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Mapping Innovation-Driven Entrepreneurial Ecosystems: An Overview*

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Innovation-driven entrepreneurship enables people and companies to pursue global opportunities based on innovative processes, products, or services. Studies show that innovation-driven entrepreneurial high-growth firms represent a small fraction (< 10%) of all start-ups but create more than 50% of jobs and are more resilient during crises, including the recent coronavirus disease (COVID-19) pandemic. However, their growth depends on an entrepreneurial ecosystem surrounding them, including access to key markets, finance, networks, and human resources, especially new knowledge and education. To ensure the development of innovation-driven entrepreneurial activities, their geographical and sectoral distribution needs to be mapped, but indicators are lacking, especially for the Association of Southeast Asian Nations (ASEAN). New sources of data, including social media, offer a new way to expand these indicators, and we propose a new methodology to identify emerging places of innovation-driven entrepreneurship (E-PIE).

Key Messages:

- Innovation-driven entrepreneurship has a key role to play in the post-pandemic recovery across the Association of Southeast Asian Nations (ASEAN), as it leads to the creation and/or scale-up of firms based on new business models, concepts, and ideas.
- The development of innovation and entrepreneurship ecosystems is highly dependent on local and place-based characteristics: from the presence of certain types of firms, educational institutions, framework conditions, and policies to the network and relationship of different actors. It is very difficult, nearly impossible, to replicate the development of successful examples (like the Silicon Valley or the Bangalore information and communication technology (ICT) cluster) elsewhere.
- ASEAN is a very diverse and dynamic region with respect to innovation-driven entrepreneurship ecosystems. However, indicators to map and understand their development and emergence are either lacking or not fully capturing the local context.
- This lack of indicators makes it difficult for policymakers to develop context-based policies for the development of innovation-driven entrepreneurship ecosystems.
- The proliferation of new alternative data sets, both public and privately owned, offer many opportunities to better understand emerging innovation ecosystems outside North America and Europe, including across ASEAN.
- A new methodology has been proposed to map emerging places of innovation-driven entrepreneurship (E-PIE), in order to combine traditional and new data sources. This develops a more holistic approach to determining relevant metrics (such as scientific publications) and new emerging big data sources (investment tracking databases) and social media/networks.

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Why Innovation-driven Entrepreneurship is Important for ASEAN

A strong correlation exists between the emergence of innovative and entrepreneurial activities and economic growth. Innovation-driven entrepreneurs pursue global opportunities based on innovative processes, products, or services. The notion of being driven by innovation is key as it emphasises the entrepreneur's drive to build a competitive advantage, which can only be achieved by using resources to do something new and unique with them (e.g. Rosenberg, 2004; Verspagen, 2005; Acs, 2006; Baumol and Strom, 2007; Crescenzi et al., 2019). Their essential role is to trigger the generation, dissemination, and exploitation of innovative ideas. Entrepreneurs not only search for and identify potentially profitable economic opportunities but are also willing to take risks and create the conditions to ascertain if their intuitions are correct.

Over recent years, the Association of Southeast Asian Nations (ASEAN) region has been characterised by the emergence of vibrant entrepreneurial communities, especially in some of its cities (Teare, 2021; Ajmone Marsan, Sabrina, and Ooi, 2022; Litania and Shukla, 2022). Innovation-driven entrepreneurship has the potential to become one of the main drivers for the post-pandemic recovery in the region, especially if combined with the booming adoptions of digital technologies by increasing segments of the population.

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However, innovation-driven entrepreneurship in ASEAN is still not well researched, mapped, or understood. Indicators traditionally used to map or measure innovative entrepreneurial behaviour in more advanced economies are lacking or not fit for purpose. For instance, the most widely used methodologies, based on patents, might not be entirely suitable to capture emerging and consolidating innovation and entrepreneurship dynamics across the region, as innovation-driven entrepreneurship in ASEAN tends to rely less on research and development (R&D) activities performed by large corporations or research organisations. For all these reasons, sharing and adopting good policy practices and evidence based-strategies relevant for all ASEAN Member States remains challenging.

What are Innovation-driven Entrepreneurial Ecosystems?

The concept of the entrepreneurial ecosystem became popular in the early 2010s, a period characterised by austerity in various parts of the developed world, economic stagnation, and widening geographical disparities in economic development following the global financial crisis. Studies such as Mason and Brown (2014) described entrepreneurial ecosystems as fertile grounds for the emergence of high-growth companies, offering a new and distinctive perspective on the geographical clustering of economic activity, although including many of the themes from the earlier literature on industrial clusters.

