Information and Communication Technology Systems and Innovation

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Entrepreneurship has become increasingly important for innovation and economic growth. The connection of innovation and entrepreneurship to Information and Communications Technology (ICT) is gradually being increasingly recognised as a catalyst and a facilitator of social and economic growth. Innovation, as a rule, causes companies to be more creative, experimenting with the development of new processes, services, and products, thus giving rise to new business models that allow companies to expand and improve overall competitiveness. ICTs have been pointed out as a key factor in developing innovation.

open innovation dynamic | entrepreneurship | resource-based theory | information and communications technology (ICT) | total early-stage entrepreneurial activity (TEA) | entrepreneurial activity

1. Introduction

The connection of innovation and entrepreneurship to Information and Communications Technology (ICT) is gradually being increasingly recognised as a catalyst and a facilitator of social and economic growth [1]. The increasing evolution of digital technologies means businesses must adapt to an increasingly global market [2], and policymakers have been considering ICTs for formulating their regional and national development objectives. However, the practical mechanisms for implementing policies that assist in adopting entrepreneurship and open innovation dynamics based on ICTs vary significantly from economy to economy [1][3].

In more uncertain and dynamic economic environments, innovation, as a rule, causes companies to be more creative, experimenting with the development of new processes, services, and products, thus giving rise to new business models that allow companies to expand and improve overall competitiveness [4].

In this context, ICTs have been pointed out as a key factor in developing innovation. In turn, innovation has been pointed out as being the basis of the economic development achieved by some economies since the last decade of the twentieth century. However, ICTs alone do not guarantee greater socio-economic growth [5][6]. Thus, the use and availability of citizens' access to ICTs helps to understand how much an economy has used and taken advantage of the new knowledge made available by the knowledge society and what their impacts have been on economic growth [5][7][8][9][10].

From this perspective, entrepreneurship plays a relevant role in economies and society, with the need to foster it [11][12][13]. However, there are significant differences in entrepreneurial activity globally and across different types of economies, and these differences should be further studied [5]. Some studies point to the predictors for new ventures' success and growth [14][15]. However, little attention has been paid to the intersection of technological capabilities and innovations in new ventures, which are fundamental today [2]. More studies linking ICT development in different countries to entrepreneurial activity are still needed [16].

Thus, this entry aims to analyse the potential influence of ICT on entrepreneurial activity in OECD countries in the context of the open innovation dynamic. ICT, including mobile-cellular telephone subscriptions, individuals using the internet, and fixed-broadband subscriptions, were considered for this entry. Thus, the following research questions were formulated: (1) whether ICTs positively influence the rate of new firm creation in OECD countries, and (2) whether different ICTs have equal importance in stimulating entrepreneurial activity.

ICTs can help firms and economies improve their performance and achieve competitive advantages. However, both performance and competitive advantage typically depend on the internal resources that firms have access to and their ability to coordinate and combine the various resources [17][18][19]. The resource-based theory is relevant for addressing the implications of firms' resources [20]. The resource-based theory is appropriate for addressing the implications of firms' resources for organisational performance in economies [17][21]. The resource-based theory tells researchers that the possession of specific firm resources influences organisational performance. Therefore, resources are repeatedly considered the basis of wealth creation, allowing firms to develop competitive advantages by creating value for their customers [22][23][24]. In this way, access to ICTs is considered a necessary resource for business performance.

2. Entrepreneurship and Resource-Based Theory

Entrepreneurs and resources play a key role in global economies [2]. The entrepreneurs drive value creation through a correct combination and optimisation of resources. In this context, the relationship between entrepreneurship and resource-based theory has been recognised by academics [25]. This relationship has gradually developed new insights [24], and the resource-based theory can explain the success of entrepreneurial activity [26]. According to the resource-based theory, ICT is identified as a valuable and crucial source of heterogeneous resources, which help companies to gain a competitive advantage in terms of information and improve their efficiency and business performance [27][28][29]. Specifically, in this entry, three ICTs are considered through their accessibility and use, enabling them to increase business success.

In this follow-up, implementing an entrepreneurial institution and vision are fundamental in defining which resources contribute to achieving a sustainable competitive advantage [30]. Thus, internal resources are more relevant in formulating a competitive advantage strategy than external factors [20][31]. On the other hand, internal resources must be retained and developed within the organisations, that is, they cannot be obtained or even bought from the markets. [32][33]. There are six types of internal resources: (1) organisational resources (corporate culture, quality control systems, and relationships); (2) physical resources; (3) financial resources; (4) human

resources; (5) intangible resources (e.g., goodwill, brand recognition, and reputation); and (6) technological capabilities (e.g., ICTs) [33][34].

Resources can also be intangible (e.g., employment of qualified personnel and internal knowledge of technology) or tangible (e.g., physical assets and financial capital) [17]. The shared use of tangible and intangible resources plays a vital role in firms' performances and the economies where they are located [35]. At least two resources are considered important for high-tech entrepreneurial firms: (1) the level of education of the entrepreneur, and (2) the investments in technology [36][37]. Entrepreneurial education complements technological resources, that is, to increase the firm's performance, human capital can help leverage the effects of technological resources [17][38].

