

# **THE ROLE OF GENDER IN THE ICT AND BUSINESS PERFORMANCE RELATIONSHIP: A META-ANALYSIS**

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## **ABSTRACT:**

The extant literature on ICT and Business Performance Relationship in firms shows diverse results. This requires a meta-analysis of the relationship to understand the direction and the scope of the relationship between ICT and business performance. Moreover, whether the ICT and business performance relationship in firms is gender biased or gender neutral is not clear in the existing literature. This study intended to meta-analytically integrate outcomes from more than two decades of research on how gender impacts the relationship between ICT and business performance relationship. 96 studies were reviewed which resulted in 158497 overall number of observations. Effect sizes of the considered studies range from  $r = -0.81$  to  $r = 1$ . It was found in both the Bivariate Analysis and Meta-Regression that ICT can impact the performance significantly and positively. These influences change according to the types of ICT tools used. Moreover, it was found in Meta-regression that Gender negatively moderates the relationship between ICT and performance.

## **KEYWORDS:**

ICT; Business Performance; Gender; Meta-Analysis

## **1. INTRODUCTION:**

Information and Communication Technology (ICT) has become a major driver of numerous technological innovation as well as organizational evolution. Firms

which use ICT derive benefits such as achieving new clients, faster communications as well as increased productivity (Gallego, Gutiérrez and Lee, 2014). Understanding whether and how ICT has affected firm performance is an important research issue, since it enables the managers to realize the importance of investing in ICT. There have been a considerable number of studies on the ICT and business performance relationships which shows diverse results (Chen, Jaw and Wu, 2016; Higón, 2012). This requires a meta-analysis of the relationship to understand the direction and the scope of the relationship between ICT and business performance. Moreover, whether the ICT and Business Performance Relationship in enterprises are gender biased or gender neutral is not clear in the existing literature (Higón, 2012; Polo Peña, FríasJamilena and Rodríguez Molina, 2013).

This study intends to meta-analytically integrate outcomes from two decades of research on the relationship between ICT and Business Performance in enterprises and also explore whether Gender has any influence on ICT and Business Performance Relationship.

This meta-analysis study adds value to the entrepreneurship-related literature by rendering the first meta-analytic review of existing studies integrating ICT-business performance in firms where the influence of gender as a moderator has also been taken into consideration. Our analysis is grounded in the dynamic capability extend as well as build on RBT (Resource-based View) to emphasize that it is not enough to simply own vital resources since the genuine worth of resources remain in the capacity of the organization to 'utilize' them (Teece et al., 1997).

The remainder of the paper is organized as follows. In the "Literature review and research framework" section, the existing literature on ICT and business performance are reviewed to integrate diverse independent, dependent, as well as moderator variables applied in diverse studies to construct our research model. The sample papers, inclusion criteria, coding as well as analysis method applied in our Meta-analysis are incorporated in section "Research methodology". The outcomes from the meta-investigation are displayed in Section "Results". The findings of our meta-analysis, suggestions for future research, as well as limitations of our study are presented in the section "Discussion and Conclusion".

## 2. LITERATURE REVIEW AND RESEARCH FRAMEWORK:

### 2.1. Theory:

The prevalent utilization of ICT in the firms have been attempted to be explained by quite a few number of theories including resource-based view (RBV), media richness theory (Banker et al., 2006), transaction cost theory (Li and Ye, 1999; Subramani, 2004), social exchange theory (Goo et al., 2007; Han et al., 2008), coordination theory (Straub et al., 2004; Lai et al., 2008) etc.

The abovementioned theories have diverse applications. For instance, the theory of transaction cost has been generally applied to clarify the issue of ICT related outsourcing. On the other hand, the media richness theory has been utilized to clarify the decision of choosing specific software. Among all the theories, RBV by Wernerfelt (1984) remains the major one which has been applied to explain the ICT and business performance relationship.