Entrepreneurial ecosystems – like business ecosystems – are shaped by framework conditions and systemic conditions (Stam, 2018). Framework conditions include the social, institutional, and infrastructural factors that allow or limit interactions and transactions. Systemic conditions are the essence of the ecosystem: networks of entrepreneurs, leadership, finance, talent, knowledge, and support services (Stam, 2018). The most important amongst these are:

1. Access to markets for new goods and services. This access to buyers of goods and services, however, is likely to be more related to the geographic location or the position of the ecosystem within global value chains than to its internal conditions.
2. Networks of entrepreneurs enable flows of knowledge, skills, and capital. Leadership provides vision and role models, a key element for the development and maintenance of a healthy ecosystem, requiring the engagement of serial entrepreneurs who are committed locally (Feld, 2012).
3. Access to finance, preferably provided by investors with entrepreneurial knowledge, guarantees investments in uncertain and long-term business projects.
4. The presence of diverse and synergetic human capital (Acs and Armington, 2004; Mason and Brown, 2014). The presence of well-functioning universities is important in both the educational sense and in terms of creating new knowledge. On the one hand, their technology transfer offices can be significant sources of new spin-offs. On the other hand, and probably even more importantly, universities form the human capital that supports the development of the ecosystem.

Figure 1: Schematic Perspective of Selected Key Dimensions of an Entrepreneurial Ecosystem

Source: Authors.

The capacity to share and absorb knowledge from interactions is a precondition for innovation that crucially depends on inter-organisational networks. They help coordinate the activities of entrepreneurial actors through structures and practices that support resource mobilisation and knowledge flows. Frequently, this happens at the interfaces of both geographically close and cognitively related domains, although extra-regional links can also be a source of innovation, as they can bring a greater variety of knowledge to the region (Neffke et al., 2014). The networks through which knowledge is absorbed into and diffused within a certain location have been conceptualised as the absorptive capacity (Cohen and Levinthal, 1990) of a region (Caragliu and Nijkamp, 2012), an innovation district (Giuliani and Bell, 2005), or an entrepreneurial ecosystem (Zahra and Nambisan, 2012).

However, the flows of knowledge, while spreading on a global scale, do not flow uniformly. The actors and systems that make knowledge flow range from individuals to businesses to governments and research institutes, but they can also include structured sets of these actors in the form of research collaborations – systems of local innovation linked together through networks of scientists, entrepreneurs, or policymakers. The building blocks of these complex network structures are not uniformly distributed. For several years, the Global Innovation Index (GII) has provided a perspective on the spatial distribution of innovative activity. In particular, it has identified the best performing innovative districts on the basis of microdata concerning scientific and technological outputs. While mostly associated with large urban centres, the resulting class often includes municipal districts, sub-federal states, and sometimes even two or more countries.

How to Measure Innovation-driven Entrepreneurial Ecosystems?

Measurement of innovation is a widely discussed topic in the literature and there is no agreement on which indicator is the most appropriate (Griliches, 1990). The innovation indicators are divided into input indicators (e.g. R&D expenditure or jobs) and output indicators (e.g. patents, new products). The main drawback of the former is that they do not take into account the activities related to contextual knowledge, which are more important in smaller companies. Patents and new products, on the other hand, represent the outcome of the innovation process. As long as the patents granted are based on new ideas (i.e. not already existing) and unique, and the financial costs are sustained by the applicant, it can be assumed that the patented innovation has economic value. Scientific publications have no direct economic value, so their use as innovative output proxies is more controversial. However, they are often used, as in the case of the GII (Dutta, Lanvin, and Wunsch-Vincent, 2021). Patent documents contain various data such as the address of the applicant and the assignee, name, date, and technological classification. For these reasons, patent indicators are the most commonly used innovation indicators, though they only indicate the levels of knowledge-driven innovation and to a lesser degree other types of new business creation (i.e. process innovation, business model, etc.). They are also a less accurate measure of innovation where patenting is (prohibitively) expensive and where, culturally, the intellectual property is not seen as a protectable asset.

