

## **TTO Strategic Entrepreneurship Model for Strengthening RUs Innovation Ecosystem**

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### **Abstract**

Purpose- This study aims to nurture strategic entrepreneurship within Technology Transfer Office (TTO) for enhancing the entrepreneurial role in enabling successful technology transfer for Research Universities (RUs). This article conducts a synthesis of literature review with systematic method to analyse the roles and responsibilities of TTO in RUs, critical factors to nurture Strategic entrepreneurship in TTO and recommend TTO Strategic entrepreneurship model for strengthening RUs innovation ecosystem. The result shows that TTO with strategic entrepreneurship approaches would create pathways for sustainable entrepreneurial culture to support entrepreneur researcher characteristics for best practices on technology transfer to strengthen the innovation ecosystem in RUs. This study highlights recommendation on TTO strategic entrepreneurship model for strengthening RUs innovation ecosystem in enabling successful technology transfer in Malaysia. This is one of few studies in this topic of commercialization of innovation which has remained unexplored. Future study is projected to include development of a framework for nurturing strategic entrepreneurship within TTO to enhance commercialization of innovation through RUs technology transfer

**Keywords:** Roles and Responsibilities of TTO, Strategic Entrepreneurship, Knowledge Spillover, RUs Innovation Ecosystem, Entrepreneurial University

## **Introduction**

This study draws upon Theory of Knowledge Spillover (Acs et al., 2006) and Model of Strategic Entrepreneurship (Ireland et al., 2003) on the issue related to technology transfer and entrepreneurship in commercialization of innovations. Knowledge spillovers was defined as the external benefits from the creation of knowledge that accrue to parties other than the creator and occur at multiple levels of analysis. Meanwhile, strategic entrepreneurship highlights the complementarities within strategy and entrepreneurship that requires a dual focus on creating change, exploiting, or appropriating the value through the change. Fusion of the two concepts provide a valuable analysis of the causes and consequences of entrepreneurial action toward either creation and/or appropriation of value through investments in knowledge. Hence, this paper presents a preliminary exploration on nurturing strategic entrepreneurship within Technology Transfer Office (TTO) for enhancing the entrepreneurial role in enabling successful technology transfer for Research Universities (RUs).

## **Nurturing Strategic Entrepreneurship**

This section presents the results of selected literature review on roles and responsibilities of TTO, strategic entrepreneurship with knowledge spillover, and entrepreneurial university.

## **Roles and Responsibilities of TTO**

According to Sapah et al (2022), roles and responsibilities of TTO are important elements in elucidating the technology transfer process flow in universities commercialization of innovation. However, rate of technology transfer activities and TTO formation becomes inconsistent due to different TTO services in each university (Clarysse et al., 2014; Rahim et al., 2019). Hence, RUs technology transfer should focus on align the mission statement and organizational structure resources that affect the effectiveness of the TTO (Secundo et al., 2017).

In addition, Incubation programs are an important element in determining effective university innovation strategies such as the formation of spinoff companies that are able to increase the exploitation of university innovations (Carrasco & Aceytuno, 2015; Corsi & Prencipe, 2016). Thus, start-ups/ spin offs formation process needs entrepreneurial activity including entrepreneurship interest and experiences with robust entrepreneurship enhancing the commercialization process through RUs technology transfer (Sapah et al., 2022; Gregorio & Shane, 2003; O'Shea et al., 2008; Corsi & Prencipe, 2016). Whereas The success of entrepreneur researchers is a decisive factor in realizing university entrepreneurship (Secundo et al., 2019; Adelowo et al., 2020; Civera et al., 2020). In line with that, TTOs is an essential component of fostering patent applications and commercialization of innovation and defining strategies to improve success of technology transfer efforts as integrated tool for risk assessment in transferring new technology (Mascarenhas et al., 2019; Cedano et al., 2021). TTO as the main body for entrepreneur researcher need to escalate strategic entrepreneurship in supporting mentorship formal relationships that will improve networking and technology transfer comprehensively. Therefore, TTO being a center of innovation ecosystem that has appropriate institutional structures with integrated incentive system policies could facilitate synergies supporting entrepreneur researcher's characteristics thereby increase commercialization of innovation in RUs (Sapah et al., 2022).

