Resource-Based Perspective on ICT Use and Firm Performance: A Meta-analysis Investigating the Moderating Role of Cross-Country ICT Development Status

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ABSTRACT:

Although there is a stream of literature that considers the use of Information and Communication Technology (ICT) to be an advantage-seeking entrepreneurial activity resulting in superior business performance, the findings regarding the impact of ICT use on business performance are heterogeneous in the existing literature. Consequently, a meta-analysis is required in order to comprehend the direction and scope of this relationship, taking into account the national ICT development status across countries. Hence, with a theoretical grounding in the Resource-Based View (RBV), this meta-analysis combines research studies spanning a twenty-two year period (147 studies) on how a country's national ICT development status impacts the relationship between the use of different ICT tools, categorized as either General Purpose Technology or Enabling Technology, and firm performance by applying both bivariate and meta-regression analyses.

KEYWORDS:

Meta-analysis; Resource-Based View (RBV); Enabling Technology (ET); General Purpose Technology (GPT); Information and Communication Technology (ICT); Firm Performance; ICT Development Index; Competitive Advantage

1. INTRODUCTION:

The concept of Industry 4.0 (also known as the Fourth Industrial Revolution), which reflects fundamentally new ways in which technology becomes embedded into aspects of human life, including enterprises, has sparked considerable interest from academia and practitioners in recent years (Shao et al., 2021). In this era of the Fourth Industrial Revolution, Information and Communication Technology (ICT) has come to replace Information Technology (IT) as an essential resource for achieving strong business performance (Koh, Orzes and Jia, 2019). There are fundamental differences between the role of IT and ICT. The

latter is used to help obtain and impart (communicate) information more effectively with the help of technology, whereas IT is simply used to manage information more effectively with the aid of technology. Hence, communication is one of the core foci of ICT in the current era (Kumar, Zindani and Davim, 2019).

During recent years, the world has witnessed significant developments in ICT in terms of the inclusion of new and more advanced tools which have come to be increasingly used in business. One stream of prior research has reported that ICT acts as a means of achieving a competitive advantage (Kodama, 2021) by integrating a firm's process, products, and services (Kodama, 2021). ICT use has also been described as an advantage-seeking entrepreneurial activity (Zhang and Li, 2018). However, in spite of the widespread belief that ICT is an essential element of a firm's survival and growth (Škare and Soriano, 2021), the extant literature on the relationship between ICT use and firm performance does not offer any real consensus or conclusive results[1] (DeStefano, Kneller and Timmis, 2018; Popa, Soto-Acosta and Perez-Gonzalez, 2018), largely due to the various types of ICT tools that have been explored in different countries. To consolidate these disparate views and findings from different countries, it is necessary to conduct a meta-analysis to examine potential trends within this domain.

Previous meta-analyses in relation to this topic have predominantly explored the impact of IT on firm performance in general terms (Liang, You and Liu, 2010), as well as various other issues such as IT-business strategic alignment (Gerow et al., 2014), and the productivity paradox (Polák, 2017). These studies have not considered the "communication" aspect of IT, and hence, none have investigated the impact of ICT in its totality[2]. In addition, none of the

[1] These varied outcomes from the primary studies can be broadly categorized as follows: negative outcomes (Ganbold, Matsui and Rotaru, 2020; Viete and Erdsiek, 2020); a zero outcome (Chen, Liu and Song, 2020); conditional positive outcomes (Loukis, Janssen and Mintchev, 2019; Cataldo, Pino and McQueen, 2020) and direct positive outcomes (Kumar and Ganguly, 2020; Vafaei-Zadeh et al., 2020).

[2] A number of prior meta-analyses have been conducted on the topic of IT and business performance. For instance, in their seminal paper, Kohli and Devaraj (2003) explored the impact of IT on business performance in firms. Sabherwal and Jeyaraj (2015) examined the same topic but added more empirical research to their study and its findings. Other studies such as that by Liang, You, and Liu (2010) have used similar methods to investigate the impact of IT on firms' business performance, but from a theoretical perspective (RBV). In their respective analyses, Lim et al. (2011) and Ada, Sharman and Balkundi (2012) explored the impact of IT investment on firms' financial performance and are specifically mentioned because IT investment is one of the preconditions of IT use (Chae, Koh and Park, 2018); thus, they provide useful comparisons. None of these meta-analyses have examined communication technologies as well as information technologies. Moreover, some aspects of the business value of information and communication technology (BVICT) remain unexplored in these meta-analyses, and thus

previous meta-analyses have taken into account the impact of a country's IT/ICT infrastructure on the relationship between ICT use and firm performance. Therefore, this represents a significant research gap[3]. The topic is worthy of exploration because, as previously mentioned, a firm's ICT infrastructure is regarded as a key resource that can be utilised to gain a long-term competitive advantage (Chiu and Yang, 2019; Tan, Ng and Jiang, 2018), and the effect of firm-level ICT or ICT infrastructure is largely dependent on a country's national ICT infrastructure (Wu, Feng and Wang, 2021).

There is evidence in the existing literature (e.g. Abdullah et al., 2018; Bürer et al., 2019; Greenstein, 2020) to suggest that basic elements of ICT infrastructure such as electricity, affordable bandwidth, and government structures must be implemented at the country level in order for ICT to be effectively adopted and used at the firm level. Many studies have pointed out that failing infrastructure, low levels of education, expensive internet access, and weak governance constitute major obstacles that can prevent developing countries from achieving a level of ICT infrastructure on a par with developed countries. This is in line with some prior studies (e.g. Rice and Martin, 2020; Tan, Ng and Jiang, 2018) that have reported that disparities relating to a country's ICT infrastructure are closely linked to its economic growth, which helps to explain why developed countries tend to have superior, better-equipped ICT infrastructures to developing countries.

These wide variations between countries (especially between developed and developing countries) in terms of their ICT infrastructure (ITU, 2019), as well as in the proliferation and exploitation of ICT resources, means that the influence of ICT also varies from one country to another (Dagnino, Picone and Ferrigno, 2021). Earlier IT-related meta-analyses did not consider country-level variations in terms of ICT infrastructure. However, it

require immediate attention. For example, the moderating impact of ICT infrastructure (ICT development status) has so far been overlooked in the context of the BVICT) using a meta-analysis.

[3] Evidence from the existing literature suggests that the ICT infrastructure at a country level remains crucial with regard to the access and use of ICT tools (Das, Singh and Joseph, 2017; Madon and Krishna, 2018). Therefore, it is crucial to consider this contextual factor when exploring the impact of ICT use on the business performance of firms in its totality. A meta-analysis constitutes the best method for doing this as it is able to synthesize the findings of various empirical studies conducted in different countries with varying levels of ICT infrastructure and, hence, can provide a deeper understanding of the relationship between ICT use and firm performance. Importantly, this kind of more in-depth understanding includes "the universality" of the relationship between the use of ICT tools and firm performance. Because a meta-analysis examines primary studies conducted worldwide, its results will be more generalizable with regard to the topic under investigation, which is almost impossible to achieve via a single empirical study.

is commonly believed that a country's ICT infrastructure is of paramount importance for international business activities and firm competitiveness (IMD, 2019). Therefore, conducting a meta-analysis will address this research gap by exploring how ICT infrastructure development in different countries modifies the influence of ICT use on firm performance.

To analyse the relationship between ICT use and business performance, we adopted the RBV lens. Over the past three decades, the RBV has become firmly established as a widely used theory to explain differences in firm performance (Alexy et al., 2018). The RBV maintains that a firm's superior performance or competitive advantage is determined by its ownership of strategic resources (Chen, Michel and Lin, 2021). A resource qualifies as a strategic resource if it is valuable enough to either reduce expenses or enhance value for customers, is rare in the sense that competitors are unable to access the same resource(s) to create similar value, and hard to substitute or imitate, thus making it difficult for competitors to achieve parity (Chen, Michel and Lin, 2021).

It is debatable whether ICT meets these aforementioned criteria that would allow it to be regarded as a strategic resource (Huemer and Wang, 2021). For example, some ICT tools are so widely used that they can no longer be considered rare and inimitable. Consequently, competitors can easily purchase them (e.g. hardware-related technology) or implement the same ICT project (Meral, 2019). However, other ICT tools are still rare, inimitable, and non-substitutable, as well as being valuable, due to their design or novel configuration (Amit and Han, 2017), subject to the pace of change of a country's ICT infrastructure and the prevalence of ICT use in that country. This is consistent with the categorization of technology into General Purpose Technology (GPT) and Enabling Technology (ET based on whether they are widely used or not (Teece, 2018). Thus, we classified widely used and basic ICT tools such as mobile phones/telephony, computers, etc., as GPTs and less widely used and advanced technologies such as Enterprise Resources Planning (ERP), Information Management System (IMS), cloud computing, big data, artificial intelligence (AI), etc., as ETs. Due to their exclusivity (Teece, 2018), those ICT tools categorised as ETs meet all the criteria (valuable, rare, inimitable, and non-substitutable) to be considered strategic resources of a firm, irrespective of whether they are used separately or alongside GPTs. Hence, this research explores the effect of their usage, either separately or in conjunction with GPTs (strategic ICT tools), on firm performance to

accurately capture the value of ICT in firms, thus avoiding mismeasurement[4]. As no prior meta-analysis has explored this aspect of ICT use on firm performance, this study contributes to several streams of literature by exploring the following research questions (see figure 1[5] in appendix):

1. What is the impact of using ETs on the relationship between ICT use and firm performance?

2. What is the combined impact of using GPTs and ETs on the relationship between ICT use and firm performance?

3. How does considering the ICT development status of different countries explored in the primary studies moderate the effect of ET use on the ICT use-firm performance relationship?

4. How does considering the ICT development status of different countries explored in the primary studies moderate the effect of the combined use of GPTs and ETs on the ICT use-firm performance relationship?

By exploring the relationship between ICT use and business performance and taking the impact of national ICT development on that relationship into account, this research contributes to evidence-based research in the fields of ICT, business strategy, strategic entrepreneurship, business performance, and the international business environment. Importantly, while contributing to the understanding of how ICT tools classified as ET can be considered as strategic resources for enhancing a firm's competitive advantage, this study also recognizes that not all ICT tools act in this manner. For example, ICT tools that come under the GPT category cannot be regarded as strategic resources for creating competitive advantages. However, this study also acknowledges that some GPT tools are a precondition of using certain ET tools and hence help to clarify the use of ET as a strategic resource and contribute to the RBV.

[4] A closer examination of the extant literature indicates that mismeasurement is likely to be a prime cause of the real value of ICT in firms not being captured (Gebauer et al., 2020).

[5] Our theoretical model, along with the research questions, is delineated in figure 1.

With the growing popularity of the RBV, this meta-study contributes to the international business strategy and strategic entrepreneurship literature by assessing the extent to which broader constructs such as the use of ICT (both ETs alone and GPTs and ETs together) as strategic resources impact business performance in different countries. It also makes a significant contribution to the business performance/firm performance[6] literature as business performance is one of the key constructs of this paper.

Secondly, the majority of the previous meta-analyses on this topic have investigated the topic of IT investment, whereas we specifically examined the use of ICT. According to Devaraj and Kohli (2003), IT investment is not the key driver for securing IT payoff; rather, the actual usage of individual technologies is the major driver. Therefore, by exploring the impact of ICT use on business performance and further investigating the moderating role of country-level ICT development on this relationship, this paper also adds value to the ICT literature.