RBV remains one of the major theories in the field of strategic management. It contends that the competitive advantage of a firm remains impacted by the major resources possessed by that firm. According to Barney (1991), if an organization wants to create competitive advantages, its resources should possess the accompanying characteristics:

**Valuable:** The resources have the capacity of enabling an organization to formulate or execute strategies which enhance the effectiveness or efficiency of a firm.

**Rare:** The important resource must not be owned by an extensive number of contending organizations.

**Imperfectly imitable:** The precious resource must be with such features which cannot be straightforwardly copied.

**Non-substitutable:** The significant resources ought not to be effortlessly supplanted by different substitutes.

The essential contention of RBV remains that the performance of a firm is dictated by its resources. The organizations which possess more important and rare resources are more prone to create sustainable competitive

advantages compared to other firms. Along these lines, ICT is viewed as a significant resource of a firm that can upgrade the capacities of an organization and in the long run prompt better performance. According to Crook et al. (2008), RBV has established itself as a crucial theory in investigating the factors that impact the performance of an organization. On the other hand, the advocates of RBV theory also admit that the only ownership of rare and valuable resources is not enough to guarantee better performance (Barney and Arian, 2001). In this way, numerous critical inquiries remain to be investigated. For instance, how is a competitive advantage of a firm in actuality achieved? What kind of transformation is required within a company's firm's resource endowment with a view to creating such a competitive advantage? What particular role does ICT related resources play in that procedure? (Newbert, 2007; Sirmon, Hitt and Ireland, 2007).

To address this gap the dynamic capability stretches out and expands on RBT to stress that the only ownership of rare and valuable resources is not enough to guarantee better performance, but that the real worth of resources remains in the capacity of an organization to 'utilize' them. The inclusion of the notion of the dynamic capacity (Teece et al., 1997) in the resource-based view enables researchers to investigate a change in the organization with environment related dynamics via a fresh theoretical prism. This research will explore whether the gender aspect which is an intangible aspect have any influence over the utilization of resources such as ICT within a firm.

So based on the literature review we can say that past research proposes that IT framework is a basic catalyst of organizational performance (Bharadwaj, 2000; Sambamurthy et al., 2003; Santhanam and Hartono, 2003; Zhu and Kraemer, 2002). A few previous pieces of research have likewise found that investment in ICT positively affects performance at firm-level (Weill, 1992; Barua et al., 1995; Mitra and Chaya, 1996; Kohli and Devaraj, 2003). On the other hand, some studies show that use of ICT has a negative impact on firm-level performance (Brasini and Freo, 2012; Bauer, Dehning and Stratopoulos, 2012; Ferri, Galeotti, and Ricchi, 2001; Matambalya, and Wolf, 2001; Teo and Ranganathan, 2004). These negative findings in some of the cases are dependent on different contexts. Moreover, even in case of a positive outcome in ICT and

business performance relationship, the extant literature shows the difference in the strength of the relationship.

## **2. LITERATURE REVIEW AND RESEARCH FRAMEWORK:**

### **2.1. Theory:**

### **2.2. ICT and business performance:**

Today the ICT has travelled beyond the national boundaries, and at the same time, has tied the nations together on single global platform. The part of ICT in new firms remains as predominant as, that huge numbers of hierarchical authorities, leaders and determinants, prescribe the firms to construct their strategies as per the organizational technological orientation (Poston et al, 2010).

ICT is an inclusive terminology which incorporates a wide range of tools and applications including sophisticated computer science and technologies, information systems etc with a view to saving, operating and transmitting any sort of information, for example, content, voice, picture etc. (Brizek, 2003; Sin Tan et al., 2009).

ICT has been defined in a diverse way in extant literature which extends beyond hardware and software. ICT incorporates a wide range of contextual factors related with its application inside firms (Kling 1980; Markus and Robey 1987). Review of existing literature reveals that what constitutes ICT shape the value ICT provides to business.

ICT is considered as worthy resource of a firm which can be utilized to enhance internal correspondence in an organization, improve the quality of product design, decrease design related cycle time, and reduce cost related product development.

