



## **A Review of Commercialization Tools: University Incubators and Technology Parks**

**Farhan Jamil<sup>1</sup>, Kamariah Ismail<sup>2\*</sup>, Nasir Mahmood<sup>3</sup>**

<sup>1</sup>Faculty of Management, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia, <sup>2</sup>UTM Technology Entrepreneurship Centre, Universiti Teknologi Malaysia, Skudai, Johor, 81310, Malaysia, <sup>3</sup>School of Management, Northwestern Polytechnical University, Xian, P.R. China. \*Email: [m-maria@utm.my](mailto:m-maria@utm.my)

### **ABSTRACT**

In recent years, commercialization has gained significant importance due to its active participation in knowledge transfer, economic growth, job creation and entrepreneurship. Whereas the role of university incubators and technology parks to excel commercialization has also much evidence. This study reviews the roles, practices, functions, factors and dimensions of the commercialization, university incubators and technology parks. During review, it come to surface that property development, networking with local and international markets, research and development, proximity to university, firm's clustering, provision of advanced equipments, managerial support, faculty and students, and institutional reputation are the most important elements of university incubators and technology parks to promote commercialization. However, various challenges such as lack of human expertise and insufficient financial capital are still exists which requires to be further studied to upraise the commercialization efficacy.

**Keywords:** Commercialization, University Incubators, Technology Parks, Knowledge Transfer, Entrepreneurship

**JEL Classifications:** M00

### **1. INTRODUCTION**

Recently, a rapid increase in establishment of incubators, technology parks and other property initiatives have become a source of revenue generation by most of the universities. Link and Siegel (2005) experienced this change in US and Europe. Many countries have supported these institutions as tool to commercialization in various ways; policies, funding and legislation. The motivation to review the university incubators and technology parks is their contribution in knowledge-based economies. Universities have taken several initiatives including excel in R and D investment to promote commercialization (Huggins and Kitagawa, 2012). However, the role of intermediary to facilitate the knowledge transfer is much desired. Recently, Costantini and Liberati (2014) also emphasized the importance of the identification of knowledge transfer approach.

In view of the above, Munkongsujarit (2013) analyzed technology parks and incubators as potential intermediaries between

universities and industries to excel commercialization. Hence, the existence of several stakeholders such as government, university and industry to achieve the strategic goal of developing technology parks and incubators is essential (Sanni et al., 2010). Grimaldi and Grandi (2005); Audretsch (2014) supported the presence of university to promote the commercialization by having some knowledge transfer mechanism. Many of the researches tells the role, functioning, implications and contributions of technology parks and university incubators (Abetti, 2004; Bergek and Norrman, 2008; Chandra et al., 2012; Dahlstrand and Politis, 2013; Link and Scott, 2007; Link and Scott, 2006; Lundqvist, 2014; Phan et al., 2005; Sofouli and Vonortas, 2007; Squicciarini, 2008; Tamásy, 2007; Wonglimpiyarat, 2010).

However, the capabilities of universities are not fully capitalized and show less output in commercializing their products and services (Huggins, 2008a). Mueller (2005) brief the reasons of inefficiency in the commercialization process as; current

knowledge not being fully commercialized, universities and higher education institutions are not commercializing their research and knowledge at the utmost level and existing entrepreneurs also not willing to share new knowledge whereby suggests to involve intermediary channels to foster the knowledge transfer scheme.

## 2. COMMERCIALIZATION

Commercialization is a mechanism to transform the knowledge into products, services and institutes by having competitive advantage to achieve the regional economic growth (Mueller, 2005). Meanwhile, Audretsch et al. (2006) analyzed universities as the backbone of knowledge based economy. According to Bramwell and Wolfe (2008); Breznitz and Feldman (2010), commercialization got more popularity in its participation in economic growth through university platform. University has evolved as an “entrepreneurial university” to support commercialization of research and knowledge for a sustainable and progressive ecosystem (Audretsch, 2014). Whereas He further explained entrepreneurial university as a university focusing on establishment of new enterprises, promote entrepreneurial environment and commercialization to transfer knowledge from academicians to society. Moreover, Siegel et al. (2003) monitored a sharp rise in university commercialization to businesses. Thus, commercialization and knowledge transfer to society becomes the third mission of universities apart from two previous of teaching and research (Baycan and Stough, 2012).