Thirdly, none of the ICT impact-related meta-analyses in the existing literature have taken factors relating to country-level infrastructure into account, which usually have a significant effect on the successful adoption and use of ICT in firms (Greenstein, 2020). As this study does so, it adds further value to the literature on the international business environment by explaining the moderating role of ICT development at a national level in the relationship between the use of ICT and business performance. For example, the effect of using ICT as a strategic resource in a developed country will be different to using it in a developing country. Multinational corporations or international firms therefore need to take the ICT development context of a country into account when developing their strategic ICT resources.

The rest of this paper is organized as follows. In the "Literature review and research framework" section, we carry out a literature review of the relationship between ICT use and business performance from an RBV perspective to consolidate various independent, dependent, and moderator variables applied in the primary studies to develop our research model. The "Research methodology" section then explains how we conducted our literature search and the

[6] Up to this point in the study, we have used the terms business performance and firm performance interchangeably. However, hereafter, we solely use the term business performance for consistency because business performance is a key construct of strategic entrepreneurship and is also commonly used in research relating to various other disciplines.

selection strategy used, covering the inclusion criteria, coding, and method of analysis. This is followed by the "Results" section, which reports the results of the analysis. Finally, in the "Discussion and Conclusion" section, we summarize the key findings and limitations, and suggest avenues for future research.

2. LITERATURE REVIEW AND RESEARCH FRAMEWORK:

2.1. The resource-based view (RBV):

The RBV, which claims that the key resources of a firm determine its competitive advantage, has become a pre-eminent theory in the field of business strategy (Chen, Michel and Lin, 2021) over the last 40 years. It originated from Penrose's (1959) seminal work, which describes a firm as an amalgamation of productive resources and explains how these current key resources impact the firm's future growth by dint of effective utilization (Pereira and Bamel, 2021). Wernerfelt (1984) concurred with this view but added that resources serve to facilitate effective strategies in relation to the product market. Scholars such as Amit and Schoemaker (1993), Barney (1986, 1991), Collis and Montgomery (1995), and Peteraf (1993) reinforced this theory by developing specific criteria for organizational resources to be qualified as 'strategic resources,' which help firms to formulate strategies that can be employed to create and maintain competitive advantages.

According to the RBV, resources are heterogeneously dispersed among firms, and some resources are not entirely substitutable or imitable (Barney, 1991). When a firm has distinctive groups of resources, this is referred to as "resource heterogeneity" (Peteraf, 1993). If it is not possible for competitors to imitate a firm's resources, this is known as "imperfect imitability" (Barney, 1991). If there are no substitute resources available that can be used to formulate and deploy strategies as effectively or efficiently as the original resources, those resources are regarded as being "non-substitutable" (Barney, 1991; Falahat et al., 2020). Strategic resources help firms to gain competitive advantages by generating economic value (Alexy et al., 2018). Moreover, these competitive advantages have a higher likelihood of becoming sustainable in the long term because strategic resources cannot be easily replicated (Maury, 2018). Therefore, firms that possess strategic resources should enjoy sustained competitive advantages over their competitors who lack them (Chen, Michel and Lin, 2021).

While competitive advantages are difficult to quantify (Cannon et al., 2020; Ketchen, Hult and Slater, 2007), numerous scholars have tried to empirically connect strategic resources with business performance (Huemer and Wang, 2021). The underlying argument is that if strategic resources are related to business performance, then they should result in a competitive advantage (Alexy et al., 2018). Since the term competitive advantage is "generally used to describe the relative performance of rivals in a given (product) market environment" (Peteraf and Barney, 2003: 313), many scholars have used it as a synonym for business performance (Alexy et al., 2018). Consequently, according to the RBV, the extent to which a firm possesses strategic resources should have a proportionately positive impact on business performance (Alexy et al., 2018).

2.2. Use of ICT as a strategic resource and its impact on business performance:

The term ICT has been defined in diverse ways that extend beyond hardware and software in the existing literature. ICT covers a broad range of contextual factors related to its diverse uses in firms (Amankwah-Amoah and Hinson, 2019). It is an inclusive term that incorporates an array of tools and applications ranging from simple technologies like mobile telephony and the Internet to more complicated and sophisticated technologies such as computer science, information systems, ERP, etc. Such tools are used to save, operate, and transmit information such as content, voice recordings, pictures, etc. (Mourtzis et al., 2019). In the current era of Industry 4.0, ICT also encompasses intelligent machines (e.g. smart supply chain management systems), The Internet of Things[7], The Internet of Services[8], and smart factories[9] (Shao et al., 2021).

[7] The Internet of Things (IoT) connects various devices to the Internet or other devices to enable them to do new things in addition to what they can already do. For example, an IoT device may be managed remotely, or one could receive alerts and status updates from IoT devices. Alexa, Amazon's voice assistant, is among the most comprehensive IoT services, as it has the ability to operate more smart home devices than Google Assistant or Siri (Hassan, 2018).

[8] As a result of rapid technological advances, most electronic equipment can now be connected to the Internet or a smartphone. However, its utility is hampered by the complexity that arises from the wide range of smart gadgets and electronics available. The Internet of Services aims to create a link between all connected smart devices to get the most out of them by making the integration process simpler (Hassan, 2018).

[9] The smart factory is a flexible system that can optimize its own performance across a larger network. The true power of the smart factory lies in its ability to evolve and grow in tandem with an organization's changing needs, such as shifts in customer demand, expansion into new markets, development of new products or services, more

As previously mentioned, there is a debate about whether or not ICT, which is an extension of IT, should be considered as a strategic resource. Rice and Martin (2020) argued that ICT is a strategic resource, the effect of which is likely to differ between companies. If they have staff who know how to use it efficiently, companies can use ICT as a source of competitive advantage. The effective use of ICT is a key factor in a firm's success. A firm's competitive advantage is determined both by endogenous forces such as resources and capability, and exogenous forces such as its market position within the industry (Huang et al., 2015; Alexy et al., 2018). The competitive advantage conferred by effective ICT usage can be either temporary or sustainable. It will only be sustainable if a firm's ICT is valuable, rare, inimitable, and non-substitutable, whereas if it is merely valuable and rare, the advantage will be temporary (Chen, Michel and Lin, 2021).

A number of studies within several streams of research have captured the impact of ICT use on organizational performance, from various theoretical and empirical perspectives. The lack of integration of these divergent approaches has resulted in considerable ambiguity. Earlier research tended to focus on ICT conceptually, and frequently employed the RBV, arguing that organizations can be differentiated based on their ICT-related resources, which create organization-specific capabilities and can contribute to sustainable competitive advantages (Luo et al., 2018; Mitra, O'Regan and Sarpong, 2018). Empirical research has shown that ICT use can improve profit ratios or Tobin's q ratio (Al-Busaidi and Al-Muharrami, 2020) and can catalyze firm-specific assets in the process of international diversification (Lee, Kogler and Lee, 2019). In the past few decades, however, a debate has emerged about whether IT matters (Polák, 2017), with some scholars arguing that numerous firms have not only overestimated its value but have also overspent on IT.

In tandem with the aforementioned trend, the investigation of ICT has recently developed in a new direction. Leonardi and Treem (2020) argue that advances in firms' ICT usage have become apparent, involving a progression from GPTs to ETs (Bresnahan and Trajtenberg, 1995; Teece, 2018). As previously mentioned, we have followed this categorization of ICT into GPTs and ETs in our meta-analysis.

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predictive and responsive approaches to operations and maintenance, the incorporation of new processes or technologies, or near-real-time production changes (Nayyar and Kumar, 2020).

2.2.1. Use of GPTs as a non-strategic resource and their impact on business performance:

The key qualities of GPTs are their ability to be widely used, to be capable of continuous technical improvement, and to catalyze complementary innovations within the sectors where they are applied. Examples of ICT tools that are categorized as GPTs (Maurseth, 2018) include fixed-line telephones, mobile phones, computer hardware and software, the Internet, and online social media. With more than 5.2 billion global subscribers (GSMA, 2020), mobile telephony is one of the most widely used GPT tools, which offers transformative opportunities by providing internet access to its 3.8 billion subscribers. In terms of business use, mobile telephony and the Internet provide essential connectivity to firms which allows them to access their customer base from anywhere (Martínez-Caro et al., 2020; Rochet and Tirole, 2006).

GPTs improve over time, and as they do so, they become more widely applied across firms, resulting in overall productivity gains for the whole economy (Bresnahan and Trajtenberg, 1995; Guerrieri and Padoan, 2007; Howell, van Beers and Doorn, 2018). Hence, as their use becomes more extensive, GPTs do not remain rare and inimitable. Consequently, GPTs do not meet the criteria for being regarded as strategic resources, and, as a result, they cannot bring about firm-specific sustainable competitive advantages on their own.

2.2.2. Use of ETs as strategic resources and their impact on business performance:

The term Enabling Technology (ET) was first coined by Teece in 2018 within the strategy literature, and he claimed that ETs are extensions of GPTs. ETs are similar to GPTs in terms of their capacity for continual technological improvement and ability to catalyze complementary innovations. However, ETs differ from GPTs in one important respect, namely that they are not as widely used as the latter (Teece, 2018).

ETs meet all the criteria (valuable, rare, inimitable, and non-substitutable) for being regarded as a strategic resource of a firm. Because they are not widespread across the economy (Teece, 2018) but are exclusive to a few firms, ETs fulfil the resource heterogeneity condition of the RBV. Consequently, ETs create a competitive advantage for a firm. Moreover, complementary capabilities development in terms of a firm's human resources remains a precondition for the deployment and optimum utilization of ETs (Benitez et al., 2018; Ram, Corkindale and Wu, 2015). Therefore, it is difficult for competitors to imitate ETs because they

not only require the technological infrastructure but also the technological know-how in regard to human resources (Benitez et al., 2018; Ram, Corkindale and Wu, 2015), as well as considerable investment (Glyptis et al., 2020) in order to replicate the success of a competing firm's ETs. Additionally, ETs provide unique benefits or value such as rendering new business opportunities, and acting as the foundation of organizational strategies and business models (Raut et al., 2019), which no GPTs can substitute. Therefore, according to the RBV, ETs meet the necessary criteria for being a firm-specific strategic resource. As per the aforementioned definition of ETs, several ICT tools fulfil the requirements of being considered as ETs, for example, AI, cloud computing, machine learning, IMS, Customer Relationship Management (CRM), and e-commerce[10] (Won and Park, 2020).

According to Munoko, Brown-Liburd and Vasarhelyi (2020), the typical benefits offered by GPTs are now regarded as insufficient for firms and their stakeholders as they expect technologies to provide more sophisticated benefits than in the past. These expectations include catalyzing further innovations, increasing customer engagement, improving revenue growth, and enhancing profitability. It has become problematic for many organizations to try to meet all these demands simultaneously through GPTs alone; therefore, ICT tools categorized as ETs offer an excellent solution because they provide comprehensive benefits (Björkdahl, 2020). Although opponents of ETs contend that they increase service delivery costs because the increasingly sophisticated nature of these technologies makes them comparatively expensive (Glyptis et al., 2020), proponents of ETs argue that, by providing improved responsiveness and better utilization of existing resources, they have a positive impact on business performance in terms of increased product/service reliability and availability, better product/service design, less manual supervision, a more streamlined supply chain, and improved client service. All these factors, in turn, contribute to reducing the service delivery costs of a firm (Glyptis et al., 2020).

As per the above discussion, we propose the following hypothesis to test the impact of the use of ETs as strategic resources on business performance:

[10] The growing use of augmented reality and innovative features within e-commerce means that it meets the criteria to be regarded as an ET (Yim et al., 2017). E-commerce is an electronically mediated exchange of information between an organisation and its external stakeholders (Chaffey, Edmundson-Bird and Hemphill, 2019).

H1: Use of ETs as strategic resources has a positive effect on business performance.

