Strong, tangible, and specialized services | 67.0 | 2  |
| 2  | Incubator goals                       | Entrepreneurial climate                    | 73.0 | 1  |
| 3  | Incubator type                        | Technology incubators                      | 60.7 | 4  |
| Second dimension: incubator outcomes       |                                       |  |      |    |
| 1  | Jobs created from the incubator (n)   | >50  | 63.2 | 3  |
| 2  | Graduate companies from incubator (n) | 6–25                                       | 36.0 | 10 |
| 3  | Tenants inside the incubator (n)      | 6–25                                       | 48.3 | 7  |
| 4  | Survival rate of tenants (%)          | 81–90                                      | 47.7 | 8  |
| Third dimension: financial                 |                                       |  |      |    |
| 1  | Incubator income                      | Low  | 44.2 | 9  |
| 2  | Annual turnover growth                | \$100,000–999,000                          | 54.4 | 5  |
| 3  | Growth of revenue                     | \$100,000–999,000                          | 50.6 | 6  |

innovation programs is based on the high jobs creation over 50 jobs per year and high number of graduate and client companies of around 25 companies per year.

In conclusion, the successful adaptation of the incubators and innovation programs leads to high outcomes when reaching a higher stage of economic growth based on the development of the number of graduate companies, client companies with high survival rates, and high added value for innovative products and services, as well as fostering an entrepreneurship environment, and commercializing technology transfer. This evidence comes from worldwide successful implementations in developed and developing countries.

## Methods

To determine the challenges and opportunities, an international survey was completed. This is an appropriate tool for collecting quantitative data that can be summarized and analyzed to reach valid conclusions. This method is generally utilized to gather specific information is familiar to the respondents. The questions found the survey on were developed through refining the relevant questions.

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## Author's contributions

This work was carried out in collaboration between both the authors. HM designed the study, managed the literature searches, and collected the survey results. MB wrote the introduction and prepared the first draft of the manuscript. Both authors read and approved the final manuscript.

## Competing interests

The authors declare that they have no competing interests.

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