### **Strategic Entrepreneurship with Knowledge Spillover**

Entrepreneurship has been identified as crucial element in technology transfer process. The fusion of strategic entrepreneurship elements within TTO could enhance the effectiveness of their role and responsibilities in supporting technology transfer process in RUs. Entrepreneurship is a strategic implementation for all organization as it is a key factor for fundamental shifts to entire manufacturing or production systems (Schumpeter, 1942). Entrepreneurship is also known as the engine of socioeconomic development with the concepts of newness and novelty, amplify new job opportunities with various types of new products to the country (Shane and Venkataraman, 2000). In line with that, Abreu and Grinevich (2013) stated that entrepreneurial ecosystem as innovation activities that are risky and occur outside of traditional academic roles leading to financial rewards for entrepreneur researchers and academic institutions. In the other hand, strategic management look into the efforts to assist competitive advantages as a key factor for potential to create wealth (Hitt et al., 2001), transform and create organizational excellence (Darling et al., 2007).

Therefore, Ireland et al. (2003) stated that strategic entrepreneurship is about the fusion of entrepreneurship elements and strategic management which include opportunity seeking behaviour and advantage seeking behaviour in evolving effective new ventures or established firms (Hitt et al., 2001). In other word, strategic entrepreneurship suggested the formation of an institutional framework beneficial to entrepreneurial initiatives by individuals and institutions with the focus to fulfill regional growth (Kuratko and Audretsch, 2009). Hence, it is a process to assist organization in recognizing entrepreneurial component, thus lead highest potential for value creation and exploit them by measured strategic actions (Kyrgidou & Huges, 2010). Furthermore, Agarwal et al (2010) pointed out that knowledge spill overs and strategic entrepreneurship concepts is a knowledge investment that produce a valuable analysis for entrepreneurial action toward value creation and economic growth. Jones & Ratten (2021) stated that technology transfer or commercialization of innovation and university entrepreneurial ecosystems are recently most popular research topic as consequence of their theoretical and practical relevance. In addition, knowledge spillover process through the strategic entrepreneurship needs to be investigate on how it influenced by other elements such as regulatory, institutional structure and policies (Ferreira et al., 2017).

The performance of technology transfer is positively related to investments in new knowledge by universities and firms (Audretsch & Link, 2019). In line with that, Bianchini et. al (2019) agreed that knowledge spill over through entrepreneur researcher will enhance technology transfer and boost the innovations. Innovation-led economic generated by entrepreneurially driven innovation in products and processes (Schumpeter, 1942) to acknowledge the business landscape without the absence of entrepreneurship elements (Shane & Venkataraman, 2000). According to Hitt et al (2001) the technology transfer process such as creative destruction (discontinuities), resource-based view, organizational learning, network theory and institutional theory can be determined by integrating research from strategic entrepreneurship. In addition, Alexander et al (2018) highlighted on implications of TTO officers that can simplify the complexity in technology transfer process or knowledge spill over co-ordination, resource allocation and strategic alignment.

University technology transfer arouse significantly by the quality of relationships than the quantity of relationships (Vega-Gomez et al.,2018) through the practice of entrepreneur researcher (Abreu & Grinevich, 2013; Bianchini et. al., 2019; Adelowo & Surujlal, 2020) and

nurturing entrepreneurial ecosystem through TTOs (Belitski et al., 2017; Fuster et al., 2019; Audretsch et al., 2021). Importantly, Agarwal et al (2010) highlighted on the fusion of strategic entrepreneurship and knowledge spill over that can be resolved through strategically entrepreneurial action and knowledge investment. Generally, strategic entrepreneurship consists of four important components known as entrepreneurial mindset, entrepreneurial culture and entrepreneurial leadership, strategic management of resources and creativity to develop innovations (Ireland et al., 2003). Nevertheless, previous studies focused on the merging of strategic management and entrepreneurship in various important domains including networking, organizational learning and innovation with core components in strategic entrepreneurship that captures condition for its applications (Hitt et al., 2001; Kyrgidou & Huges, 2010). Even so, successful strategic entrepreneurship leadership is based on four key strategies: attention through vision, meaning through communication, trust through positioning, and confidence through respect (Darling et al., 2007).

Therefore, this study proposed on elucidating strategic entrepreneurship as a conduit for knowledge spill over and technology transfer within RUs. Hence, analyse the linkages more comprehensively by examining issues at their interface to see direct and indirect effect of the two approaches for best practices of RUs technology transfer.