2.2.3. The combined use of GPTs and ETs and their impact on business performance:

As mentioned earlier, GPTs are widely used and provide value across the economy (Bresnahan and Trajtenberg, 1995; Guerrieri and Padoan, 2007; Howell, van Beers and Doorn, 2018). Hence, GPTs do not fulfil the preconditions of being rare/heterogeneous, inimitable, and non-substitutable in the way that ETs do. Consequently, the value provided by GPTs alone cannot ensure a firm-specific competitive advantage, meaning that they cannot be regarded as strategic resources. Conversely, ETs fulfil all the criteria for qualifying as firm-specific strategic resources, and they enable better utilization of existing resources such as GPTs when they are used in combination (Martínez-Caro et al., 2020). Hence, when GPTs and ETs are used together in a firm, they can be regarded as a strategic resource because they fulfil the criteria of being valuable, rare, inimitable, and non-substitutable, and thus can create a sustainable competitive advantage.

It is worth mentioning that some GPTs act as preconditions for using ETs. For example, having access to a computer is a precondition of ERP, but other ICT tools in the GPT category, such as a mobile phone or internet access, are not necessary. However, e-commerce (via a website) can be used on either mobile phones or computers, and an internet connection is necessary in order for this to happen (Chi, 2018; Petit, Velasco and Spence, 2019). Furthermore, if firm-specific IMS is required, access to a computer or a mobile phone is sufficient; an additional internet connection is not necessary. Finally, in the case of cloud computing, a computer or a mobile phone with an internet connection is required. When we refer to the combined use of ETs and GPTs, this means that their use is combined for a particular purpose. For example, a computer, mobile phone, website, and ERP are used simultaneously in order to create sales reports, which helps increase a firm's effectiveness[11]. However, if ERP is used for supply chain purposes, and the computer is merely a platform to enable ERP to function, it cannot be claimed that ERP and computers are being used in combination. Rather, ERP is being used singularly. Thus, the most important consideration is

[11] Firms' effectiveness is considered to be a performance indicator.

the purpose for which technology is being used, which is the key reason why we categorized ICT tools into GPTs and ETs in this meta-analysis.

When GPTs and ETs are used together in a firm, they increase productivity by influencing every distinctive aspect of the process, including organizational procedures and schedules, product and process-related knowledge, the organization of production and service facilities, regulatory mechanisms, and financial organization and managerial coordination practices (Martínez-Caro et al., 2020). They also decrease the cost of accessing information and participating in markets (Howell, van Beers and Doorn, 2018).

As per the above discussion, we propose the following hypothesis to test the impact of combined use of GPTs and ETs on business performance:

H2: Combined use of GPTs and ETs as strategic resources has a positive effect on business performance.

2.3. Contextual moderators of the ICT use-business performance relationship:

2.3.1. Impact of Country-level ICT development on the ICT use-business performance relationship:

Evidence from the existing literature indicates that the availability of a robust ICT infrastructure remains crucial for firms to be able to access, implement, improve, and make more effective use of ICT tools (Madon and Krishna, 2018). For example, a robust ICT infrastructure at a national level is essential for facilitating the development and implementation of ETs such as e-commerce at the firm level (Madon and Krishna, 2018), and will enable such technology to be used more effectively. Similarly, the use of ERP at the firm level in different countries also depends on the ERP infrastructure (Tchamyou, Erreygers and Cassimon, 2019). Despite the benefits of having a strong ICT infrastructure, there are significant discrepancies in terms of ICT infrastructure development between different countries, particularly between developed and developing countries, as explained in the introduction. . These inequalities in terms of ICT development status affect access to and the use of ICT tools across countries (Pradhan et al., 2021) which, in turn, affects the payoff of ICT use in firms as more effective use of ICT results in better output (Devaraj and Kohli, 2003; De Luca et al., 2020).

However, such differences also vary according to different ICT tools. The extensive use of GPTs in both developed and developing countries (Liu et al., 2019) supports the view that the GPT-related ICT infrastructure in developing countries is not drastically different to that of developed countries. By contrast, the use of ETs has not yet become prevalent in developing countries in the way that it has in developed countries (GSMA, 2020). Therefore, it can be assumed that the ET-related ICT infrastructure in developing countries is inferior to that of developed countries. Consequently, infrastructure development remains an important factor which impacts the relationship between ET use and business performance (Tchamyou, Erreygers and Cassimon, 2019). Therefore, based on the above discussion, we propose:

> ***H3:*** More improved ICT infrastructure in the country of primary study impacts the ICT use-business performance relationship positively when ETs are used as strategic resources.

As mentioned previously, the combined use of GPT- and ET-related ICT tools results in an increase in yield, productivity, and efficiency for firms by improving coordination and communication with relevant stakeholders, internally as well as externally. Their combined use also catalyzes innovation and leads to better decision-making via the more effective utilization of information and knowledge (Martínez-Caro et al., 2020; Yadav, Shankar and Singh, 2020). However, it is unlikely that the combined deployment and use of GPT and ET tools will occur if a country's national ICT infrastructure does not provide the necessary support (Dwivedi et al., 2019; Rogers, 2001). This leads to the following hypothesis:

> ***H4:*** More improved ICT infrastructure in the country of primary study impacts the ICT use- business performance relationship positively when GPTs & ETs are used combinedly as strategic resources.

As mentioned earlier, the use of GPT-related ICT tools has become so widespread globally (be it in developed or developing countries), (Liu et al., 2019) that they have come to be regarded as a basic necessity for every firm (Agarwal and Audretsch, 2001; Strømmen-Bakhtiar, 2020). They are now so pervasive at the firm level that it has become difficult to measure the actual payoff of these tools. For example, it is almost impossible to quantify precisely how they create an extra sale or an extra unit of profit, particularly as firms do not pay sufficient attention to monitoring that. Furthermore, due to attempts to reduce costs and minimize training needs, firms do not always utilize GPTs in an optimum way, which is one

reason why the value rendered by GPTs is less than their potential. Additionally, most GPT-related ICT tools are so widely used that their contribution to business performance can be diluted by other factors. This is consistent with Feeny and Ives' (1997) and Gupta and Bose's (2019) view, who asserted that only radically new resources can provide value to businesses as opposed to existing resources which are already over-used. This is also consistent with Millar's theory, which claims that because some ICT tools are such a widely available commodity, they do not add any value to a firm's output (Fountaine, McCarthy and Saleh, 2019; Schubert and Leimstoll, 2007).

In contrast, ETs are, by definition, used for a specific purpose (Teece, 2018). For example, e-commerce is specifically targeted at creating profit via online sales. Because their purpose is so specific and focused, it is easy to measure an additional unit of revenue generated by ETs compared to GPTs. These tools also have mechanisms by which their actual contribution can be measured. For example, e-commerce (websites) can reveal how many sales are generated online. Therefore, when ETs are used alone, it is possible to measure their contribution accurately without the risk of it being diluted by other factors. Moreover, firms take extra precautions when using ET tools and assessing their value because the implementation and usage of ET tools incurs considerable costs and requires extensive training (Davenport, 2018). Therefore, ET tools are often more effective at providing unique benefits for firms (Raut et al., 2019) and/or sustainable competitive advantages. Correspondingly, when GPTs are used alongside ETs (such as ERP), the results of their joint payoff are usually diminished compared to the payoff achieved by using ETs alone.

GPTs, such as mobile phones, are now less dependent on countries' national ICT development status (James, 2012; Lashitew, van Tulder and Liasse, 2019). However, this is not the case with ETs as they are unequally distributed between different countries, and their deployment is comparatively more dependent on the national-level ICT development status. For example, the ERP infrastructure at a national level affects the adoption and use of ERP tools in firms located in that country (Tchamyou, Erreygers and Cassimon, 2019).

Based on the above literature review, we posit:

H5: More improved ICT infrastructure in the country of primary study impacts the ET use-business performance relationship more than the combined use of ET and GPT-business performance relationship.

Based on the literature review, the research model showing the hypothesized relationships for the meta-analysis is illustrated in figure 2.

<Insert figure 2 here>

3. RESEARCH METHODOLOGY:

We verified the proposed models and hypotheses by applying a meta-analysis approach which consists of techniques that can be used to investigate the coefficients reported in earlier empirical studies (Ohiomah, Benyoucef and Andreev, 2020; Saeed, Yousafzai and Engelen, 2014) in order to obtain conclusive outcomes. Therefore, our meta-analysis explains the variance in the primary empirical studies that it examined. The primary empirical studies chosen for analysis were those that have explored the relationship between the use of different ICT tools and business performance. We adopted the following Research Methodology:

3.1. Literature search and selection strategy:

We comprehensively searched for primary studies on the topic under investigation published between January 1998 and December 2020. Initially, we searched the papers available in the EBSCO database (Business Source Elite), and then, to ensure the inclusion of all relevant data, we cross-validated our search with JSTOR Databases, ABI/INFORM, EconLit, ERIC (Expanded Academic Index), PsycINFO, Science Direct, and Wilson Business Abstracts (Caputo et al., 2018; Rialti et al., 2019). We applied various keywords related to ICT use and business performance (such as performance, business value, business payoff, profit, growth, ROE, ROI, ROS, and ROA) in our literature search[12]. We also used synonyms for ICT such as IT (Information Technology), IS (Information Systems), GPTs (General Purpose

[12] This was done following previous meta-analyses by Saeed, Yousafzai and Engelen (2014), Kohli and Devaraj (2003), and Sabherwal and Jeyaraj (2015) that used these keywords to search for literature relating to business performance.

Technologies), and ETs (Enabling Technologies) to search for primary studies on the topic. Additionally, we used keywords related to the use of specific ICT tools such as mobile phones, landline telephones, computers, laptops, software, hardware, internet/broadband, social media, e-commerce, ERP, IMIS (Integrated Management Information System), CRM, cloud computing, big data, machine learning, and AI, etc., in the literature search. The full list of keywords used in the search is provided in Table 1. In addition, a manual search was conducted (we looked on these journals' websites and searched relevant papers containing the previously mentioned keywords), including but not limited to the following journals:

Technological Forecasting and Social Change, Technovation, Journal of Management Information Systems, Journal of Information Technology, Information Systems Research, MIS Quarterly, Computers in Human Behavior, Decision Support Systems, Information and Management, Journal of Global Information Technology Management (JGITM), Journal of Global Information Management, Journal of Business Research, Journal of Small Business Management, Journal of Business Venturing, Journal of World Business, Strategic Management Journal, Academy of Management Journal, Entrepreneurship and Regional Development, International Journal of Information Management, Electronic Markets, Information management & computer security, Industrial Management & Data Systems, Internet Research, International Journal of Operations & Production Management, Information Economics and Policy, International Small Business Journal, Small Business Economics, Research Policy, Telematics and Informatics, European Management Journal, etc.

Thereafter, we searched the reference list of the primary studies obtained to find more papers on the topic.

<Insert Table 1 here>

To address the issue of duplicate studies[13] in our meta-analysis, we followed the guidelines provided by Wood (2008), according to which, no duplicate studies were detected in the meta-analysis.

3.2. Rules for the inclusion of studies in meta-analysis:

We adhered to the following inclusion criteria to develop the scope of this meta-analysis:

i) Studies were required to have an explicit focus on examining the association between ICT use and business performance in firms as the key research question.

ii) We did not consider qualitative research. The studies had to be quantitative and empirical as well as providing information regarding the relationship between ICT use and business performance.

iii) To be incorporated into the meta-analysis, the studies had to report the Pearson correlation coefficient for the predefined relationship.

3.3. Calculation and analysis of effect size:

Following a comprehensive search process, by the end of December 2020, we had collected and reviewed a total of 2,500 studies. After considering all the studies reviewed, based on the protocol set out in Section 3.2, we were left with 147[14] studies in our database.