The success of commercialization depends on the involvement of multidimensional parties having different missions and objectives such as government, academicians, business and community (Markman et al., 2008). Hence, the commercialization has various implementations for academicians, industry, government, students and researchers. The major changes in commercialization framework brought by Bayh-Dole Act through legislative reforms (Ibata-Arens, 2008).

Siegel et al. (2003) explain a well integrated and complete process of commercialization. According to Siegel et al. (2003), commercialization depends on research and development to take initiative and followed by disclosure, evaluation feedback, faculty input and patents, if required. After the patenting, marketing channels are located for licensing and spinoffs. Finally, products or services are commercialized that contribute in wealth generation.

Researches have identified various commercialization channels and measurements (Audretsch et al., 2006; Carlsson et al., 2007; Faria and Barbosa, 2014; Grimm and Jaenicke, 2012; Guerrero et al., 2014; Markman et al., 2008; Perkmann et al., 2013; Swamidass, 2013). These can mainly be classified into patents, licensing, research contracts and formation of new businesses.

## 3. UNIVERSITY INCUBATORS

Since the inception of first incubator on earth, Batavia at USA, incubators were not much popular till 1970s. However, a rapid increase in incubators happened after 1980s and cross the figure of

7000 incubators around the world (National Business Incubation Association, 2014a).

Incubators are seen as a mechanism to support and establish new businesses by providing resources and facilities (Chen, 2009; Grimaldi and Grandi, 2005; National Business Incubation Association, 2014b). Meanwhile, incubators deliver assistance to new entrepreneurs in several ways. The main services discussed by several scholars (Al-Mubarak and Busler, 2010; Chandra et al., 2012; Colombo et al., 2012; Özdemir and Şehitoğlu, 2013; Schwartz and Hornyk, 2010; Tang et al., 2013) are provision of shared space, advanced equipments, managerial support, networking and access to national and international markets, patenting and IP protection. An intermediary to rationalize transaction cost, establishing university industry linkages, access to knowledge and financial capital, encouraging entrepreneurship and support in screening and selection program of incubates.

There are mainly two types of incubators (Allen and McCluskey, 1990). One is for profit incubators, mostly operated by private sector. The second one is non-profit incubators; mainly funded by government with support from rental income (Chandra et al., 2012). Non-profit incubators are mostly academic based initiatives (Phillips, 2002).

The universities are at central position in economic growth of a country by playing an active role in research and development, innovation, incubators and technology park, and commercialization (Miner et al., 2001). Henceforth, many economies have established university incubators to promote the ecosystem and new ventures (Studdard, 2006). However, Palumbo and Dominici (2013) define university incubators simply as a university supported incubation system with shared space at campus and facilitate in formation of university spinoffs. University incubators have a successful history in provision of location, human and financial capital, innovation and commercialization (Chandra et al., 2012; Somsuk et al., 2012). Moreover, university incubators are also considered as the most powerful incubators (Salem, 2014). Several dimensions providing the pillars and seems as successful factors of university incubators are identified by researchers (Bøllingtoft and Ulhøi, 2005; Bruneel et al., 2012; Culkin, 2013; Grimaldi and Grandi, 2005; Gstraunthaler, 2010; Lee and Osteryoung, 2004; McAdam and Marlow, 2011; Ratinho and Henriques, 2010; Somsuk et al., 2012; Todorovic and Suntornpithug, 2008) are infrastructure, networking, human and technical support, faculty and institutional reputation.

Researchers have witnessed that commercialization is accelerated and influenced by incubators (Al-Mubarak and Busler, 2010; Chandra et al., 2012; Tamásy, 2007) in the shape of spinoffs (Lee and Osteryoung, 2004; Mian, 1996; Palumbo and Dominici, 2013). OECD (2010) also supported the engagement of university and industry to excel commercialization from the platform of incubators. However, Phillips (2002) thinks it differently as not found a strong interaction between commercialization and incubators. He further suggested to examine the incubator’s efficacy in commercialization.

#### 4. TECHNOLOGY PARK

Technology park is defined as an organization works to promote innovation, university industry linkages, developing knowledge institutes, commercialization of products and services, formation of new ventures and other facilities by having managerial, technical and physical capabilities (International Association of Science Parks, 2014). However, different terms have been used in different regions for technology parks. Research Park is more common in USA, Science Park in Europe and Technology Park in Asia (Link and Scott, 2011). According to Phan et al. (2005), the greatness of technology parks rely on the involvement of multiple stakeholders; academicians, government, industry and community. These multiple members contribute in the success of technology parks. Even so, the role of university is critical in technology parks framework (Malairaja and Zawdie, 2008).