Numerous studies have been conducted to capture the impact of ICT on organizational performance in several streams. Each study has brought its own empirical and theoretical perspective to address similar research question. Because of divergent approaches in diverse studies, an ambiguity has surfaced due to lack of integration. On the other hand, there surfaced a debate in the recent years whether "IT matters" with the

argument that many organizations not only have overestimated but also have overspent on ICT(Carr, 2003).

In spite of the fact that IT act as a valuable resource which is able to enhance performance of an organization, different kinds of IT resources themselves might not be able to cause firm performance which sustain (Raietal, 2006). Recent findings indicate that the impact related to valuable resources might be influenced by some other factors. The concept of resource complementary and organizational capabilities can be used to explain this further. According to resource complementary concept, by integrating diverse complementary resources, organizations can create synergy which in turn brings about better performance (Karimi et al., 2007; Melville et al., 2004; WadeandHulland, 2004; Zhu, 2004). Organizational capabilities contend that by enhancing critical organizational capabilities, IT related resources can improve the performance of a firm (Alvarez-Suescun, 2007; Bharadwaj, 2000; Bhatt and Grover, 2005; Brown et al., 1995; Chan et al., 1997; Rai et al., 2006).Other studies additionally indicates factors, for example, 'strategic fitness' which contends that the integration of IT with business procedure can improve performance of a firm (Li and Ye, 1999; Palmer and Markus, 2000; Weill, 1992). Previous research has also specified some other factors which might impact the ICT-Performance relationship. These factors include categories of ICT, management practices, structure related to organization, competitive as well as macro environment etc. (Brynjolfsson et al. 2002; Cooper et al. 2000; Dewan and Kraemer 2000).

The extant literature additionally indicates that organizations don't always capture the value generated by IT; rather other stakeholders such as trading partners or end consumers might capture the value generated from IT (Bresnahan 1986; Hitt and Brynjolfsson 1996).

As per the above discoveries, we propose the first hypothesis to look at the immediate impact of ICT on the performance of the firms. Hence:

***H1: Use of ICT tools is positively associated with Firm Performance.***

***H1a: Use of Mobile/telephony is positively associated with Firm Performance.***

***H1b: Use of Computer /software/hardware is positively associated with Firm Performance.***

***H1c: Use of Internet/Broadband/Social Media/Internet communication tools like whatsapp, viber, skype/Own website is positively associated with Firm Performance.***

***H1d: Use of e-commerce/e-business is positively associated with Firm Performance.***

***H1e: Use of ERP tool/Integrated Information management System/other information tools /CRM/Cloud Computing is positively associated with Firm Performance.***

***H1f: Use of A combination of ICT tools/Overall ICT is positively associated with Firm Performance.***

### **2.3. Contextual Moderators of the ICT-Performance Relationship:**

The world has witnessed a steady growth of participation of women in the workforce (Brush, 1992; Minitti et al., 2005; Hughes et al., 2012). At the same time, the number of female entrepreneurs has also increased all across the globe. Consequently, a rising interest is evident to explore the dynamics as well as the financial impact that gender has on entrepreneurship (Zinger et al., 2007). Such research remains imperative on the grounds that there remains a clear contrast amongst males and females in enterprises (Gatewood et al., 2009).

While the quantity of female-led businesses has been rising at a fast pace, these have been smaller compared to male-led businesses in terms of size and sustainability (Marlow and Carter, 2006). Additionally, there remains a general conjecture that a lion's share of these organizations is life-style type businesses. Consequently, the commitment of such firms to grow might be less compared to male-owned firms (Wiklund et al., 2003). Nonetheless, regardless of the increasing attention for women entrepreneurship, there remains a dearth of research into the impact of ICT into the development as well as the long-term performance of businesses owned by females (Roomi et al., 2009).

Various research conducted in the previous years demonstrated that there exist critical contrasts amongst male and females as to the utilization of ICT in businesses and their outlook towards ICT (Whitley, 1997).