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[13] Sometimes authors use the same data set in a conference paper or dissertation that they have used in a published study (Wood, 2008).

[14] Around 2,500 papers were found on the topic of "firm performance" and "information technology" among the search results obtained from databases such as EBSCO (searching Academic Search Complete), Business Source Complete, and the Psychology and Behavioral Sciences Collection. We narrowed those 2,500 papers down to 624 based on the inclusion criteria of considering only those studies that have an explicit focus on examining the association between ICT use and business performance in firms as the key research question. We further narrowed these down to 323 papers based on the inclusion criteria of considering only quantitative studies. Among these 323 quantitative studies, 122 reported Pearson correlation coefficient,113 studies reported that they only conducted descriptive analysis such as frequency, mean, etc. We then contacted the authors of the rest of the 88 papers that reported regression coefficient or Structural Equation Modeling (SEM) results. Normally, Pearson Correlation Coefficient is tested before conducting regression or SEM to check the multicollinearity issue (Kraha et al., 2012). Hence, we contacted the authors of those 88 papers. The outcome related to our contact to 88 authors was following:

- ✓ 25 authors shared the Pearson correlation coefficient. We used them in this meta-analysis,
- ✓ 11 authors informed that because of various reasons (such as loss of data due to a computer crash), they lost associated data. Hence, the Pearson correlation coefficient was not available for these 11 papers,

The number of primary studies we excluded based in each inclusion criteria is given in Table 2.

<Insert Table 2 here>

A list of the finally qualified 147[15] primary studies is provided in Table 3; each study is representative of an independent sample. Consequently, we obtained a solid empirical base (N= 280806) with which to conduct a meta-analysis (Ohiomah, Benyoucef and Andreev, 2020; Saeed, Yousafzai and Engelen, 2014). Sample sizes ranged from 8 (Devaraj and Kohli, 2000) to 100,000 (Hagsten and Kotnik, 2017), and effect sizes ranged from r = -0.81 (Bauer, Dehning and Stratopoulos, 2012) to r = 0.978 (Ojukwu, 2006). As bivariate meta-analysis has often been criticised for its inadequacies in evaluating multivariate relationships, we conducted both a bivariate analysis and a meta-regression. To validate our hypotheses, we applied the following rule:

<Insert Table 3 here>

A hypothesis is supported when both bivariate and meta-regression analyses result in its confirmation. A hypothesis is partly supported if either the bivariate analysis or meta-regression analysis confirms it.

We also explored the moderating effect of the ICT development status of the countries examined in the primary studies in this meta-analysis. To obtain the ICT development status of these countries, we used the 2017 (latest) ICT development index of countries, published by the International Telecommunication Union (ITU), a specialised agency of the United Nations. We used firm size, sample size, and control for industry vs. no control for industry, performance scope (i.e. i. firm profitability, ii. firm growth, and iii. other performance measures), and control for publication bias (published vs. unpublished studies) as control variables.

- ✓ 9 authors replied they did not conduct Pearson correlation coefficient,
- ✓ The rest of the 43 authors did not reply.

So, the final total of 147 (122+25) primary studies was achieved by considering only those primary studies that reported the Pearson correlation coefficient for the predefined relationship.

[15] Among these 147 primary studies, 123 are journal articles, 12 are dissertations, and 12 are conference papers.

3.4. Variable coding:

We created a coding manual to extract the necessary data from the chosen 147 primary studies and to minimize coding errors (Edeling and Himme, 2018; Lipsey and Wilson, 2001; Stock, 1994). We followed Sabherwal and Jeyaraj's (2015) strategy of having two coders independently coding the same set of studies in order to train them. They coded three rounds of randomly selected primary studies to ensure consistency across the codes. Any disagreements[16] were resolved through discussion, or, if necessary, the mediation of a third individual. It is worth mentioning that the level of agreement between the coders increased with each round. During these three rounds, we updated the coding manual when required before finalising the coding sheet. The interrater reliability measure, Kappa (Gwet, 2014), was calculated as 0.45 (moderate agreement), 0.67 (substantial agreement), and 0.85 (almost perfect agreement) for the 1st, 2nd, and 3rd round, respectively.

The coded variables included: the use of different ICT tools, firm size, sample size, control for industry vs. no control for industry, performance scope (profitability, growth, and other performance measures), publication bias (published vs. unpublished studies), cross country ICT infrastructure development status, and the statistics required to calculate the effect sizes.

Further details of the variable coding are provided in Table 4.

<Insert Table 4 here>

3.5. Meta-analytic procedures:

The Pearson product–moment correlation coefficient (r) was the most broadly applied measurement in our shortlisted primary studies. Hence, we collected the Pearson product–moment correlation coefficient for each study and took this as a representative indicator of the ICT use-business performance relationship. Two different methods are commonly used in the

[16] These related to the definitions of the variables, for instance, what options to include in the 'performance measure' variable.

meta-analysis process to combine study-related estimates (Hedges and Olkin, 2014; Hui et al., 2020): the fixed effect model and the random effect model.

We adopted the random effect model to calculate the mean correlations (Dahlgrün and Bausch, 2019; Schmidt, Oh and Hayes, 2009) because it produces comparatively more realistic evaluations related to average effect sizes, permits researchers to make generalizations about a population of studies, and provides clues to the variability in actual effect sizes across different studies (Raudenbush, 2009) in comparison to the fixed effect model. The random effect model infers that randomly distributed factors (Kisamore and Brannick, 2008; MacCann et al., 2020) along with sampling errors are responsible for creating variability in effect sizes. Consequently, we corrected the effect sizes in the random effect model for sampling errors and any other relevant factors.

We followed Lipsey and Wilson's (2001) method for correcting the effect sizes. We considered sampling errors, measurement errors, and a value ($\hat{v}$) which denotes the variability related to other sources, and which we assumed to be distributed randomly in the selected studies. In addition, a 90% confidence interval (CI) was computed around the estimated population correlation. The heterogeneity, moderator-related effects, and statistical tests of significance were calculated based on the sizes of the weighted effects of sample size (Samba et al., 2020; Schmidt and Hunter, 2014; Unger et al., 2011).

For the bivariate analysis, all the variables were dichotomized and divided into mutually exclusive groups in our study based on the underlying hypothesis to test the hypothesized associations between variables and effect sizes (Lipsey and Wilson, 2001). Subgroup analysis was conducted by running two or more meta-analyses for several subgroups to ascertain whether the subgroups contrasted in terms of their mean effect size (Schmidt and Hunter, 2014). However, in our meta-regression, sample-size weighted effect sizes ($\bar{r}$) were used, following the method employed by Samba et al. (2020), Saeed, Yousafzai and Engelen (2014), and Unger et al. (2011).

4. RESULTS:

H1, H2, H3, and H5 are supported by both the bivariate, and meta-regression analyses (details of the hypothesis test results are provided in Table 5). However, H4 is partially supported since it is confirmed by the bivariate analysis but not by the meta-regression analysis.

The detailed results of the bivariate analysis are given in section 4.1, and the detailed results of the meta-regression analysis are provided in section 4.2.

<Insert Table 5 here>

4.1. Bivariate analysis:

Firstly, we completed a bivariate examination (outlined in Table 6). We found comparatively larger effect sizes for studies that examined the use of ET tools ($\bar{r}_c$ [17]= 0.5157, k = 66) compared to studies that explored the combined use of GPT and ET tools ($\bar{r}_c$ = 0.3963, k = 39). The considerable Q- value relating to ET use (1766.1750, df=65; $p < 0.001$) indicates variability across the effect sizes, especially for studies which reported on the combined use of GPT and ET tools (16619.5757, df=38; $p < 0.001$). Hence, there is a strong likelihood of theoretically relevant moderators (Schmidt and Hunter, 2014). This supports our argument that relevant moderators and contextual factors affect the relationship between ICT use and business performance (Schmidt and Hunter, 2014).

Among the studies that examined the use of ET tools, we found a larger effect size for primary studies focusing on countries that are included in the ICT Development Index ($\bar{r}_c$ = 0.5207, k = 60) compared to those which investigated countries that are not included in the ICT Development Index ($\bar{r}_c$ = 0.3184, k = 6).

By contrast, in the case of primary studies that reported on the combined use of GPT and ET tools, we found a smaller effect size for those relating to countries that are included in the ICT Development Index ($\bar{r}_c$ = 0.3984, k = 35) compared to their counterparts that investigated countries not included in the ICT Development Index ($\bar{r}_c$ = 0.6405, k = 4).

We found comparatively larger effect sizes for studies that examined micro-sized firms ($\bar{r}_c$= 0.6203, k = 7) than for those investigating small and medium sized enterprises (SMEs) ($\bar{r}_c$ = 0.4030, k = 69), as well as mixed-sized firms ($\bar{r}_c$ = 0.5524, k = 56), and large firms ($\bar{r}_c$ = 0.1279, k = 15). Regarding controlling for publication bias, we found considerably larger effect

[17] $\bar{r}_c$ denotes reliability corrected random-effect mean effect size.

sizes for unpublished studies ($\bar{r}_c$ = 0.5008, k = 24) than for published studies ($\bar{r}_c$ = 0.2465, k = 123). In terms of industry, comparatively larger effect sizes were revealed for studies with no control for industry ($\bar{r}_c$ = 0.5004, k = 81) than for those studies that did control for industry ($\bar{r}_c$ = 0.3233, k = 66). Finally, relatively larger effect sizes were found for studies that took firm growth into account ($\bar{r}_c$ = 0.6191, k = 13) compared to those studies that used other performance measures ($\bar{r}_c$ = 0.4254, k = 108) and studies that examined firm profitability ($\bar{r}_c$ = 0.3261, k = 26).

We used Rosenthal's Fail-Safe N to investigate the publication bias issue (file drawer problem), and found that all of the constructs passed the (5k+10)[18] criterion established by Rosenthal (1979), indicating that studies not included in the meta-analysis do not pose a serious threat to the validity of the findings.

<Insert Table 6 here>

4.2. Meta-regression outcomes:

Thereafter, we carried out the meta-regression analysis (outlined in Table 7), which allowed the relative explanatory power of every contingency variable to be explored, taking other variables into consideration. The regression results indicate that the use of ET tools (β = 0.368, $p < 0.01$) is positively and significantly related to the ICT use-business performance relationship. Similarly, the combined use of GPT and ET tools (β = 0.143, $p < 0.1$) is positively and significantly related to the ICT use-business performance relationship, but the effect size is smaller than for that of ET tools alone.

The results suggest that ET use in countries with a more developed ICT infrastructure (β = 0.098, $p < 0.05$) is positively and significantly related to the ICT use-business performance relationship (Model 4 in Table 7). However, the combined use of GPT and ET tools in countries

[18] "Rosenthal (1979) proposed a criterion that the number of studies that the Fail Safe N should be just more than 5 times the number of studies (actually 5K + 10, where K equals the number of studies in the meta-analysis) that were included in the meta-analysis before the file-drawer problem could be reasonably ignored'' (Quintana and Minami, 2006:866).

with a stronger ICT development status (β = -0.088, p <0.1) is significantly but negatively related to the ICT use- business performance relationship (see Model 5 in Table 7).