History tells Stanford Technology Park, owned by Stanford University, established in 1950s at California, USA as the pioneer (Phan et al., 2005). The Stanford technology park later on becomes a well-known industry cluster called Silicon Valley. Other early days famous technology parks established in 1960s are Cornell business and technology park (Cornell University) and research triangle park (affiliated with Cambell, Duke and other Carolina Research Institutes) (Link and Scott, 2003). However, Silicon Valley acknowledged as role model for all other technology parks whether developed or in developing stage. The concept of technology parks has taken much popularity and spread across the world. There are around 365 technology parks only in Europe, creating jobs for more than 750,000 employees by having heavy investments.

The essence of technology parks identified by several researchers time by time are real estate development, technology park's location, clustering nature, internationalization and promotion of R and D (Abetti, 2004; Appold, 2004; Durão et al., 2005; Fukugawa, 2006; Henneberry, 1984; Jongwanich et al., 2014; Link and Scott, 2003; Malairaja and Zawdie, 2008; Porter, 1998; Ratinho and Henriques, 2010; Salvador, 2011; Westhead and Batstone, 1999).

Researchers accepted technology parks as a tool to economic development, commercialization and social benefit to society. Abetti (2004); Durão et al. (2005); Sanni et al. (2010) agreed that technology parks take an active part in new ventures formation, creating jobs and economic growth. However, the development of technology parks requires a strong academic business association apart from technology and knowledge management (Wonglimpiyarat, 2010). The relation of technology parks and commercialization has been further illuminated by Link and Scott (2003), technology parks with university association magnify the patenting. Similarly, Huibing and Nengli (2005) also extended that technology parks having university affiliation becomes a source of revenue generation and job creation by commercializing the products and services. In another study, the formation of new ventures is substantial at technology parks in contrast to off parks. Moreover, Link and Scott (2011) also supported technology parks as a tool of commercialization for economic and social goals.

However, researches are still lacking consensus on the measures of technology park's performance (Fikirkoça and Saritas, 2012; Phan et al., 2005) and that empirical studies regarding technology parks are nascent (Link and Scott, 2011).

#### 5. METHODOLOGY

The purpose of this study is to make a direction for analyzing the knowledge transfer from university to society especially through commercialization and its mechanisms such as incubators and technology parks. A systematic approach is adopted to review the previous literature. The purpose of systematic literature review (SLR) is to identify the areas having ambiguity or remained less focused by researchers and to further suggest the future prospects. A total of 197 articles or studies have been identified comprising of 85 articles from only three renowned journals (Technovation, Research Policy, and Journal of Technology Transfer). The answers of following research questions are located during the review; (1) What are the commercialization barriers and how universities can overcome them? (2) How universities collaborate with industry to promote commercialization? (3) What are the practices of incubators and technology parks? (4) How much incubators and technology parks are helpful in promoting commercialization? (5) Where are the missing links in previous studies?

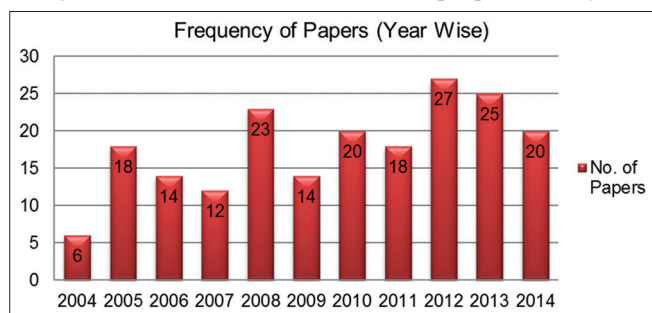
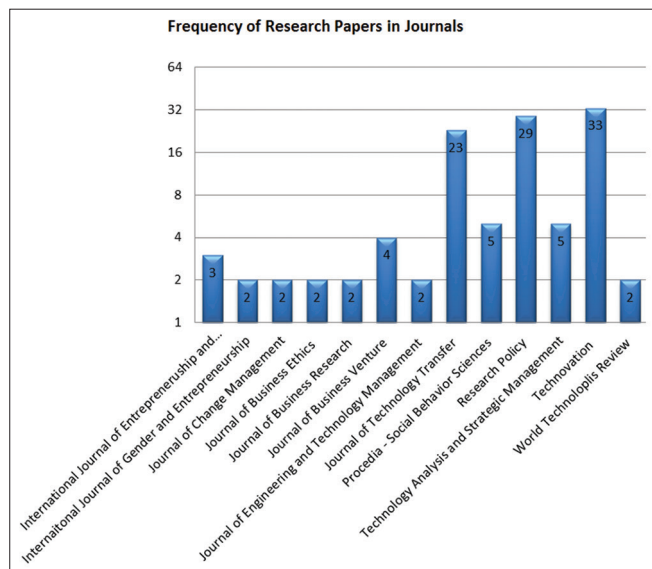
The idea behind using SLR is to select the variables that can contribute in commercialization. The databases used to identify the study are mainly Emerald, ScienceDirect, Web of Science, Taylor and Francis, and Wiley Online Library that have mostly cited publications and consist of high ranked journals across the disciplines. Subsequently, a filter is placed to restrict the publications for a specific period of last 10 years from 2004 to 2014. The journals having more articles relevant to commercialization, incubators and technology parks are Journal of Technology Transfer, Technovation, Research Policy, Journal of Business Venture, Strategic Management Journal, Journal of Small Medium Enterprise, Procedia-Social Behavior Science.