Following the logic of the resource-based theory, a widespread access to ICT can provide entrepreneurs with access to new markets and new business ideas since a better knowledge and understanding of consumers, competitors, and markets is a critical and crucial resource for increasing responsiveness to markets and is a determinant of better business performance [27][39]. Thus, the great quantity of information qualified by access to ICTs is a valuable resource for entrepreneurs. Thus, the great quantity of information qualified by access to ICTs is a valuable resource for entrepreneurs, since this information is used as determinants for entrepreneurs to achieve competitive advantages [40].

3. Open Innovation Dynamic in Entrepreneurship

Open innovation has provided a new paradigm for businesses and economies [13][41]. Open innovation can be defined as using "intentional knowledge inputs and outputs" to accelerate internal innovation, allowing a firm to expand in markets for the external use of innovation [42]. Thus, open innovation is one of the approaches to innovation management that is, according to West and Gallagher [43], "systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels". In recent years, globalisation and rapid technological advances have led to the increasing dynamics of open innovations, leading to a new paradox of open innovation called the open innovation dynamic [44].

Open innovation consists of two dimensions: (1) open innovation input; (2) open innovation output [1]. Open inbound innovation consists of establishing relationships with external individuals or organisations to access their scientific and technical expertise. This can enable the improvement of internal innovation performance. Open input innovation is further considered to be a practice of leveraging the discoveries of others, i.e., it suggests that a company cannot consider only its R&D [41][45][46]. Concerning outbound open innovation, it can be defined as a practice of establishing relationships with other external organisations to commercially exploit their technological knowledge [1][47]. Thus, the outgoing open innovation should look for the market (externally) organisations that contemplate business models that are more appropriate for the commercialisation of a particular technology [47][48][49].

Currently, the relationship between open innovation and entrepreneurship must be explored, taking into account the digital economy [50][51]. In this digital context, interactions between different actors are fast and global, creating ideal conditions for entrepreneurship [52]. Thus, technological innovations are considered essential sources of new value creation, leading organisations to maximise profits. The motives of open innovation, namely those of open inbound innovation, contemplate the acquisition of new knowledge as well as increasing customer satisfaction [53][54].

It is necessary to study the benefit and proper development of open innovation activities from an external perspective, considering the elements that best use information [55]. Therefore, it is convenient to anticipate which capabilities benefit the information flow, both at the internal environment level (e.g., communication processes and culture) and the external environment level (e.g., information technology used and external collaboration) [56][57]. The ICT adoption by organisations is considered a key factor in the value creation process [55][58], and the ICTs can lower the costs of the open innovation dynamic and the complexity of innovation. Thus, an open innovation dynamic could eliminate the harmful consequences of inadequate knowledge [59]. If open innovation is implemented effectively, its momentum can drive new business creation activity and cause companies to have significant growth from small businesses to world leaders. In this way, open innovation not only changes companies and the business structure but can lead to economic growth [59][60].

Nowadays, technological tools process, store information, and allow the communication and exchange of information in different ways, contributing to the inclusion of innovation activities at various external and internal levels. ICTs enable the frequent cooperation of the actors involved in actions that work together, regardless of how complex they are, as the innovation process [57][61][62]. On the other hand, ICTs are considered key elements by organisations for transforming and assimilating knowledge and information into competitive advantages, which come from the innovation process [55].

4. ICT Access and Entrepreneurship

Access to ICTs facilitates the creation of new enterprises and boosts their development and growth [63]. Thus, entrepreneurs can benefit from access to ICTs for several reasons: (1) the development of ICTs increases and facilitates the ability of entrepreneurs to create, collect, process, and interpret information [64]; (2) it boosts an environment conducive to new ideas and new business opportunities namely, in online markets, encouraging the creation of new businesses [63]; (3) it increases entrepreneurs' motivation through the social influence on ICT-facilitated interactions of an entrepreneur with other entrepreneurs, making entrepreneurs more aware of the benefits of ICT use and endowing them with greater market intelligence capable of more assertive and quicker responses [65][66][67]; (4) it enhances the effective communication and information exchange, enabling entrepreneurs to coordinate multiple consumers in entrepreneurial activities, reducing uncertainty and increasing the possibility of greater entrepreneurial success [67].

In this entry, the access to ICTs is represented by mobile-cellular telephone subscriptions, individuals using the internet, and fixed-broadband subscriptions. Researchers use these ICTs as determinants of entrepreneurial

activity for several reasons. First, the growth of mobile-cellular telephones, the internet, and fixed-broadband subscriptions is stagnating due to their increasingly widespread access, but the conditions and ease of access are not equal in all countries. That is, in all countries, the efficient access to these ICTs should be a primary condition. On the other hand, internet access is a fundamental resource for mobile technology, integral to the information society [16]. The use of mobile phones and the internet has catapulted the diffusion of ICTs [68], and as such, has increased the quality and quantity of the information available for innovations, enhancing the crucial role of entrepreneurship [69][70]. The access to broadband internet has also boosted the business environment, accelerating entrepreneurship through the lower costs of starting a new business and facilitating the creation of networks between entrepreneurs, customers, suppliers, and competitors [63][71][72]. The effective and efficient communication and information exchange among the various participants in entrepreneurial activity is facilitated by access to ICTs, reducing the risk and uncertainties inherent in the entrepreneurial process and increasing the chances of business success [67].

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