Furthermore, a negative but statistically significant association was found for the ICT use-business performance relationship if industry was controlled for (β = -0.192, p <0.05). Likewise, firm size (β = -0.046, n.s.) affected the ICT use-business performance relationship in a negative and statistically non-significant way. However, controlling for publication bias (β = 0.076, p <0.01) affected the ICT use-business performance relationship in a positive and statistically significant way. Similarly, the sample size (β = 3.07e-06, p <0.01) had a small but positive and statistically significant influence on the ICT use-business performance relationship. Finally, we found that controlling for performance measures like firm profitability (β = -0.404, p <0.01) had a negative but statistically significant impact on the relationship between ICT use and business performance. Lastly, firm growth (β = -0.0596, n.s.) had a small negative and statistically non-significant impact on the ICT use-business performance relationship.

<Insert Table 7 here>

5. DISCUSSION AND CONCLUSION:

5.1. Main findings:

As mentioned previously, the lack of integration of the outcomes of studies that have examined the relationship between ICT use and business performance has resulted in considerable ambiguity, prompting a debate about whether IT matters or not. Carr (2003) initiated this debate by claiming that organizations may have tended to overspend on IT as a result of overstating its strategic value. The results of this meta-analysis refute this argument by showing that the utilization of most ICT tools (both ETs alone, and GPTs and ETs together) as strategic resources has a positive impact on the performance of a firm.

These influences differ according to the types of ICT tools used, and some ICT tools have a stronger impact on business performance than others when used as strategic resources. For example, H1, which expected the use of ETs as strategic resources to have a positive effect on business performance, received support in both the bivariate and meta-regression analyses.

This could be because of the nature of these ET tools, specialized knowledge is needed alongside training for their adoption and usage, and when they are embraced by firms, they exert a considerable positive influence on business performance. For example, the implementation and use of ET-related ICT tools such as ERP, cloud computing, e-commerce, IMIS, big data, and AI serve to enhance organizational performance, for example by increasing sales and resultant profitability, improving communication with stakeholders, enabling information to be better managed, streamlining supply chain management, providing one-stop services, and reducing the need for human labor (Gupta et al., 2019; Rialti et al., 2019).

Similarly, H2, which expected the combined use of GPTs and ETs as strategic resources to affect business performance positively, received support in both the bivariate and meta-regression analyses. However, in this case, the effect size was smaller for both analyses in comparison to that of ET use alone. This could be because GPTs are not regarded as a strategic resource, and hence they are only used as cost minimization tools which hinders their optimum use. Therefore, their actual value is rendered lower than their potential. This is consistent with the findings of Willcocks and Skyes (2000) and Chege, Wang and Suntu (2020), who claimed that, rather than using ICT resources as a cost minimization tool, they should be deployed as a strategic resource because this allows them to contribute to business performance in a more effective way. Additionally, most GPT-related ICT tools are so widely used that their contribution to business performance can be diluted by other factors. This is consistent with Feeny and Ives' (1997) and Gupta and Bose's (2019) argument that only radically new resources can provide value to businesses rather than overtly used existing resources. Hence, when GPT- and ET-related ICT tools are used in combination in an organization, their joint impact on business performance decreases.

In addition, the very nature of GPT-related ICT tools makes it difficult for them to directly impact organizational performance in isolation, without acting in a complementary manner with other business functions (Teece, 2018). This is in accordance with the concepts of resource complementarity (Marvel, Sullivan and Wolfe, 2019) and organizational capabilities (Neirotti, Raguseo and Paolucci, 2018). Consequently, although GPT-related ICT tools are considered valuable organizational resources which can enhance business performance, they may not be sufficient to generate sustained business performance alone (Roßmann et al., 2018). Instead, these tools impact business performance via complementary relationships with other resources such as ETs, as well as firms' capabilities, for example,

technological knowledge of human resources (Helm, Endres and Hüsig, 2019; Hirschheim, Heinzl and Dibbern, 2013). Although the RBV acknowledges the importance of resource complementarily in firms, the theory cannot fully explain it. Hence, it is vital to refine this component of the theory in order to increase the relevance of the RBV to GPT-related analysis.

H3, which posited that more improved ICT infrastructure in the country of primary study impacts the ICT use-business performance relationship positively when ETs are used as strategic resources, received support in both the bivariate and the meta-regression analyses. The implementation and usage of ET tools incurs considerable costs and training (Davenport, 2018), which results in firms being more cautious about their use of ET tools and the assessment of the value they provide. Consequently, the payoff of ETs can be more accurately gauged at the firm level. However, because ET-related ICT tools are advanced and sophisticated in nature, their adoption depends on the ICT infrastructure of a country. Thus, the moderating impact of a country's ICT development status on the relationship between ET use and business performance will be stronger in countries with better ICT infrastructures than in those with less advanced ICT infrastructures. This explanation is consistent with the outcomes of both the bivariate and meta-regression analyses.

H4, which hypothesized that more improved ICT infrastructure in the country of primary study impacts the ICT use- business performance relationship positively when GPTs & ETs are used combinedly as strategic resources, is supported by the bivariate analysis but not the meta-regression analysis. As explained earlier, when GPT- and ET-related ICT tools are used in combination in an organization, their joint impact on business performance decreases. Nonetheless, their combined use still has a positive impact on business performance. However, the ICT development status as a moderator does not impact this relationship as strongly as it affects the relationship between ET use and business performance (supported in bivariate analysis but not the meta-regression analysis). The probable reason behind this is that GPT-related ICT tools are so widely used worldwide that the associated infrastructures in almost all countries have reached a similar level. However, this is not the case with regard to the ET infrastructure because there is still a vast difference between developed and developing countries in terms of their technology-related infrastructures (Rahman et al., 2020). Therefore, a country's ICT infrastructure acts as a stronger moderator in the ET use-business performance relationship than in the combined GPT and ET use-business performance relationship.

Finally, H5, which expected that more improved ICT infrastructure in the country of primary study impacts the ET use-business performance relationship more than it affects the combined ET and GPT use-business performance relationship, is supported by both the bivariate and meta-regression analyses. As previously mentioned, due to the high investment and considerable training (Davenport, 2018) required for the successful deployment and use of ETs, firms try to maximise the benefits gained from these tools, which means they have a higher value for firms than other kinds of ICT tools. By contrast, anecdotal evidence suggests that, compared to ET tools, less investment and training are required to implement GPTs at the firm level, and hence firms often do not pay much attention to using GPTs in an optimum way. Consequently, the actual value of GPTs is often lower than their potential value. As mentioned previously, this is consistent with Millar's theory that ICT is a commodity available to everyone and therefore does not add any value to the firm's output (Fountaine, McCarthy and Saleh, 2019; Schubert and Leimstoll, 2007).

As mentioned earlier, when GPT is used alongside ET tools in an organization, their joint impact on business performance also decreases. However, this will only happen when firms are able to adopt these technologies, for which a country's level of ICT development is one of the precursors (Cheng, Chien and Lee, 2021). However, the moderating effect of ICT development status is not as strong with regard to the combined GPT- and ET use-business performance relationship as it is for the relationship between ET use and business performance (supported by the bivariate analysis but not the meta-regression analysis). This is because there are still vast differences between developed and developing countries in terms of their advanced technology-related infrastructures, which is not the case with regard to GPT (Rahman et al., 2020).

Of the 147 studies considered in the meta-analysis, only 66 studies controlled for the type of industry. The regression results revealed that there is a statistically significant but negative effect on the ICT use-business performance relationship if the industry is controlled for. Most of the studies considered in the meta-analysis examined SMEs (69 studies) and mixed-sized firms (56 studies). The remainder explored large firms (15 studies) and micro-sized firms (7). The meta-regression results indicated that the effect on the ICT use-business performance relationship is negative and statistically insignificant if the firm size is controlled for. The results of the bivariate analysis showed comparatively larger effect sizes for studies that investigated micro-sized firms compared to those that examined SMEs, mixed-sized firms,

and large firms, respectively. This is not consistent with the findings of Neirotti, Raguseo and Paolucci (2018), who reported that larger firms have several advantages over small firms in terms of ICT adoption and ICT value creation.

Finally, we found that firms' profitability performance measures, controlling for publication bias, and sample size had a significant effect on the outcome.

5.2. Contributions and implications for the literature:

First, one stream of literature argues that ICT has the potential to bring about the most significant technological revolution in human history. A study by Snow (1966) adopted this kind of optimistic approach to the impact of IT or ICT around fifty-five years ago. Several recent studies have concurred with this view and evidenced that ICT has a positive influence on business performance (e.g. Yunis, El-Kassar and Tarhini, 2018). However, other studies have taken a more cautious view of ICT, with their authors claiming that ICT productivity might have stagnated (Brynjolfsson, 1993; Gebauer et al., 2020; Polák, 2017). A closer examination of the extant literature indicates that mismeasurement is likely to be a prime cause of this reported productivity paradox (Gebauer et al., 2020). Thus, the meta-analysis conducted in this study is a critical addition to the existing IS, IT, and ICT literature since it addresses the crucial question of how the effect of ICT use on business performance can be accurately measured (when the contribution of ETs is measured separately from the combined contribution of GPTs and ETs). Moreover, this meta-analysis integrates the impact of the use of ICT as a strategic organizational resource on business performance, whereas previous meta-analyses have only analysed the impact of IT on business performance, and overlooked communication tools. Hence, this meta-analysis also contributes to the ICT-related literature.

Second, this meta-analysis contributes to the existing literature by increasing our theoretical and empirical understanding of how the use of ICT as a strategic resource affects business performance in the context of national ICT development. Thus, it contributes to the literature on business or firm performance in a cross-country context. This is the paper's most significant contribution: the fact that it is the first meta-analysis to examine the moderating role played by the national ICT development context on the relationship between ICT use and business performance. Hence, this meta-analysis provides a building block for more comprehensive empirical research on the topic to be conducted in the future. The majority of the existing studies have sought to answer the question: what is the impact of ICT use on

business performance? However, this meta-analysis additionally addressed the associated set of questions regarding when, where, and how ICT use impacts on business performance, by examining the moderating role of the status of ICT infrastructure development at the country level on the relationship between ICT use and business performance. Thus, this study also enhances the existing understanding of the effects of ICT use on business performance and provides suggestions for meaningful research in the future. Therefore, the findings of this meta-analysis are pertinent for practitioners, including educators, policymakers, and researchers.

Third, business performance or growth being a vital aspect of business strategy and entrepreneurship, this meta-analysis paper also contributes to the literature on strategic entrepreneurship. Additionally, it is the first to explore the relationship between ICT use and business performance, taking into account the status of national ICT infrastructure development of the countries examined in the primary studies. Hence, it contributes to evidence-based research in the field of entrepreneurial ecosystem analysis.

Fourth, as the entire analysis was based on the RBV and the categorization of ICT tools into GPTs and ETs (purpose of using technology), this study also contributes to theory-driven research.

5.3 Managerial Relevance

Starting from the premise that not all ICTs are strategic resources, this study identified ET-related ICT tools do act as strategic resources and provide a competitive advantage. It was established that GPT-related ICT tools do not operate as strategic resources. However, when a firm uses both GPT- and ET-related ICT tools together, they provide a competitive advantage. Our results indicate that if a firm can use ET-related ICT tools alone, it will achieve a greater competitive advantage than if it uses a combination of GPT- and ET-related ICT tools. Nonetheless, managers need to consider GPT-related ICT tools as forming part of the necessary infrastructure for ET-related ICT tools.

Because the lifecycle of technology is short, a growing number of ICT tools become GPTs when they are made accessible to the wider public (Trajtenberg, 2018). Therefore, managers should continually strive to improve firms' ETs by improving their IT infrastructure, human resources and adopting additional technologies that complement their existing technologies so as to maintain their ETs as strategic resources. Making additional investment

in their human capital in order to gain knowledge about ETs may help firms in this regard by enabling them to achieve a superior performance (Blanco-Mazagatos, de Quevedo-Puente and Delgado-García, 2018).