#### 6. RESULTS AND DISCUSSION

The trend of publications relevant to commercialization, incubators at university and technology parks over the last 10 years depicts a positive attitude of researchers. The publications especially in last 5 years show the emergence of commercialization, incubators and technology parks as a dynamic research area. Figure 1 elaborates the same:

Moreover, Figure 2 depicts that the publications are mostly by highly renowned impact factor journals such as Technovation, Research Policy and Journal of Technology Transfer. The publications by these highly ranked journals also reflect the importance of commercialization, university incubators and technology parks in current era and also in forthcoming.

As the objective of the study is to understand the importance of commercialization for local and regional socio economic development, job creation and new business formation; and how

**Figure 1:** Number of studies reviewed as per publication year**Figure 2:** Number of studies reviewed as per journal

university incubators and technology parks as knowledge transfer mechanisms can contribute to achieve the commercialization output. Moreover, researchers have highlighted the challenges; university incubators and technology parks have to face, are also discussed in this study.

The literature reveals that commercialization is an effective means of knowledge transfer from university to industry and to achieve the economic growth, sustainability, wealth generation, job creation and establishment of new businesses. Whereas, university incubators and technology parks are also used as the successful tools of commercialization and knowledge transfer to society. However, they have to face major challenges and constraints such as lack of human expertise and insufficient financial capital which needs to be addressed.

## 7. CONCLUSION

Commercialization participates significantly in local and regional economic growth and sustainability though it has to face several challenges and barriers to achieve this goal. Commercialization would not be able to achieve the destination level until a well-defined mechanism is established. Whereas, technology parks and university incubators are proved by researchers as

successful commercialization institutes. Therefore, technology parks and university incubators can be used as a valuable means of commercialization. However, these mechanisms are also struggling to fully support the commercialization due to several barriers. The human and financial constraints are the main hurdle in technology parks and university incubators functioning.

Although most developed economies have abundant supply of financial resources through various pipes, also struggling to tackle this problem. Financial constraints remain the big filter in narrow down the knowledge transfer process (Hsu, 2007; Huggins, 2008b). Additionally, ample financing along with other resources and capabilities is desired to magnify the commercialization output. A compatible financial model suitable for incubators and new business formation is much desired for economic and industrial sustainability. Henceforth, a complete set of funding mechanism oriented to commercialization needs to be explored. Moreover, a financial framework suitable for commercialization tools such as technology parks and university incubators needs to be institutionalized. The participation of various financial hubs should be recognized and triggered to enhance the efficacy of technology parks and university incubators for an expanded research commercialization.