### **Entrepreneurial University Ecosystem**

Entrepreneurial university generates technology advances and facilitates the technology diffusion process through intermediaries such as TTO and the creation of incubators or science parks that spawn new firms (Rothaermel et al., 2007). As example, Stanford University environment encourages creativity and entrepreneurship with details best practices for creating an entrepreneurial ecosystem to enhance successful of commercialization (Eesley & Miller, 2018). The regulation of intellectual property (IP) ownership and royalty sharing with inventors was identified as a major result, strengthening entrepreneurial universities' role. (Bandera & Thomas, 2019; Mascarenhas et al., 2019; Gong et al., 2020; Cedano et al., 2021). According to Audretsch et al (2021), if regional policy makers aim to increase the productive of entrepreneurship, the emphasis should be on establishing supportive regulative institutional arrangements and government programs, increase informal networks and promote entrepreneurial culture. This environment should be in close interconnection with each other and use strategic approach when dealing with issues of obtaining commercial value (Kireyeva et al., 2020; Lee & Jung, 2021)

Entrepreneur researchers recognizes as intellectual asset in the corporate innovation process that have impact of university demand on the innovative performance (Bianchini et al., 2019). According to Vega-Gomez et al (2018), entrepreneur researcher predisposition to become entrepreneurs and academic's profile influence by a few conditions such as personal economic benefit, research benefit, CV benefit, support programs, teaching reduction and personal cost. Therefore, entrepreneur researcher identification should be widened to entrepreneurial activities; innovative, carries an element of risk, and leads to financial rewards for the individual academic (Abreu & Grinevich, 2013). Based on above studies, this study will focus on understanding the pathways available for RUs to support sustainable entrepreneurial ecosystems and policies to promote the entrepreneurial culture in universities.

### **Research Methodology**

This study conducted a review of selected literature on TTO roles and responsibilities, Strategic entrepreneurship, and strengthen RUs innovation ecosystem. These keywords were identified using Ibrahim's (2008,2011) research question's construct (or RQ Construct) categorization technique for identifying 3 different RQ Constructs - "WHO","WHAT" and "HOW" - in formulating a main research question. Ibrahim defines "WHO" construct as the element used or impacted by research, "WHAT" construct as the information required to solve a research problem, and "HOW" construct as the action or impact on the element or information of the research. This study covers Roles and responsibilities of TTO, Nurturing strategic entrepreneurship, and Entrepreneurial university.

For each topic, this paper will present the major works by prior scholars, how their works could support future studies, and what aspects need to be enhanced for each selected topic. The outcomes of this exercise would produce a synthesized information gearing towards high probable solutions that could satisfy there is a need to enhance the entrepreneurial role of TTO. This paper concludes with a potential integrated solutions for future development of a strategic entrepreneurship approaches would understand the pathways available for RUs sustainable entrepreneurial and innovation ecosystem. Thus, support entrepreneur researcher characteristics for best practices on knowledge spill overs to promote the entrepreneurial culture theoretical model to enable successful technology transfer for RUs.

### **Discussions**

This section discusses how the analyses of the literature review results for roles and responsibilities of TTO, strategic entrepreneurship with knowledge spillover and entrepreneurial university ecosystem.

### **Strategic Entrepreneurship within TTO Strengthen University Innovation Ecosystem**

Nurturing strategic entrepreneurship within TTO would create pathways for sustainable entrepreneurial culture and support entrepreneur researchers' characteristics for best practices on technology transfer to strengthen the innovation ecosystem in RUs. In accordance with the concept, strategic entrepreneurship that based on opportunity seeking behaviour and advantage seeking behaviour may have an impact on understand the entrepreneur researchers' characteristics could promote the entrepreneurial culture. In order to be competitive, TTO could facilitate synergies support and strengthen the RUs innovation ecosystem. See Figure1 illustrating the synthesis flow below.