Various researchers in the 1990s have shown these gender differences in attitudes towards ICT, where men show comparatively positive attitude compared to females. Campbell (1990) and Comber et al (1997) also reported a more positive viewpoint towards computers by boys compared to girls as a result of which girls are less interested in learning computer-related skills. Levin and Gordon (1989) also supported the positive attitude of boys towards computers by stating that boys perceive computers as a thing to enjoy which results in a more confident use of computers than girls. Girls suffer from computer anxiety more than boys (Martin, 1991; Sherman et al., 2000 and Corston et al., 1996). Girls also feel they have less control over a computer. According to Shashaani and Khalili (2001), though women suffer from lower self-confidence in case of using computers, no substantial gender difference was found in perceived efficacy of computers.

Busch (1995), on the contrary, did not find any gender-related differences in case of computer attitudes in terms of computer tasks which are simple in nature. However, he also found evidence of boys being more experienced in computer programming as well as video games. Moreover, he found evidence of boys getting more encouragement in this regard from family and friends.

Although the overall expectation was the gender-related differences would be minimized over time, the recent studies show that impact of gender difference in computer use is still there. But some recent studies have shown mixed results.

The literature on gender differences regarding the use of ICT suggests that ICT use is more common among men than women. Basuet al. (2000) argues that technologies are implicitly designed to cater to men's needs, and women have negative attitudes towards ICTs (Varank, 2007). According to Hilbert (2011), women use ICTs to socialize and men use it for the experience.

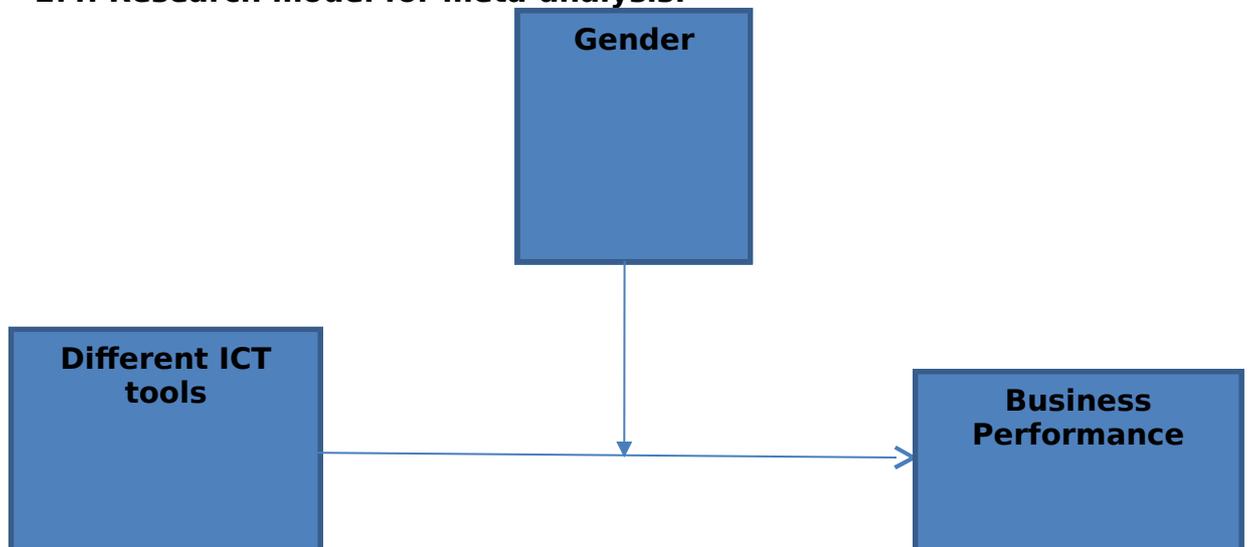
The use and impact of ICTs differ across countries. Women are increasingly empowered by ICTs, especially in the developing world (Davis, 2007),

enabling them to overcome discrimination, inequality, poverty, and support their connections to the world at large (Hilbert, 2011). Changes in the relationship between women and ICTs in the developing world exist, but the role of women in using ICTs for productivity performance remains unanswered (Hilbert, 2011).