The business performance of ICT depends on the national ICT development context. If a country is comparatively more developed in terms of its national ICT infrastructure, ETs alone will provide a better competitive advantage. Thus, managers employed by international firms should learn from developed countries and introduce ET-related ICT tools in developing countries as soon as they are introduced in developed countries in order to gain a comparative advantage. Firms operating in developing countries should be constantly seeking out ET-related ICT tools introduced in developed countries to get ahead of their market competitors.

Unlike the previous meta-analyses on IT investment, this meta-analysis primarily focuses on the use of ICT. Furthermore, the positive and significant results obtained regarding the relationship between ICT use (both ETs alone and GPTs and ETs combined) and business performance indicate that firm-level decision-makers should not focus on ICT investment alone. Instead, they should pay close attention to how ICT investment can be transformed into performance improvements if they are optimally used, as ICT investment per se does not always result in an optimum payoff (Devaraj and Kohli, 2003; De Luca et al., 2020).

5.4. Policy implications

In addition to its academic and practical contributions, the meta-analysis has several policy implications. For instance, the outcomes of the analysis show that ET tools have a greater impact on business performance. A robust ICT infrastructure and congenial laws at the national level are essential for facilitating the development and use of ET tools like AI, big data, e-commerce, and ERP at the firm level (Tchamyou, Erreygers and Cassimon, 2019), thus leading to better use of ETs. However, discrepancies persist in terms of ICT infrastructural development between different countries, which are closely related to a country's economic growth (Cheng, Chien and Lee, 2021), and hence developed countries tend to have superior ICT infrastructures to developing countries. These inequalities have an impact on the extent to which ICT tools can be accessed and used across countries (Pradhan et al., 2021). This, in turn, affects the payoff of ICT use in firms because more effective use of ICT results in improved output (Devaraj and Kohli, 2003). Such differences also vary according to different ICT tools.

The extensive use of GPTs in both developed and developing countries (Liu et al., 2019) supports the argument that GPT-related ICT infrastructure does not differ drastically between developing and developed countries.

By contrast, the use of ETs is not yet as prevalent in developing countries as in developed countries (GSMA, 2020). Therefore, it can be assumed that the ET-related ICT infrastructure in developing countries is not as advanced or effective as in developed countries. Consequently, governments should consider expanding and improving their country's infrastructure with regard to ET tools as well as training facilities. Moreover, governments should also provide incentives, such as tax cuts, ICT investment-related loans, etc., to firms to encourage them to invest in advanced ICT tools.

5.5. Limitations and avenues for future research:

The findings of this meta-analysis need to be interpreted in light of its limitations. Firstly, only quantitative empirical studies were considered in order to fulfil the requirements of a meta-analytic process. Consequently, the results of qualitative studies, other meta-analyses, conceptual articles, and simulations were not included. Hence, it provides a limited overview of the literature on the relationship between ICT use and business performance.

Secondly, although some GPT-related ICT tools act as preconditions for using ET-related ICT tools, we did not specify this preconditioned relationship between GPT- and ET-related ICT tools. Future research should address Independent ET-related ICT tools and GPT dependent ET-related ICT tools to identify their comparative influence on business performance. Since ICT tools have a short life span, future meta-analyses should track the life cycle of ET-related ICT tools to find the optimum efficiency and performance levels over the life cycle.

Thirdly, we observed that cross-sectional research is widely used in quantitative ICT use-business performance research. Nonetheless, since the time lag factor exists when the effect of ICT payoff is considered, as argued by Kohli and Devaraj (2003), future meta-analyses could include more primary studies adopting a more longitudinal focus to understand

why some firms are better at converting their ICT use into superior business performance. However, the availability of such primary longitudinal studies on the relationship between ICT and business performance is limited. Hence, more primary research on this topic is necessary.

Finally, ICT improves access to information, business collaboration, and resources (Tchamyou et al., 2019; Mwila and Ngoyi, 2019). Future meta-analyses should identify the relationships among ICT, access to information, and collaborative business performance.

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APPENDIX:

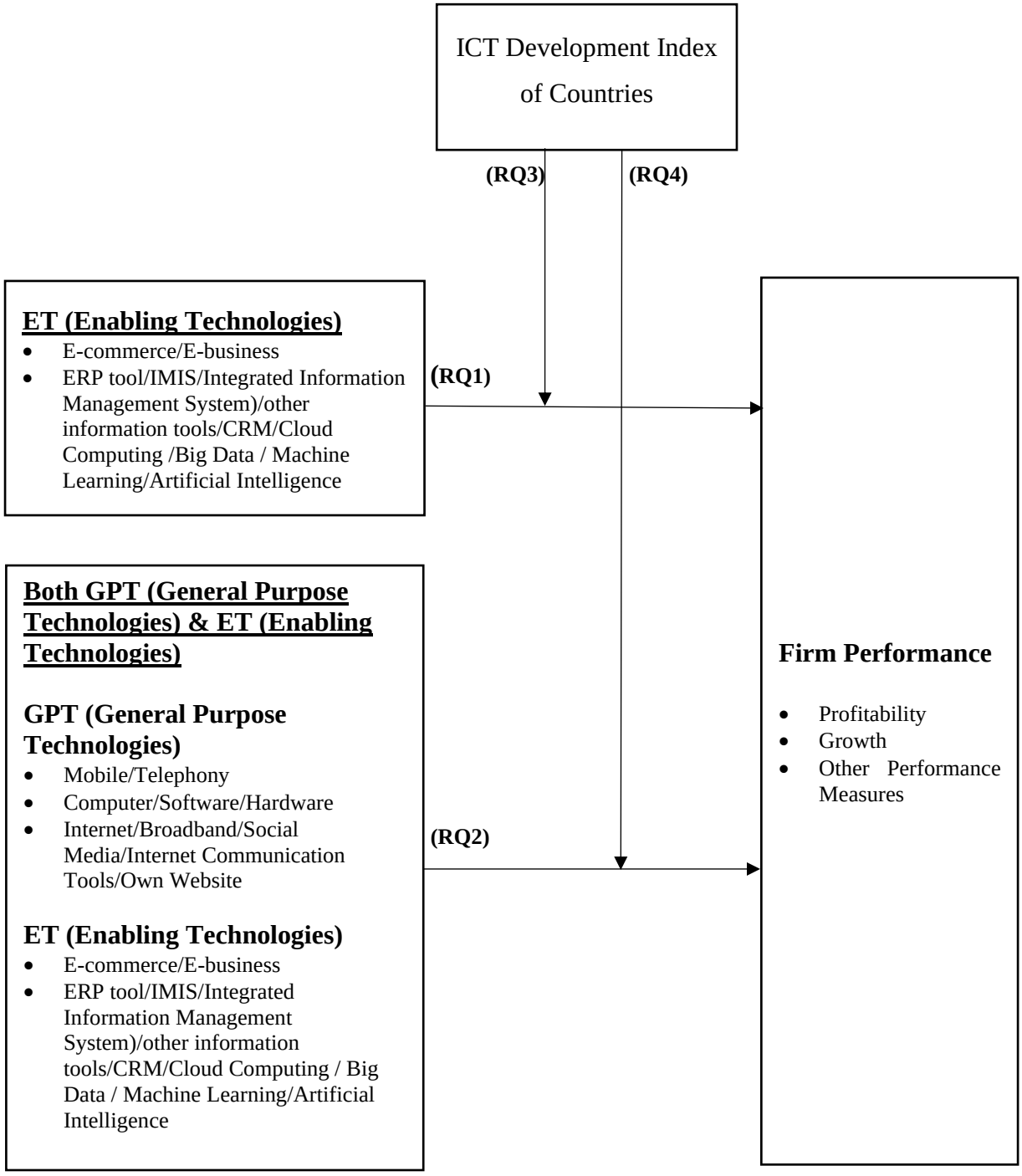

Figure 1: Theoretical model for meta-analysis

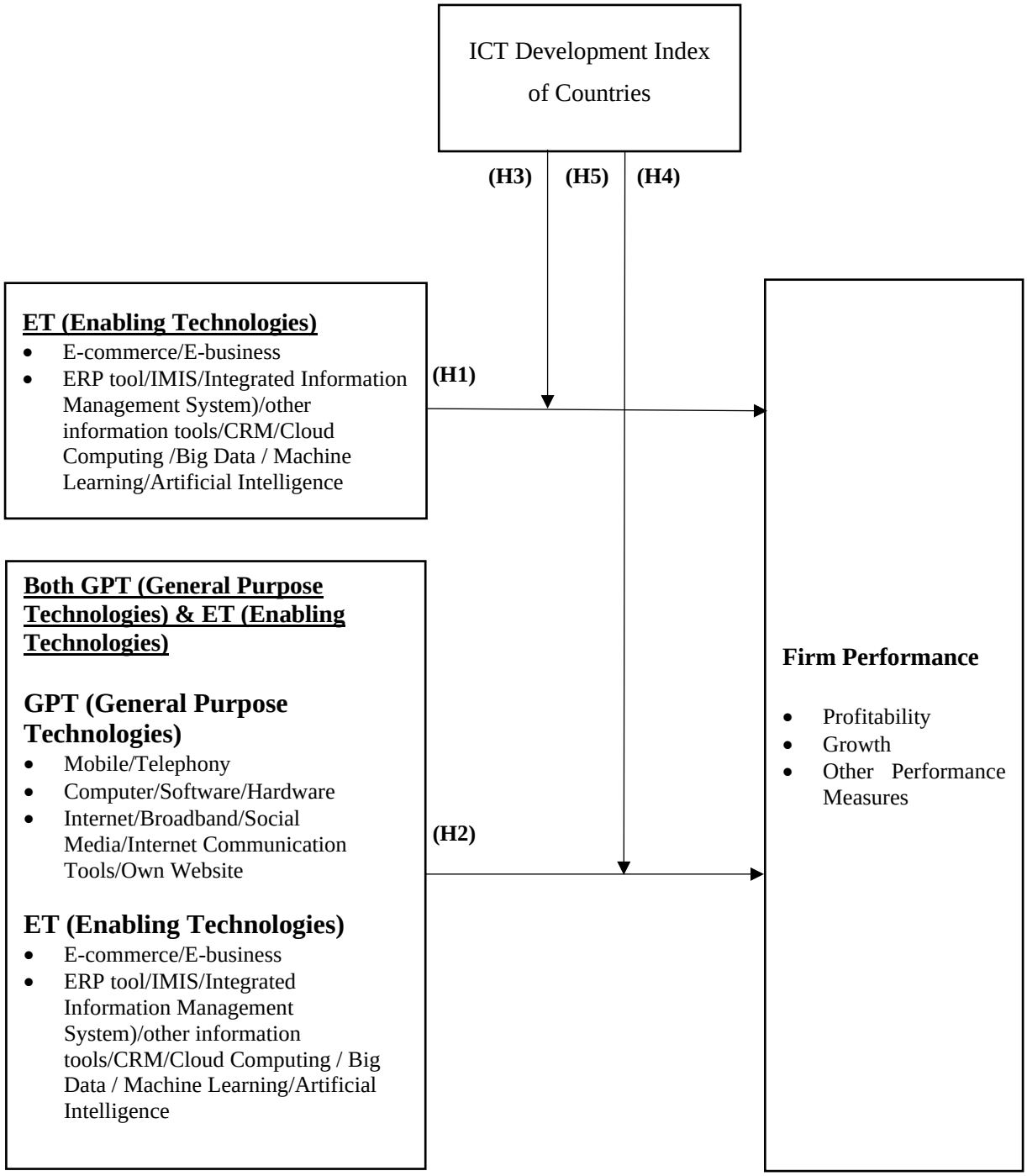

Figure 2: Research model for meta-analysis

Table 1: Keywords used to search literature:

We used the following keywords (categorized by three types of performance measures) to search existing literature:

Firm Profitability related keywords	**Firm Growth related keywords**	**Other Performance measures related keywords**
• Impact of ICT on business profitability	• Impact of ICT on business growth	• Impact of ICT on entrepreneurship
• Impact of ICT on ROI (Return on Investment) of firms	• Impact of ICT on business productivity growth	• Impact of ICT on entrepreneurial performance
• Impact of ICT on ROE (Return on Equity) of firms	• Impact of ICT on economic growth of firms	• Impact of ICT on improvement of external and internal communication of firms
• Impact of ICT on ROA (Return on Assets) of firms	• Impact of ICT on employment growth of firms	• Impact of ICT on sustainable competitive Advantage of firms
• Impact of ICT on Return on Capital Employed (ROCE) of firms	• Impact of ICT on sales growth of firms	• Impact of ICT on overall firm performance/success of enterprise
• Impact of ICT on sales turnover of firms	• Impact of ICT on Firm growth	• Impact of ICT on competitiveness of firms
• Impact of ICT on sale per employee of firms	• Impact of ICT on general business growth of firms	• Impact of ICT on export performance of firms
• Impact of ICT on internal rate of return (IRR) of firms	• Impact of ICT on growth in ROS of firms	• Impact of ICT on innovation performance of firms
• Impact of ICT on economic profitability of firms	• Impact of ICT on growth in cash flow of firms	• Impact of ICT on efficiency of firms
• Impact of ICT on average net profit margin of firms	• Impact of ICT on growth in revenue of firms	• Impact of ICT on perceived organizational performance of firms
• Impact of ICT on financial or accounting performance of firms	• Impact of ICT on growth in net income of firms	• Impact of ICT on domestic and export market expansion of firms
	• Impact of ICT on growth in profit of firms	• Impact of ICT on self-assessed measures of international performance of firms
	• Impact of ICT on international sales growth of firms	• Impact of ICT on cost saving of firms
	• Impact of ICT on labour productivity growth of firms	

Table 2: Number of primary studies excluded based on each inclusion criteria:

Inclusion Criteria	**Studies excluded based on each exclusion criteria**	**Examples of studies excluded based on each Inclusion criteria**
Studies were required to have an explicit focus on examining the association between ICT use and performance in firms as the key research question.	1876	Salim, I. M., & Sulaiman, M. B. (2011). Impact of organizational innovation on firm performance: Evidence from Malaysian-based ICT companies. *Business and Management Review*, *1*(5). Golonka, M. (2013). THE ALLIANCE STRATEGY AND FIRMS'PERFORMANCE: INSIGHTS FROM RESEARCH ON THE ICT INDUSTRY. *Journal of International Business Research*, *12*(1), 67. Martinez, C. A., & Williams, C. (2010). NATIONAL INSTITUTIONS, ENTREPRENEURSHIP AND GLOBAL ICT ADOPTION: A CROSS-COUNTRY TEST OF COMPETING THEORIES. *Journal of Electronic Commerce Research*, *11*(1).
We did not consider qualitative research. The studies had to be quantitative and empirical as well as providing information regarding the relationship between ICT use and business performance.	301	Weeramanthri, W. A. D., Gunawardana, K., & Kulathunga, K. M. S. (2015, December). Impact of ICT usage on entrepreneurs' innovations & business performance: A Review of Literature. In *12th International Conference on Business Management (ICBM)*. Rodrigues, J., Ruivo, P., & Oliveira, T. (2014). Software as a Service Value and Firm Performance-a literature review synthesis in Small and Medium Enterprises. *Procedia Technology*, *16*, 206-211. Cardona, M., Kretschmer, T., & Strobel, T. (2013). ICT and productivity: conclusions from the empirical literature. *Information Economics and Policy*, *25*(3), 109-125.
To be incorporated into the meta-analysis, the studies had to report the Pearson correlation coefficient for the predefined relationship.	176	Johnston, D. A., Wade, M., & McClean, R. (2007). Does e-business matter to SMEs? A comparison of the financial impacts of internet business solutions on European and North American SMEs. *Journal of Small Business Management*, *45*(3), 354-361. Ferri, G. M. G., & Ricchi, O. (2001). Inside the 'Magic Box': Internet and the Growth of Small and Medium-Sized Enterprises. Some Evidence from Italy. In *XIII Villa Mondragone International Economic Seminar "Financial Markets, the New Economy and Growth", organised by CEIS, University of Rome "Tor Vergata", Monte Porzio Catone (Rome), June* (pp. 25-26).

Table 3: List of primary studies included in the meta-analysis

Sl.	Study
1.	Lopez-Nicolas C, Soto-Acosta P. 2010. Analyzing ICT adoption and use effects on knowledge creation: An empirical investigation in SMEs. International Journal of Information Management 30(6):521—528.
2.	Falk M. 2005. ICT-linked firm reorganisation and productivity gains. Technovation 25(11): 1229—1250.
3.	Popa S, Soto-Acosta P, Perez-Gonzalez D. 2018. An investigation of the effect of electronic business on financial performance of Spanish manufacturing SMEs. Technological Forecasting and Social Change 136: 355—362.
4.	Jahanshahi AA, Rezaei M, Nawaser K, Ranjbar V, Pitamber BK. 2012. Analyzing the effects of electronic commerce on organizational performance: Evidence from small and medium enterprises. African Journal of Business Management 6(22):6486—6496.
5.	Thimm HH, Rasmussen KB, Gohout W. 2016. Website quality and performance indicators including ratio numbers–A study of German and Danish SME companies. Journal of Business 1(3):22—36.
6.	Trigueros-Preciado S, Pérez-González D, Solana-González P. 2013. Cloud computing in industrial SMEs: identification of the barriers to its adoption and effects of its application. Electronic Markets 23(2):105—114.
7.	Luo Y, Bu J. 2016. How valuable is information and communication technology? A study of emerging economy enterprises. Journal of World Business 51(2):200—211.
8.	Steinfield C, LaRose R, Chew HE, Tong ST. 2012. Small and medium-sized enterprises in rural business clusters: the relation between ICT adoption and benefits derived from cluster membership. The information society 28(2):110—120.
9.	Bauer TD, Dehning B, Stratopoulos TC. 2012. The financial performance of global information and communication technology companies. Journal of Information Systems 26(2):119—152.
10.	Castorena OH, Enríquez LA, Adame MG. 2014. The influence of information technology and communication supply chain management performance for greater SME manufacturing in aguascalientes. International Journal of Business, Economics and Management 1(12):382—396.
11.	Chew HE, Levy M, Ilavarasan V. 2011. The limited impact of ICTs on microenterprise growth: A study of businesses owned by women in urban India. Information Technologies & International Development 7(4):1—16.

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16. Nyandoro CK. 2016. Factors influencing information communication technology (ICT) acceptance and use in small and medium enterprises (SMEs) in Kenya (Doctoral dissertation, Capella University). Available at: https://search.proquest.com/docview/1769012171?pq-origsite=gscholar

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Table 4: Variables, definitions, and coding

Variable type	Variable name	Variable Definition	Code
Independent variable: Use of ETs	Use of Enabling technologies (ETs)	Use of ETs includes: • Use of E-commerce/E-business • Use of ERP/Integrated Information Management System/other information tools /CRM/cloud computing/ big data /machine learning/artificial intelligence.	1
	Not use of Enabling technologies (ETs)		0
Independent variable: Combined use of GPTs and ETs	Combined use of GPTs and ETs	Use of both GPTs and ETs includes: • Use of Mobile/Telephony • Use of Computer/Software/Hardware • Use of Internet/Broadband/Social Media/Internet communication tools like WhatsApp, Viber, Skype/Own website • Use of E-commerce/E-business • Use of ERP/Integrated Information Management System/other information tools /CRM/cloud computing/ big data / machine learning/artificial intelligence.	1
	Not combined use of GPTs and ETs		0

Dependent Variable: ICT use-firm performance relationship	Impact of ICT use on Firm performance in primary studies	Effect size (Pearson Correlation Coefficient) of ICT use and Firm performance relationship of the primary studies.	Continuous Variable
Moderator variable: Cross country ICT development status		We considered the status of ICT infrastructure development in the countries examined in the primary studies, dividing them between 'Not Present' (ICT development context not present) and 'Present' (ICT development context present) in the bivariate analysis. In the meta-regression analysis, we used the value of each country as per the ICT development index of 2017 (latest one available) prepared by the International Telecommunication Union (ITU). Since 2007, the ITU has published the ICT Development Index (IDI), which evaluates the ICT infrastructure and uptake of 176 countries (ITU, 2019).	In the bivariate analysis, 1. Absence of ICT development status context coded 0. 2. Presence of ICT development status context coded 1.
Control Variable: Industry control	Not controlled for industry	Whether the primary study has controlled for the type of industry (Brinckmann, Grichnik and Kapsa, 2010) or not. The only time we categorized data as "no control for the industry" was when all observations came from the same industry, or if they came from different industries, but there was no industry category among the independent variables of the study.	0
	Controlled for industry	Whether the primary study controlled for the type of industry (Brinckmann, Grichnik and Kapsa, 2010).	1
Control Variable: Sample Size	Sample size of the primary studies	We also controlled for the sample size of the primary studies.	Continuous Variable
Control Variable: **Firm Size**	Size of the firms surveyed in the primary studies	Firm size was categorized in the following ways: 1. **Micro:** Fewer than 10 employees (OECD, 2018) 2. **Small and medium sized enterprises (SMEs):** Fewer than 500 employees (OECD, 2018)	1. Studies with micro firms coded as 0. 2. Studies with SMEs coded as 1.

		3. **Large:** More than 500 employees (OECD, 2018) 4. **Mixed:** Having micro, SMEs, and large firms	3. Studies with mixed-sized firms coded as 2. 4. Studies with large sized firms coded as 3.
Control Variable: Control for publication bias	Control for publication bias	We controlled for publication bias by dividing studies into those that have been published (in a journal) and those that have not been published (a dissertation or conference paper).	1. Unpublished studies (e.g. a dissertation or conference paper) coded as 0. 2. Published studies (published in a journal) coded as 1.
Control Variable: Use of firms' profitability performance measures	Use of firms' profitability performance measure	Firms' profitability performance measures include: • Return on Sales (ROS) (Zahra, Hayton and Salvato, 2004) • Profitability (Antoncic, 2006; Ward, 2016) • Return on Assets (ROA) (Andersén, 2010; Andersén and Samuelsson, 2016) • Cash flow (Renko, Carsrud and Brannback, 2009) • Internal Rate of Return (IRR) (Chowdhury, 2006) • Return on Investment (ROI) (Miller and Toulouse, 1986) • Sale per employee (Walter, Auer and Ritter, 2006).	1
	Not use of firms' profitability performance measure		0