## REFERENCES

- Abetti, P.A. (2004), Government-supported incubators in the helsinki region, Finland: Infrastructure, results, and best practices. *The Journal of Technology Transfer*, 29, 19-40.
- Allen, D.N., R. McCluskey (1990), Structure, policy, services and performance in the business incubator industry. *Entrepreneurship. Theory and Practice*, 15(2): 61-77.
- Al-Mubarak, H.M., Busler, M. (2010), Business incubators: Findings from a worldwide survey, and guidance for the GCC states. *Global Business Review*, 11(1), 1-20.
- Appold, S.J. (2004), Research parks and the location of industrial research laboratories: An analysis of the effectiveness of a policy intervention. *Research Policy*, 33(2), 225-243.
- Audretsch, D.B. (2014), From the entrepreneurial university to the university for the entrepreneurial society. *The Journal of Technology Transfer*, 39(3), 313-321.
- Audretsch, D.B., Aldridge, T., Oettl, A. (2006), The knowledge filter and economic growth: The Role of scientist entrepreneurship. Available from: <http://www.ssrn.com/abstract=1456458>.
- Baycan, T., Stough, R.R. (2012), Bridging knowledge to commercialization: The good, the bad, and the challenging. *The Annals of Regional Science*, 50(2), 367-405.
- Bergek, A., Norrman, C. (2008), Incubator best practice: A framework. *Technovation*, 28(1-2), 20-28.
- Bøllingtoft, A., Ulhøi, J.P. (2005), The networked business incubator – Leveraging entrepreneurial agency? *Journal of Business Venturing*, 20(2), 265-290.
- Bramwell, A., Wolfe, D.A. (2008), Universities and regional economic development: The entrepreneurial university of Waterloo. *Research Policy*, 37(8), 1175-1187.
- Breznitz, S.M., Feldman, M.P. (2010), The engaged university. *The Journal of Technology Transfer*, 37(2), 139-157.
- Bruneel, J., Ratinho, T., Clarysse, B., Groen, A. (2012), The evolution of business incubators: Comparing demand and supply of business incubation services across different incubator generations. *Technovation*, 32(2), 110-121.