Based on the above literature review on the impact of Gender on ICT-performance relationship we can propose that:

**H2: Presence of gender differences act as a negative moderator within the ICT-performance relationship, in the sense the presence of gender as a control in the previous studies, weakens the primary ICT-performance relationship.**

#### **2.4. Research model for meta-analysis:**



*Figure 1: Research Model for meta-analysis*

### **3. RESEARCH METHODOLOGY:**

A meta-analysis approach was used in this study with a view to testing the proposed hypotheses as well as models. Meta-analysis is defined as a number of techniques to analyze coefficients found in earlier empirical research (Sabherwal et al., 2006). The researchers are able to integrate the outcomes from prior studies by utilizing this technique and consequently, they are able to conclude valid outcomes. Hence, it renders solid assistance to the model and clarifies the wide difference in earlier empirical discoveries. This meta-examination

concentrated on prior empirical investigations where independent variables were related to ICT and dependent variables were indicators of performance of firms.

The research methodology is depicted underneath:

### **3.1. The search for primary data:**

A comprehensive search was conducted to collect studies published prior to May 2017 in established databases such as EBSCO (Business Source Elite), ABI/INFORM, EconLit, PsycINFO, JSTOR Databases, ERIC (Expanded Academic Index), Wilson Business Abstracts and Science Direct in related journals applying various keywords related to ICT and Performance e.g., performance, profit, growth, ROE, ROI, ROS, and ROA and Firms. To be specific, we used the following keywords:

- Impact of ICT on entrepreneurship
- Impact of ICT on business growth
- Impact of ICT on business productivity
- Impact of ICT on business profitability
- Impact of ICT on entrepreneurial performance
- Impact of ICT on economic growth of enterprise
- Impact of ICT on ROI (Return on Investment) of enterprise
- Impact of ICT on ROE (Return on Equity) of enterprise
- Impact of ICT on ROA (Return on Assets) of enterprise
- Impact of ICT on economic growth of enterprise
- Impact of ICT on Employment growth of enterprise
- Impact of ICT on Sales growth of enterprise
- Impact of ICT on Firm growth
- Impact of ICT on General business growth of enterprise
- Impact of ICT on Growth in ROS of enterprise
- Impact of ICT on Growth in cash flow of enterprise
- Impact of ICT on Growth in revenue of enterprise
- Impact of ICT on Growth in net income of enterprise
- Impact of ICT on Growth in profit of enterprise
- Impact of ICT on International sales growth of enterprise
- Impact of ICT on Labour productivity growth of enterprise
- Impact of ICT on domestic and export market expansion of enterprise
- Impact of ICT on Firm Productivity growth of enterprise
- Impact of ICT on Return on Capital Employee (ROCE) of enterprise
- Impact of ICT on Sales turnover of enterprise
- Impact of ICT on Sale per employee of enterprise
- Impact of ICT on internal rate of return (IRR) of enterprise
- Impact of ICT on Economic profitability of enterprise
- Impact of ICT on Average net profit margin of enterprise

- Impact of ICT on Overall Business performance/success of enterprise
- Impact of ICT on Competitiveness of enterprise
- Impact of ICT on Export Performance of enterprise
- Impact of ICT on Innovation performance of enterprise
- Impact of ICT on self-assessed measures of international performance of enterprise
- Impact of ICT on efficiency of enterprise
- Impact of ICT on Perceived organisational performance of enterprise
- Impact of ICT on Financial or accounting performance of enterprise
- Impact of ICT on Cost saving of enterprise
- Impact of ICT on improvement of external and internal communication of enterprise
- Impact of ICT on sustainable competitive Advantage of enterprise

At that point, a manual search was led on related journals such as Entrepreneurship Theory and Practice, Strategic Management Journal, Journal of Business Venturing, Academy of Management Journal, Journal of Applied Psychology, Journal of Small Business Management, the Entrepreneurship and Regional Development and Administrative Science Quarterly. Then the reference lists of the selected studies were searched to identify more relevant studies.