Regarding the systemic nature of innovation districts, some authors have measured the knowledge spillovers and positive externalities that innovative firms have in such environments. A primordial attempt to measure the impact of university research conducted in the United States dates back to Jaffe (1989) and focused on its effects on the knowledge production function of geographically proximate companies.

More recently, various authors have tried to conjugate basic measures of innovation with proxies of the systemic nature of localised and globalised activities, with a view to offering more holistic and flexible methodologies that help the ideation and implementation of innovation policies. For example, Katz and Wagner (2014: 10) claimed that these districts are made up of economic assets ('firms, institutions, and organisations that drive, cultivate or support an innovation-rich environment'); physical assets ('infrastructure – designed and organised to stimulate new and higher levels of connectivity, collaboration, and innovation'); and networking assets ('the relationships between actors – such as between individuals, firms, and institutions – that have the potential to generate, sharpen, and/or accelerate the advancement of ideas').

Those who explain such a geographical concentration of assets, knowledge, and network connections can be geographically concentrated in certain locations and tend to focus on relational alignments, allowing for spillovers and the exploitation of synergies. Especially when industrial research focuses on complex and multi-technology products and processes, it is extremely important that organisations and individuals learn how to interact and complement new knowledge. Second, knowledge that spills over is mainly tacit, so owners and users need common code-books that allow reciprocal understanding. Transferring tacit knowledge requires the ability to interpret it within a defined cognitive framework and locate it within familiar categories. Hence, different socio-cultural contexts may suggest distinctive ways of assessing solutions and predicting future scenarios as similar problems arise. Co-location can provide firms with the required tools to obtain and understand even the most subtle, inexpressible, and complex information of potential relevance.

International Interest in Innovation-driven Entrepreneurial Ecosystems in Asia is growing

Amongst the largest innovation districts on a global scale, Crescenzi et al. (2019) noted that there are several cases of successful government intervention to generate clusters in technologically emerging economies, not only in Europe or the United States, but also in Asia. Crescenzi et al. (2019) cited the example of the municipal government of Chongqing, China, which in 2008 took steps to relocate several small personal computer manufacturing centres to the city. Investments in infrastructure, labour market organisation, and other business-friendly policies were used to attract innovation-driven entrepreneurial companies. However, this is a district that has been displaced rather than having emerged. In contrast, in Bangalore (India), the innovative district started with investments in the Indian space programme and then grew, supported by local investments in infrastructure and human capital (Gao et al., 2018).

Recently, increasing attention has been paid to clusters/districts that have emerged in Asia. For instance, work by Dai et al. (2021) showed that firms that had agglomerated and built networks in China were more resilient to the effects of the economic downturn caused by the coronavirus disease (COVID-19). The GII (Dutta, Lanvin, and Wunsch-Vincent, 2021) highlighted how some of the top innovation districts in the world are based in Asia (Tokyo, Shenzhen–Hong Kong–Guangzhou, Seoul, Beijing, Osaka, Shanghai are in the top 10). This is based on:

- Inventors listed in patent applications under World Intellectual Property Organization (WIPO) patents.
- Authors listed in scientific publications in the Web of Science Citation Index Expanded and covering the same period.
- The geocoding of inventor addresses using advanced algorithms.
- Measuring innovation-driven entrepreneurship ecosystems in ASEAN is challenging

The above-mentioned data are less reliable in Southeast Asia due to a larger proportion of informal knowledge flows. While comprehensive studies of existing innovation capacity and policy (Ambashi, 2018), as well as the proposed strategic outlook (Ambashi, 2020), have pointed towards a significant entrepreneurial dynamism amongst the Southeast Asia economies, subnational data are scarce. News of (isolated) examples of inward investment and company growth notwithstanding,[1] it is difficult to identify a critical mass of innovation and entrepreneurship in emerging locales, which makes directing R&D investment challenging (Ambashi, 2018). In addition, patenting and publication data on their own are not always indicative of emerging places of innovation-driven entrepreneurship, reinforcing the concentration of resources and activities in and around existing innovation districts (especially capital cities). This leaves a significant amount of the growth potential untapped, a particular issue in the current climate of post-COVID-19 renewal and significant opportunities in the (global) sustainable and digital economy (Google, Temasek, and Bain, 2020; 2021).