- Carlsson, B., Acs, Z.J., Audretsch, D.B., Braunerhjelm, P. (2007), The Knowledge Filter, *Entrepreneurship and Economic Growth* (No. 104) (Vol. 46). CESIS.
- Chandra, A., Alejandra, M., Silva, M. (2012), Business incubation in Chile: Development, financing and financial services. *Journal of Technology Management and Innovation*, 7(2), 1-13.
- Chen, C.J. (2009), Technology commercialization, incubator and venture capital, and new venture performance. *Journal of Business Research*, 62(1), 93-103.
- Colombo, M.G., Piva, E., Rentocchini, F. (2012), The effects of incubation on academic and non-academic high-tech start-ups: Evidence from Italy. *Economics of Innovation and New Technology*, 21(5-6), 505-527.
- Costantini, V., Liberati, P. (2014), Technology transfer, institutions and development. *Technological Forecasting and Social Change*, 88, 26-48.
- Culkin, N. (2013), Beyond being a student: An exploration of student and graduate start-ups (SGSUs) operating from university incubators. *Journal of Small Business and Enterprise Development*, 20(3), 634-649.
- Dahlstrand, A.L., Politis, D. (2013), Women business ventures in Swedish university incubators. *International Journal of Gender and Entrepreneurship*, 5(1), 78-96.
- Durão, D., Sarmiento, M., Varela, V., Maltez, L. (2005), Virtual and real-estate science and technology parks: A case study of Taguspark. *Technovation*, 25(3), 237-244.
- Faria, A.P., Barbosa, N. (2014), Does venture capital really foster innovation? *Economics Letters*, 122(2), 129-131.
- Fikirkoca, A., Saritas, O. (2012), Foresight for science parks: The case of Ankara University. *Technology Analysis and Strategic Management*, 24(10), 1071-1085.
- Fukugawa, N. (2006), Science parks in Japan and their value-added contributions to new technology-based firms. *International Journal of Industrial Organization*, 24(2), 381-400.
- Grimaldi, R., Grandi, A. (2005), Business incubators and new venture creation: An assessment of incubating models. *Technovation*, 25(2), 111-121.
- Grimm, H.M., Jaenicke, J. (2012), What drives patenting and commercialisation activity at East German universities? The role of new public policy, institutional environment and individual prior knowledge. *The Journal of Technology Transfer*, 37(4), 454-477.
- Gstraunthaler, T. (2010), The business of business incubators: An institutional analysis – Evidence from Lithuania. *Baltic Journal of Management*, 5(3), 397-421.
- Guerrero, M., Urbano, D., Cunningham, J., Organ, D. (2014), Entrepreneurial universities in two European regions: A case study comparison. *The Journal of Technology Transfer*, 39(3), 415-434.
- Henneberry, J.M. (1984), Property for high-technology industry. *Land Development Studies*, 1(3), 145-168.
- Hsu, D.H. (2007), Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, 36(5), 722-741.
- Huggins, R. (2008a), Universities and knowledge-based venturing: Finance, management and networks in London. *Entrepreneurship and Regional Development*, 20(2), 185-206.
- Huggins, R. (2008b), Universities and knowledge-based venturing: Finance, management and networks in London. *Entrepreneurship and Regional Development*, 20(2), 185-206.
- Huggins, R., Kitagawa, F. (2012), Regional policy and university knowledge transfer: Perspectives from devolved regions in the UK. *Regional Studies*, 46(6), 817-832.
- Huiling, X., Nengli, S. (2005), Exploration of science parks. *Chinese Journal of Population Resources and Environment*, 3(1), 55-59.
- Ibata-Arens, K. (2008), Comparing national innovation systems in Japan and the United States: Push, pull, drag and jump factors in the development of new technology. *Asia Pacific Business Review*, 14(3), 315-338.
- International Association of Science Parks. (2014), Knowledge bites science park (IASP official definition). Available from: <http://www.iasp.ws/knowledge-bites>. [Last retrieved on 2014 Sep 06].
- Jongwanich, J., Kohpaiboon, A., Yang, C.H. (2014), Science park, triple helix, and regional innovative capacity: Province-level evidence from China. *Journal of the Asia Pacific Economy*, 19(2), 333-352.
- Lee, S.S., Osteryoung, J.S. (2004), A comparison of critical success factors for effective operations of university business incubators in the United States and Korea. *Journal of Small Business Management*, 42(4), 418-426.
- Link, A.N., Scott, J.T. (2003), U.S. science parks: The diffusion of an innovation and its effects on the academic missions of universities. *International Journal of Industrial Organization*, 21, 1323-1356.
- Link, A.N., Scott, J.T. (2006), U.S. university research parks. *Journal of Productivity Analysis*, 25(1-2), 43-55.
- Link, A.N., Scott, J.T. (2007), The economics of university research parks. *Oxford Review of Economic Policy*, 23(4), 661-674.
- Link, A.N., Scott, J.T. (2011), Research, Science, and Technology Parks: Vehicles for Technology Transfer (No. 11-22). p1-22. Available from: <http://www.uncg.edu/bae/econ/>.
- Link, A.N., Siegel, D.S. (2005), University-based technology initiatives: Quantitative and qualitative evidence. *Research Policy*, 34(3), 253-257.
- Lundqvist, M.A. (2014), The importance of surrogate entrepreneurship for incubated Swedish technology ventures. *Technovation*, 34(2), 93-100.
- Malairaja, C., Zawdie, G. (2008), Science parks and university – Industry collaboration in Malaysia. *Technology Analysis and Strategic Management*, 20(6), 727-739.
- Markman, G.D., Siegel, D.S., Wright, M. (2008), Research and technology commercialization. *Journal of Management Studies*, 45(8), 1401-1423.
- McAdam, M., Marlow, S. (2011), Sense and sensibility: The role of business incubator client advisors in assisting high-technology entrepreneurs to make sense of investment readiness status. *Entrepreneurship and Regional Development*, 23(7-8), 449-468.
- Mian, S.A. (1996), The university business incubator: A strategy for developing new research/technology-based firms. *The Journal of High Technology Management Research*, 7(2), 191-208.
- Miner, A.S., Eesley, D.T., De Vaughn, M., Rura-Polley, T., (2001), The magic beanstalk vision of university venture formation. In: Schoonhoven, K., Romanelli, E. (Eds.), *The Entrepreneurship Dynamic*. Stanford Univ. Press, Stanford, CA, 109–146
- Mueller, P. (2005), Exploring the Knowledge Filter: How Entrepreneurship and University-Industry Relationships Drive Economic Growth. In: 45<sup>th</sup> Congress of European Regional Science Association - Land Use and Water Management in a Sustainable Network Society. Amsterdam, The Netherlands.
- Munkongsujarit, S. (2013), *The Impact of Social Capital on Innovation Intermediaries*. Portland, Oregon: Portland State University.
- National Business Incubation Association. (2014a), *The History of Business Incubation*. Available from: [http://www.nbia.org/resource\\_library/history/index.php](http://www.nbia.org/resource_library/history/index.php). [Last retrieved on 2014 Sep 06].
- National Business Incubation Association. (2014b), *What is business Incubation?* Available from: [http://www.nbia.org/resource\\_library/what\\_is/index.php](http://www.nbia.org/resource_library/what_is/index.php). [Last retrieved on 2014 Sep 06].
- OECD. (2010), *Technology incubators*. Available from: <http://www.oecd.org/innovation/policyplatform/48136826.pdf>.
- Özdemir, Ö.Ç., Şehitoğlu, Y. (2013), Assessing the impacts of technology business incubators: A framework for technology development