### **3.2. Decision rules for inclusion of studies in meta-analysis:**

The inclusion criteria of the studies warranted the studies to hold an obvious emphasis on Entrepreneurship related activities at the firm level, to explore the relationship between ICT & performance in enterprises as the key research question, be quantitative in nature and to include the Pearson correlation coefficient for the predefined relation.

We utilized the accompanying selection criteria to construct the scope of this meta-analysis:

1. Studies required to have an explicit focus on Entrepreneurship activities at the firm level. We screened all articles obtained to verify that the study indeed dealt with entrepreneurship topics, hence ensuring a greater homogeneity of the analyzed studies.
2. Studies required to explore the relationship between the ICT and performance in firms as a key research question. Hence, papers which explored entrepreneurship at individual-level were not considered.

3. Qualitative research was not considered. The studies had to be quantitative and empirical, providing information regarding the relationships between ICT and Business Performance.

4. To be incorporated into the meta-investigation, the studies needed to report the Pearson connection coefficient for the predefined relationship or give adequate factual data that enabled us to calculate a correlation coefficient.

So, based on the above discussion, our empirical model is provided below:

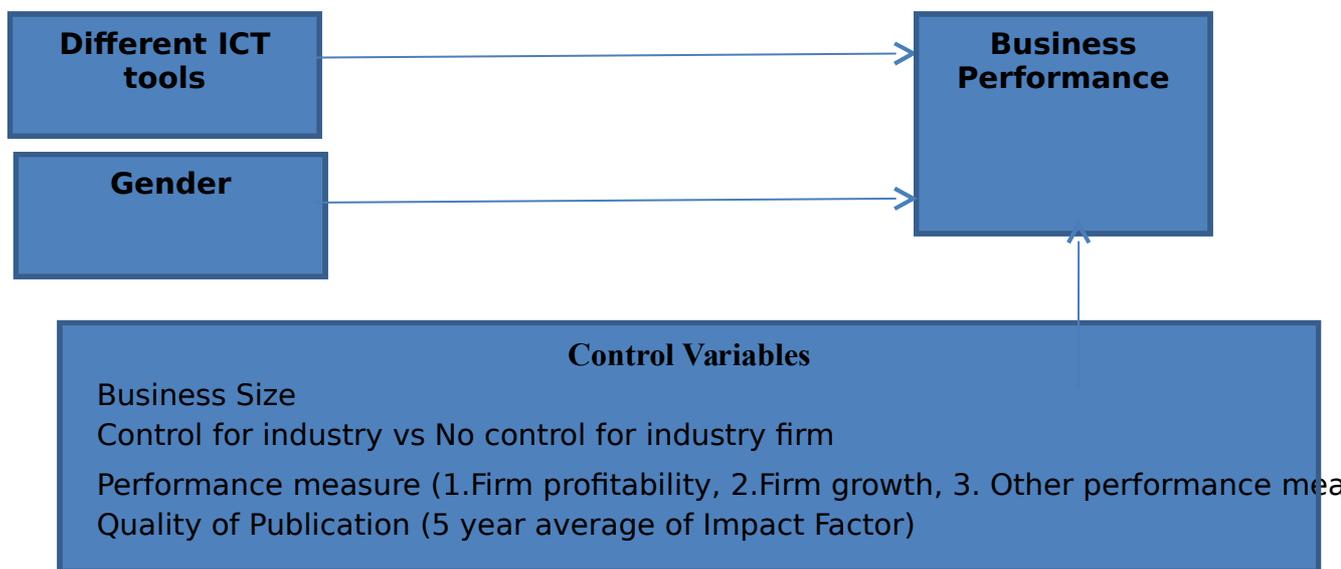


Figure 2: Empirical Model for meta-analysis

### 3.3. Calculation and analysis of effect size:

On completion of our search process in November 2017, a total number of 513 studies were collected and reviewed. After excluding a number of studies for being qualitative, not having Pearson correlation coefficient and not exploring the relationship between ICT and Performance, we finally had 96 studies in our database, each study representative of an independent sample (N=158497). Hence, we obtained a considerably solid empirical base for a meta-analysis (Brinckmann, Grichnik, & Kapsa, 2010; Read, Song, & Smit, 2009).