The Potential of Alternative data Sets and Metrics for Understanding Innovation-driven Entrepreneurship Ecosystems in ASEAN

A growing availability of large data sets from public and private sources, social media, digital applications, and crowdfunding platforms offer opportunities to use data in innovative ways (Credit, Mack, and Mayer, 2018; Spigel, Kitagawa, and Mason, 2020). This data proliferation, the methodological problems related to the use of secondary data sources, and the need to better measure the components of entrepreneurial ecosystems, together with the interest in the impact of these ecosystems on economies in the ASEAN area, has tremendous potential.

In terms of what should be measured, Feld and Hathaway (2020) also suggested that there should be a focus on networks and the immensity of interactions and not just on the size of the ecosystem components. This requires new and innovative metrics capable of measuring connectivity, e.g. by gathering data from digital platforms (Google, Meetup.com, or LinkedIn) to quantify ecosystem attributes such as entrepreneurial culture and the flow of people and ideas across actors and organisations. Moreover, one could also hypothesise the use of data from corporate websites to identify innovative and high-growth companies (Spigel, Kitagawa, and Mason, 2020).

Harrington (2016) argued that measuring the evolution of the ecosystem (St. Louis, MI, United States; 2000–2016) requires considering three dimensions: economic development (inputs; outputs); culture and societal factors; and being able to rank different ecosystems. The Stangler and Bell-Masterson (2015)/Kauffman Foundation method focuses on the overall ecosystem performance in terms of results and 'vibrancy'. Indicators of entrepreneurial ecosystem vibrancy are density, fluidity, connectivity, and diversity. The goal is to provide a holistic and dynamic set of indicators to measure the progress made by each component of an entrepreneurial ecosystem on the basis of its complex adaptive structure.

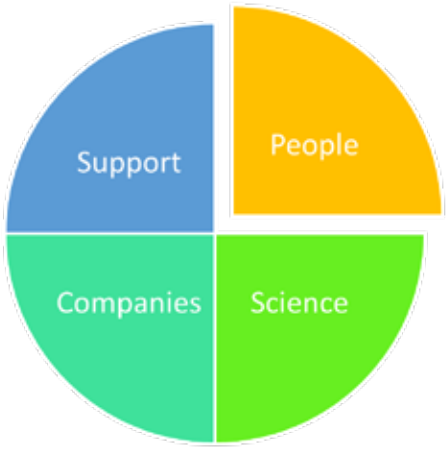
1 For example, Reyes (2021), Lee (2021), and EDB (2021).

Introducing the E-PIE Methodology to Map Emerging Places of Innovation-driven Entrepreneurship

Based on these insights, we led a pilot study to frame a new methodology for identifying emerging places of innovation-driven entrepreneurship (E-PIE). The approach we took aims to bring together insights about framework conditions with new insights into networks of entrepreneurs. This is based on mapping emerging places as a function of aggregated data tracking within the following data sources: (i) traditional sources of data on innovation, though extending beyond the patenting data set towards total scientific publication output; (ii) commercially available sources of (big) data, tracking investment in emerging companies; (iii) case study follow-up of the identified possible places of innovation-driven entrepreneurship; and (iv) social media analysis of concentration of entrepreneurs.

Based on a comprehensive data survey and a small number of targeted case studies, we noticed a certain variation in the coverage of ASEAN across the above four sources of data, but the overall size and coverage show great promise, especially if social media data can be systematically researched and included. This would also be an excellent starting point to identify key actors and gather further qualitative/survey data about the density, connectivity, fluidity, and diversity of the local entrepreneurial ecosystem.

Figure 2: E-PIE Methodology



Note: E-PIE methodology uses social network analysis to add the dimensions of entrepreneurs to the traditional measurement of entrepreneurial ecosystems based on scientific output (publications), company formation and investment, and support for accessing knowledge and markets through innovation intermediation.
Source: Authors.

Policy Recommendations

- To support their development, policymakers need to gain a better understanding of the innovation-driven entrepreneurship ecosystems across ASEAN, taking note of the dynamic nature of the evolution of framework conditions, markets, and business activity.
- Policymakers should expand the evidence base through data collection within national statistical agencies on company formation, technology applications (e.g. patents and other relevant indicators), etc., as well as start using new metrics based on big data analysis derived from indicators including, for instance, the level of investments, entrepreneurial activity, and social networks.
- Given the diversity, heterogeneity, and different level of maturity of innovation ecosystems across ASEAN, policymakers should aim to link emerging development indicators with local conditions to define targeted policy support through innovation intermediation.

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