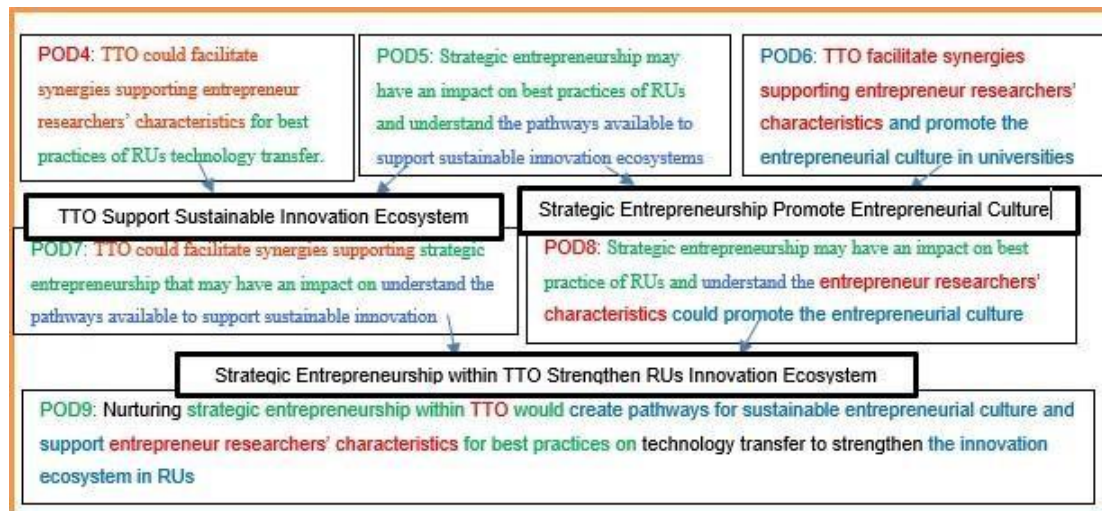


Figure 1: Point of Departure (POD) Tree Diagram for study on TTO Strategic Entrepreneurship Model for Strengthening RUs Innovation Ecosystem (Source: Ibrahim & Mustafa Kamal, 2018)

Inevitable, TTO as one of the most important support mechanisms in the creation sustainable entrepreneurial culture in RUs technology transfer. Even so, strategic entrepreneurship approaches would nurture entrepreneur researchers' characteristics that could enhance commercialization of innovation. Figure 2 is the proposed conceptual framework showing relationships of key constructs in Strengthening RUs Innovation Ecosystem.

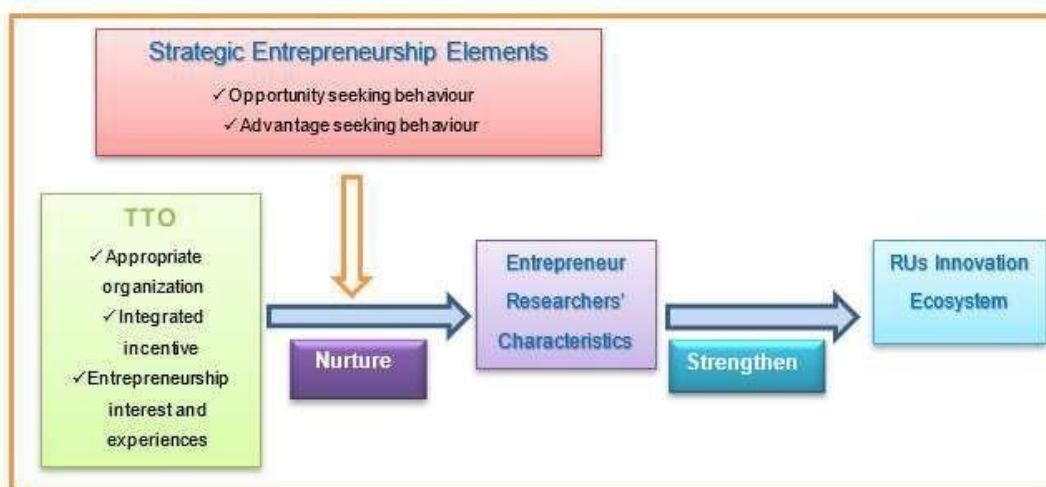


Figure 2: Proposed Conceptual Framework based on TTO Strategic Entrepreneurship Model for Strengthening RUs Innovation Ecosystem (Source: Ibrahim & Mustafa Kamal, 2018)

Thus, this proposed conceptual framework provides a tool to express clearly essential variables that should be included in future studies. Strategic entrepreneurship elements with the right TTO characteristics and educate entrepreneur researchers can strengthen Rus innovation ecosystem that could enhance commercialization of innovation.

### Conclusion

The aim of this paper is to nurture strategic entrepreneurship within TTO in enhancing the entrepreneurial role that would enable successful technology transfer for RUs. This study

concluded with a proposed conceptual framework how TTO Strategic Entrepreneurship Model could strengthen RUs innovation ecosystem. The results are significant because they contribute enabling TTO to support successful of technology transfers for Rus. These results are expected to improve the successful commercialization rate of RUs innovation in consistent with the regional economic growth in Malaysia. Future studies are recommended to include development of a framework for nurturing strategic entrepreneurship within TTO to enhance commercialization of innovation through RUs technology transfer.