- centers in Turkey. *Procedia Social and Behavioral Sciences*, 75, 282-291.
- Palumbo, F., Dominici, G. (2013), University incubator as catalyst of resources for academic spin-offs. The case of ARCA Consortium. In: *Recent Advances in Business Management and Marketing - Proceedings of the 1<sup>st</sup> International Conference on Management, Marketing, Tourism, Retail, Finance and Computer Applications (MATREFC '13)*. Dubrovnik, Croatia: WSEAS Press. p209-218. Available from: <http://www.ssrn.com/abstract=2298442>.
- Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Sobrero, M. (2013), Academic engagement and commercialisation: A review of the literature on university – Industry relations. *Research Policy*, 42(2), 423-442.
- Phan, P.H., Siegel, D.S., Wright, M. (2005), Science parks and incubators: Observations, synthesis and future research. *Journal of Business Venturing*, 20(2), 165-182.
- Phillips, R.G. (2002), Technology business incubators: How effective as technology transfer mechanisms? *Technology in Society*, 24, 299-316.
- Porter, M.E. (1998), Clusters and the new economics of competition. *Harvard Business Review*, 76(6), 77-90.
- Ratinho, T., Henriques, E. (2010), The role of science parks and business incubators in converging countries: Evidence from Portugal. *Technovation*, 30(4), 278-290.
- Salem, M.I. (2014), The role of business incubators in the economic development of Saudi Arabia. *International Business and Economics Research Journal*, 13(4), 853-860.
- Salvador, E. (2011), Are science parks and incubators good “brand names” for spin-offs? The case study of Turin. *The Journal of Technology Transfer*, 36(2), 203-232.
- Sanni, M., Egbetokun, A., Siyanbola, W. (2010), Munich personal RePEc Archive A Model for the Design and Development of a Science and Technology Park in Developing Countries (No. 25342).
- Schwartz, M., Hornych, C. (2010), Cooperation patterns of incubator firms and the impact of incubator specialization: Empirical evidence from Germany. *Technovation*, 30(9-10), 485-495.
- Siegel, D.S., Waldman, D.A., Atwater, L.E., Link, A.N. (2003), Commercial knowledge transfers from universities to firms: Improving the effectiveness of university – Industry collaboration. *The Journal of High Technology Management Research*, 14(1), 111-133.
- Sofouli, E., Vonortas, N.S. (2007), S and T Parks and business incubators in middle-sized countries: The case of Greece. *The Journal of Technology Transfer*, 32(5), 525-544.
- Somsuk, N., Laosirihongthong, T., McLean, M.W. (2012), Strategic management of university business incubators (UBIs): Resource – Based view (RBV) theory. In: *International Conference on Management of Innovation and Technology (ICMIT)*. Bali Indonesia: IEEE. p611-618.
- Squicciarini, M. (2008), Science parks’ tenants versus out-of-park firms: Who innovates more? A duration model. *The Journal of Technology Transfer*, 33(1), 45-71.
- Swamidass, P.M. (2013), University startups as a commercialization alternative: Lessons from three contrasting case studies. *The Journal of Technology Transfer*, 38(6), 788-808.
- Tamásy, C. (2007), Rethinking technology-oriented business incubators: Developing a robust policy instrument for entrepreneurship, innovation and regional development? *Growth and Change*, 38(3), 460-473.
- Tang, M., Baskaran, A., Pancholi, J., Lu, Y. (2013), Technology business incubators in China and India: A comparative analysis. *Journal of Global Information Technology Management*, 16(2), 33-58.
- Todorovic, Z.W., Suntornpithug, N. (2008), The multi-dimensional nature of university incubators: Capability/resource emphasis phases. *Journal of Enterprising Culture*, 16(04), 385-410.
- Westhead, P., Batstone, S. (1999), Perceived benefits of a managed science park location. *Entrepreneurship and Regional Development*, 11(2), 129-154.
- Wonglimpiyarat, J. (2010), Commercialization strategies of technology: Lessons from Silicon valley. *The Journal of Technology Transfer*, 35(2), 225-236.