Sample sizes ranged from 8 (Devaraj and Kohli, 2000) to 61600 (Bertschek et al., 2013), and effect sizes ranged from  $r = -0.81$  (Bauer, Dehning and

Stratopoulos, 2012) to  $r = 1$  (Trigueros-Preciado, Pérez-González and Solana-González, 2013; Mbogo, 2010).

We conducted both Bivariate Analysis and Meta-regression. So, to validate our hypotheses, we took after the accompanying rule: A hypothesis is proven when confirmation is accomplished by bivariate and the meta-regression investigations. A hypothesis is partly confirmed when confirmation is affirmed when affirmation is accomplished by the bivariate or regression examination.

The moderating effect of Gender has also been explored in this meta-analysis. Firm Size, Different kinds of ICT tools, Control for industry vs No control for industry firm, Performance scope (i. Firm profitability, ii. Firm growth, iii. other performance measures), and Quality of Publication (5 year average of Impact Factor) have been used as control variables.

### **3.4. Variable coding:**

We created a coding manual and updated it as and when required to extract the necessary data from the chosen studies lessen coding mistakes (Lipsey and Wilson, 2001; Stock, 1994). The primary data obtained from the chosen studies remained the methodological components (e.g., Different sorts of ICT tools, Firm Size, Control for industry versus No control for industry, Performance scope (1.Profitability, 2.Growth, 3. other performance measure), and Quality of Publication (5 year normal Impact Factor) and statistics required to calculate effect sizes (e.g., Pearsons correlation coefficient).

#### *3.4.1. Independent variable - usage of ICT:*

Use of ICT has been used as independent variables.

- i) The Significance of Impact of ICT:*  
We coded the studies according to the Significance of Impact of ICT. We coded not significant as 0, significant as 1.
- ii) Different kinds of ICT tools:*  
We coded the 96 studies according to the ICT tools used by the firms. We coded Different kinds of ICT tools in the following manner:
  - use of mobile/telephony as 0,
  - use of a combination of ICT tools/ Overall ICT as 1,

- use of Internet/Broadband/Social Media/Internet communication tools (like whatsapp, viber, skype) /Own website as 2,
- use of ERP tool/IMIS(Integrated Information management System)/other information tools /CRM/Cloud Computing as 3,
- use of e-commerce/e-business as 4,
- use of computer /software/hardware as 5.

#### *3.4.2. Dependent variable – performance:*

Performance is a multidimensional notion (Lumpkin & Dess, 1996). The existing empirical literature shows a variety of performance indicators (Combs, Crook, & Shook, 2005; Venkatraman & Ramanujam, 1986).

These indicators can be sorted into three general classes: Profitability, growth, and other performance measures. Productivity markers incorporate ROS (Zahra, Hayton and Salvato, 2004), Profitability (Antoncic, 2006), ROA (Andersen, 2010), Cash stream (Renko, Carsrud and Brannback, 2009), ROI (Miller and Toulouse, 1986), internal rate of return (IRR) and Sale per representative (Walter, Auer and Ritter, 2006), internal rate of return (IRR).