Control Variable: Use of firms' growth performance measures	Use of firms' growth performance measures	Firms' growth performance measures include: • Sales growth (Messersmith and Wales, 2013) • Employment growth (Frank, Kessler and Fink, 2010) • Business growth (Anderson and Eshima, 2013; Antoncic, 2006) • Growth in revenue (Griffith, Noble and Chen, 2006) • Growth in cash flow (Griffith, Noble and Chen, 2006) • Growth in ROS (Gabrielsson, 2007) • Growth in profit (Zahra and Garvis, 2000) • Growth in net income (Miller and Toulouse, 1986) • Domestic and export market expansion (Chowdhury, 2006) • International sales growth (Ripollés, Blesa and Monferrer, 2012) • Productivity growth (Luo and Bu, 2016).	1
	Not use of firms' growth performance measures		0
Control Variable: Use of firms' other performance measures	Use of firms' other performance measures	Firms' other performance measures include: • Overall firm performance/success (Barrett and Weinstein, 1998; De Clercq, Dimov and Thongpapanl, 2010; Lopez-Nicolas and Soto-Acosta, 2010; Steinfield et al., 2012; Wiklund and Shepherd, 2003) • Competitiveness (Cuevas-Vargas *et al*.,2015) • Positive organizational changes (Giuri, Torrisi and Zinovyeva, 2008) • Value addition (Osei-Bryson and Ko, 2004; Saeed, Hwang and Grover, 2002) • Customer satisfaction (Ranganathan, Dhaliwal and Teo, 2004; Devaraj and Kohli, 2000; Ray, Muhanna and Barney, 2005) • Market Share (Byrd and Davidson, 2003; Sircar, Turnbow and Bordoloi, 2000).	1

	Not use of firms' other performance measures		0

Table 5: Outcomes of hypotheses test

Hypothesis	Confirmed in …		Conclusion for hypothesis
	Bivariate Analysis	Meta-regression Analysis	
H1: Use of ETs as strategic resources has a positive effect on business performance.	Yes (0.5157***)	Yes (0.368***)	Supported
H2: Combined use of GPTs and ETs as strategic resources has a positive effect on firm performance.	Yes (0.3963***)	Yes (0.143*)	Supported
H3: More improved ICT infrastructure in the country of primary study impacts the ICT use-business performance relationship positively when ETs are used as strategic resources.	Yes (0.5207***)	Yes (0.098**)	Supported
H4: More improved ICT infrastructure in the country of primary study impacts the ICT use- business performance relationship positively when GPTs & ETs are used combinedly as strategic resources.	Yes (0.3984***)	No (-0.088*)	Partly supported
H5: More improved ICT infrastructure in the country of primary study impacts the ET use-business performance relationship more than the combined use of ET and GPT- business performance relationship.	Yes (for ETs 0.5207***) & (for GPTs & ETs 0.3984***)	Yes (for ETs 0.098**) & (for GPTs & ETs -0.088*)	Supported

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Output of bivariate analysis

	K	N	Reliability Corrected Mean ES ($\bar{r}_c$)	Mean ES (Cohen`s f)	Weighted Standard Deviations	Random Effects Variance Component	90% CI[19]	Q	P value	Fail-Safe N	(5k+10) criterion
			Random				Random		Random		
H1: Use of ETs → ICT use-business performance relationship	66	130393	0.5157	0.602	0.116	.032433	0.4357 to 0.4466	1766.1750	0.0000	1260	340
Not use of ETs → ICT use-business performance relationship	81	150413	0.2747	0.286	0.378	0.177757	0.2697 to 0.2798	21472.2677	0.0000	989	415
H2: Combined use of GPTs and ETs → ICT use-business performance relationship	39	57773	0.3963	0.432	0.537	0.335647	0.2143 to 0.2306	16619.5757	0.0000	380	205
Not combined use of GPTs and ETs → ICT use-business performance relationship	108	223033	0.5872	0.725	0.181	0.045353	0.3814 to 0.3897	7331.1329	0.0000	2257	550

[19] Following suggestions by Hair et al. (2010) and Hunter et al. (1982), we have used the 90% Confidence Level since most of our sample size in the bivariate analysis is small for quantitative analysis.

H3: Presence in ICT Development Index→ ET use-business performance relationship	60	126434	0.5207	0.610	0.099	0.025358	0.4290 to 0.4400	1229.4877	0.0000	1677	310
Absence in ICT Development Index→ ET use -business performance relationship	6	3959	0.3184	0.336	0.300	0.226996	0.6220 to 0.6845	353.8750	0.0003	100	40
H4: Presence in ICT Development Index→ Combined use of GPTs and ETs-business performance relationship	35	50742	0.3984	0.434	0.566	0.385392	0.1835 to 0.2009	16224.4312	0.0002	406	185
Absence in ICT Development Index→ Combined use of GPTs and ETs -business performance relationship	4	7031	0.6405	0.834	0.046	0.008380	0.4171 to 0.4639	15.1767	0.0000	74	30
	Use of individual ICT tools → ICT use-Business performance relationship										
Use of Mobile/Telephony → ICT use-business performance relationship	15	2860	0.3486	0.372	0.351	0.129075	0.6520 to 0.7258	347.4662	0.0000	204	85

Not use of Mobile/Telephony → ICT use-business performance relationship	132	277946	0.2417	0.249	0.297	0.108329	0.3449 to 0.3523	24499.2576	0.0000	2549	670
Use of Computer/Software/Hardware→ ICT use-business performance relationship	8	13673	0.4313	0.478	0.130	0.121651	0.7428 to 0.7763	232.0358	0.0011	157	50
Not use of Computer/Software/Hardware → ICT use-business performance relationship	139	267133	0.3312	0.351	0.291	0.105450	0.3274 to 0.3350	22554.3876	0.0000	2661	705
Use of Internet/Broadband/Social Media/Internet communication tools like WhatsApp, Viber, Skype/Own website → ICT use-business performance relationship	19	73145	0.3879	0.421	0.071	0.016980	0.2158 to 0.2303	368.5200	0.0000	376	105
Not use of Internet/Broadband/Social Media/Internet communication tools like WhatsApp, Viber, Skype/Own website → ICT use-business performance relationship	128	207661	0.2230	0.229	0.334	0.148262	0.3932 to 0.4018	23156.3943	0.0000	2424	650

Use of E-commerce/E-business → ICT use-business performance relationship	23	120037	0.5106	0.594	0.082	0.022210	0.4236 to 0.4349	814.6462	0.0000	549	125
Not use of E-commerce/E-business → ICT use-business performance relationship	124	160769	0.2943	0.308	0.380	0.173573	0.2894 to 0.2992	23104.9846	0.0000	1919	630
Use of ERP/Integrated Information Management System/other information tools /CRM/cloud computing/ Big Data / Machine Learning/Artificial Intelligence → ICT use-business performance relationship	43	7877	0.5069	0.588	0.252	0.060295	0.4846 to 0.5291	493.4909	0.0000	708	225
Not use of ERP/Integrated Information Management System/other information tools /CRM/cloud computing/ Big Data / Machine Learning/Artificial Intelligence → ICT use-business performance relationship	104	272929	0.3476	0.371	0.300	0.111299	0.3439 to 0.3514	24484.8830	0.0000	1636	530

Controls											
	Firm Size										
Micro		7	1231	0.6203	0.791	0.368	0.163889	0.5505 to 0.6632	163.7668	0.0000	93	45
Not-Micro		140	279575	0.3580	0.383	0.299	0.109268	0.3472 to 0.3546	24926.7638	0.0000	3349	710
SME		69	157574	0.4030	0.440	0.147	0.036306	0.3981 to 0.4079	3381.8852	0.0000	2635	355
Not-SME		78	123232	0.2868	0.299	0.412	0.233855	0.2812 to 0.2924	20854.8580	0.0000	705	400
Mixed		56	44841	0.5524	0.663	0.243	0.068789	0.5431 to 0.5616	2638.3512	0.0000	872	290
Not-Mixed		91	235965	0.3140	0.331	0.294	0.115985	0.3100 to 0.3181	20398.2148	0.0000	1403	465
Large		15	77160	0.1279	0.129	0.408	0.478698	0.1208 to 0.1350	12831.3398	0.0000	286	85
Not-Large		132	203646	0.4370	0.486	0.186	0.045605	0.4327 to 0.4414	6995.2202	0.0000	2546	670
	Control for Publication Bias											
Unpublished studies		24	28499	0.5008	0.579	0.157	0.035301	0.3892 to 0.4124	696.4972	0.0000	585	130

Published studies		123	252307	0.2465	0.254	0.311	0.124466	0.3426 to 0.3504	24397.7310	0.0000	1851	625
	Industry											
No Control for industry		81	29295	0.5004	0.578	0.310	0.102287	0.3427 to 0.3479	2795.0203	0.0000	1592	415
Control for industry		66	251511	0.3233	0.342	0.298	0.115290	0.3879 to 0.4083	22374.2733	0.0000	730	340
	Performance Measure											
Firm profitability		26	12505	0.3261	0.345	0.800	0.943283	0.4582 to 0.4230	7951.7546	0.0000	610	140
Not-profitability		121	268301	0.4702	0.533	0.184	0.041791	0.3850 to 0.3926	9047.8433	0.0000	1806	615
Firm growth		13	14776	0.6191	0.788	0.207	0.064856	0.2955 to 0.3278	633.7349	0.0000	230	75
Not-growth		134	266030	0.2599	0.269	0.304	0.115561	0.3505 to 0.3581	24510.3414	0.0000	2727	680
Other performance measure		108	150118	0.4254	0.470	0.224	0.062029	0.3617 to 0.3718	7548.8353	0.0000	1023	550
Not- other performance measure		39	130688	0.3133	0.330	0.367	0.330681	0.3297 to 0.3405	17550.6840	0.0000	1221	205

Table 7: Output of meta-regression

	Model 1	Model 2	Model 3	Model 4	Model 5
VARIABLES	ICT Use-Business Performance Relationship	ICT Use - Business Performance Relationship	ICT Use - Business Performance Relationship	ICT Use -Business Performance Relationship	ICT Use -Business Performance Relationship
Control for publication bias	0.0761***	0.0922***	0.0904***	0.0870***	0.0861***
	(0.0154)	(0.0156)	(0.0146)	(0.0145)	(0.0147)
Industry	-0.192**	-0.108	-0.00318	0.0245	0.0153
	(0.0887)	(0.0852)	(0.0845)	(0.0840)	(0.0844)
Sample size	3.07e-06***	6.17e-06***	6.28e-06***	5.97e-06***	5.58e-06***
	(9.22e-07)	(9.84e-07)	(1.26e-06)	(1.25e-06)	(1.31e-06)
Profitability performance measure	-0.404***	-0.579***	-0.817***	-0.808***	-0.763***
	(0.0856)	(0.0878)	(0.0977)	(0.0961)	(0.102)
Growth performance measure	-0.0596	0.0626	0.200	0.239*	0.190
	(0.115)	(0.139)	(0.137)	(0.136)	(0.136)
Significant impact on ICT use	0.191*	0.0253	0.0800	0.112	0.102
	(0.0970)	(0.105)	(0.0981)	(0.0975)	(0.0981)
Firm size	-0.0459	0.0228	0.0507	0.0650*	0.0564
	(0.0396)	(0.0394)	(0.0394)	(0.0392)	(0.0392)
ICT development index		-0.152***	-0.140***	-0.177***	-0.115***
		(0.0257)	(0.0239)	(0.0285)	(0.0277)
Use of Enabling Technologies (ETs)			0.368***	-0.377	0.375***
			(0.0711)	(0.333)	(0.0706)
Combined use of General Purpose Technologies (GPTs) and Enabling Technologies (ETs)			0.143*	0.108	0.778**
			(0.0809)	(0.0810)	(0.369)
Enabling Technologies (ETs) X ICT development index				0.0981**	
				(0.0428)	
Combined use of General Purpose Technologies (GPTs) and Enabling Technologies (ETs) X ICT development index					-0.0884*
					(0.0501)
Constant	0.280***	1.297***	0.905***	1.138***	0.683***
	(0.106)	(0.208)	(0.206)	(0.226)	(0.240)
Observations	147	135[20]	135	135	135
R-squared	0.240	0.401	0.508	0.528	0.520

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

[20] There were 12 multi-country studies, and hence a single country ICT index could not be allocated to test the moderation impact.