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### References

- Acs, Z. J., Audretsch, D. B., Braunerhjelm, P., & Carlsson, B. (2006). CESIS The Knowledge Spillover Theory of Entrepreneurship, *The Knowledge Spillover Theory of Entrepreneurship*.
- Abreu, M., & Grinevich, V. (2013). The nature of academic entrepreneurship in the UK: Widening the focus on entrepreneurial activities. *Research Policy*, 42(2), 408–422. <https://doi.org/10.1016/j.respol.2012.10.005>
- Adelowo, C. M., & Surujlal, J. (2020). Academic entrepreneurship and traditional academic performance at universities: Evidence from a developing country. *Polish Journal of Management Studies*, 22(1), 1–25. <https://doi.org/10.17512/pjms.2020.22.1.01>
- Agarwal, R., Audretsch, D., & Sarkar, M. (2010). Knowledge spillovers and strategic entrepreneurship. *Strategic Entrepreneurship Journal*, 4(4), 271–283.
- Alexander, A., Martin, D. P., Manolchev, C., & Miller, K. (2018). University–industry collaboration: using meta-rules to overcome barriers to knowledge transfer. *Journal of Technology Transfer*, 1–22. <https://doi.org/10.1007/s10961-018-9685-1>
- Audretsch, D. B., Belitski, M., & Cherkas, N. (2021). Entrepreneurial ecosystems in cities: The role of institutions. *PLoS ONE*, 16(3 March 2021).
- Bandera, C., & Thomas, E. (2019). The Role of Innovation Ecosystems and Social Capital in Startup Survival. *IEEE Transactions on Engineering Management*, 66(4), 542–551. <https://doi.org/10.1109/TEM.2018.2859162>
- Belitski, M., and Heron, K. (2017) Expanding entrepreneurship education ecosystems. *Journal of Management Development*, 36 (2). pp. 163-177. ISSN 0262-1711 doi: <https://doi.org/10.1108/JMD-06-2016-0121>
- Bianchini, S., Llerena, P., & Patsali, S. (2019). Demand-pull innovation in science: Empirical evidence from a research university's suppliers. *Research Policy: X*, 1. <https://doi.org/10.1016/j.repolx.2019.100005>
- Carrasco, F. R. C., & Aceytuno, M. T. (2015). Academic spin-offs incubation strategies: The case of the Andalusian region. *Cuadernos de Gestion*, 15(2), 113–142. <https://doi.org/10.5295/cdg.140479>
- Cedano, K. G., & Hernandez-Granados, A. (2021). Defining strategies to improve success of technology transfer efforts: An integrated tool for risk assessment. *Technology in Society*, 64. <https://doi.org/10.1016/j.techsoc.2020.101517>

- Civera, A., Meoli, M., & Vismara, S. (2020). Engagement of academics in university technology transfer: Opportunity and necessity academic entrepreneurship. *European Economic Review*, 123. <https://doi.org/10.1016/j.euroecorev.2020.103376>
- Corsi, C., & Prencipe, A. (2016) Improving Innovation in University Spin-Offs. The Fostering Role of University and Region. *In J. Technol. Manag. (Vol. 11, Issue 2)*. <http://jotmi.org>
- Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014) Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7): 1164-1176. <https://doi.org/10.1016/j.respol.2014.04.014>.
- Darling, J., Gabrielsson, M., & Seristo, H. (2007). Enhancing contemporary entrepreneurship: A focus on management leadership. *European Business Review*, 19(1), 4–22. <https://doi.org/10.1108/09555340710714126>
- Eesley, C. E., & Miller, W. F. (2018). Impact: Stanford University's economic impact via innovation and entrepreneurship. *Foundations and Trends® in Entrepreneurship*, 14(2), 130-278.
- Fernandez-Alles, M., Dianez-Gonzalez, J. P., Rodriguez-Gonzalez, T., & Villanueva-Flores, M. (2019). TTO characteristics and university entrepreneurship: a cluster analysis. *Journal of Science and Technology Policy Management*, 10(4), 861–889.
- Ferreira, J. J., Ratten, V., & Dana, L. P. (2017). Knowledge spillover-based strategic entrepreneurship. *In International Entrepreneurship and Management Journal (Vol. 13, Issue 1, pp. 161–167)*. Springer New York LLC. <https://doi.org/10.1007/s11365-01604156>
- Fuster, E., Padilla-Melendez, A., Lockett, N., & del-Aguila-Obra, A. R. (2019). The emerging role of university spin-off companies in developing regional entrepreneurial university ecosystems: The case of Andalusia. *Technological Forecasting and Social Change*, 141, 219–231. <https://doi.org/10.1016/j.techfore.2018.10.020>
- Gong, H., Nie, L., Peng, Y., Peng, S., & Liu, Y. (2020). The innovation value chain of patents: Breakthrough in the patent commercialization trap in Chinese universities. *Plos one*, 15(3), e0230805.
- Gregorio, D. di, & Shane, S. (2003). Why do some universities generate more start-ups than others? *In Research Policy (Vol. 32)*.
- Hitt, M. A., Ireland, R. D., Camp, S. M., & Sexton, D. L. (2001). Strategic entrepreneurship: entrepreneurial strategies for wealth creation. *Strategic Management Journal*, 22(6– 7), 479–491. <https://doi.org/10.1002/smj.196>
- Huyghe, A., Knockaert, M., Piva, E., & Wright, M. (2016). Are researchers deliberately by passing the technology transfer office? An analysis of TTO awareness. *Small Business Economics*, 47(3), 589–607. <https://doi.org/10.1007/s11187-016-9757-2>
- Ibrahim, R. (2008). Setting up a research question for determining the research methodology. *ALAM CIPTA International Journal on Sustainable Tropical Design Research & Practice*, 3(1), 99- 102.
- Ibrahim, R. (2011). Demystifying the arduous doctoral journey: The eagle vision of a research proposal. *Electronic Journal of Business Research Methods*, 9(2), pp130-140.
- Ibrahim, R., & Kamal, M. R. (2018). Templates for Thinking. (Unpublished Literary. Copyright MYIPO LY2018002437).



- Ireland, R. D., Hitt, M. A., & Sirmon, D. G. (2003). A Model of Strategic Entrepreneurship: The Construct and its Dimensions. *Journal of Management*, 29(6), 963–989. [https://doi.org/10.1016/s0149-2063\\_03\\_00086-2](https://doi.org/10.1016/s0149-2063_03_00086-2)
- Jones, P., & Ratten, V. (2021). Knowledge spillovers and entrepreneurial ecosystems. *In Knowledge Management Research and Practice* (Vol. 19, Issue 1, pp. 1–7). Taylor and Francis Ltd. <https://doi.org/10.1080/14778238.2020.1801363>
- Kireyeva, A. A., Turdalina, S., Mussabalina, D., Turlybekova, N. M., Akhmetova, Z. B. (2020). Analysis of the efficiency technology transfer offices in management: The case of Spain and Kazakhstan. *Journal of Asian Finance, Economics and Business* (8), 735–746. <https://doi.org/10.13106/JAFEB.2020.VOL7.NO8.735>
- Kyrgidou, L. P., & Hughes, M. (2010). Strategic entrepreneurship: Origins, core elements and research directions. *In European Business Review* (Vol. 22, Issue 1, pp. 43–63). <https://doi.org/10.1108/09555341011009007>
- Lee, K., & Jung, H. J. (2021). Does TTO capability matter in commercializing university technology? Evidence from longitudinal data in South Korea. *Research Policy*, 50(1). <https://doi.org/10.1016/j.respol.2020.104133>
- Masiran, R., Ibrahim, N., Awang, H., & Lim, P. Y. (2020). Improving multicultural parenting program for children with emotional and behavioral problems: an integrated review. *Asian Journal of Psychiatry*, 51, 101851.
- Mascarenhas, C., Marques, C. S. E., Galvão, A. R., Carlucci, D., Falcão, P. F., & Ferreira, F. A. F. (2019). Analyzing technology transfer offices' influence for entrepreneurial universities in Portugal. *Management Decision*, 57(12), 3473–3491. <https://doi.org/10.1108/MD11-2018-1200>
- Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University entrepreneurship: A taxonomy of the literature. *Industrial and Corporate Change*, 16(4), 691–791. <https://doi.org/10.1093/icc/dtm023>
- Schumpeter, J. A. (1942). *Capitalism, Socialism and democracy*. London: Allen & Unwin.
- Secundo, G., De Beer, C., Fai, F. M., & Schutte, C. S. (2019). Increasing university entrepreneurialism: Qualitative insights from the technology transfer office. *Measuring Business Excellence*.
- Shane, S., & Venkataraman, S. (2000). The Promise of Entrepreneurship as A Field of Research. *In Academy of Management Review* (Vol. 25, Issue 1).
- Vega-Gomez, F. I., Miranda, F. J., Mera, A. C., & Mayo, J. P. (2018). The spin-off as an instrument of sustainable development: Incentives for creating an academic USO. *Sustainability (Switzerland)*, 10(11). <https://doi.org/10.3390/su10114266>