Besides the Profitability indicators, extant research also utilizes Growth-related indicators to investigate the impact of ICT on the growth related performance of a firm, such as Sales growth (Messersmith & Wales, 2011), Employment growth (Fairoz, Hirobumi & Tanaka, 2010), General business growth (Guurbuz & Aykol, 2009), Firm growth (Anderson & Eshima, 2011; Antoncic, 2006), Growth in revenue (Griffith, Noble & Chen, 2006), Growth in ROS (Gabrielsson, 2007), Growth in cash flow (Griffith, Noble & Chen, 2006), Growth in profit (Zahra & Garvis, 2000), Growth in net income (Miller & Toulouse, 1986), Domestic and export market expansion (Chowdhury, 2006), International sales growth (Ripolles, Blesa and Monferrer, 2012).

There also exist other special indicators which were utilized as a part of specific conditions, for example, overall business performance/success (Barrett and Weinstein, 1998; De Clercq, Dimov and Thongpapanl, 2010; Covin and Slevin, 1989; Wiklund and Shepherd, 2003), Competitiveness (Cuevas-Vargas et al., 2015), Value addition (Osei-Bryson and Ko, 2004;

Saeed et al., 2002), Customer satisfaction (Ranganathan et al., 2004; Devaraj and Kohli, 2000; Ray et al., 2005), Market share (Barua et al., 1995; Byrd and Davidson, 2003; Sircar et al., 2000) and so forth.

In the first place, we separated growth as well as profitability related performance measures or scopes. Moreover, we included the classification of “other business performance” because a few investigations in the Entrepreneurship field utilize varied angles of performance (Barrett and Weinstein, 1998; Covin and Slevin, 1989; De Clercq, Dimov and Thongpapanl, 2010; Wiklund and Shepherd, 2003).

#### *3.4.3. Moderator variable- Presence of Gender:*

We thought about Gender, separating between 'Not Present' (Gender is absent) coded as 0 in the meta-regression investigation as well as 'Present' (Gender is available) coded as 1 in the meta-regression examination.

#### *3.4.4. Control variables:*

At the firm as well as industry level, we took into consideration the firm size, distinguishing between studies with Micro sized firms with less than 10 employees (OECD, 2005) coded as 0 in the meta-regression examination, studies with SMEs with less than 500 workers (OECD, 2005) coded as 1 in the meta-regression investigation, studies with large sized firms with more than 500 workers (OECD, 2005) coded as 2 in the meta-regression examination and Mixed (studies that have micro, SME and large firms) coded as 3 in the meta-regression investigation.

We additionally controlled for whether the primary examination controlled for industry (coded as 1 in meta-regression) or not (coded as 0 in meta-regression) (Brinckmann, Grichnik, and Kapsa, 2010). The only times we put no control for industry are when all observations in the data come from the same industry, or if they come from different industry but there is no industry category among the independent variables used in the study. On the other hand, when the industry categories have an “other” option

besides some specific ones that just means that the industry has been controlled for, to some extent.

The quality of the studies was assessed by the 5 year average of Impact Factor of the study (reported from Thomson Reuters Ranking and SJR Ranking). Studies without impact factor (not published) were coded as 0 and the studies with impact factor (published) were coded as their 5-year average Impact Factor which made it possible for us to control statistically for publication bias.

### *3.5. Meta-Analytic Procedures:*

In the empirical studies on the topic of ICT and firm performance, the Pearson product-moment correlation coefficient ( $r$ ) remains the most broadly applied measurement. Hence, correlations were collected for each study for the ICT-performance relationship.

Two different methods are used in meta-analysis process with a view to combining study related estimates (Hedges & Olkin, 1985; Hedges & Vevea, 1998). One of them is fixed effects model which assumes that there exists no heterogeneity among the outcomes of previous studies. This model also assumes that gathered effect sizes remain corrected only to address sampling errors. In other words, according to fixed effect model, variability in effect sizes is only caused by sampling error. On the other hand, random effect model assumes that variability in effect sizes is not only caused by sampling error but also by other factors. Consequently, the effect sizes in random effect model are corrected for sampling error along with other sources of variability which are assumed to be randomly distributed (Kisamore & Brannick, 2008).

Since the confidence intervals about the mean effect size in random effect model is larger compared to fixed effect models, it can also be used for relationships which remain comparatively under-studied (Overton, 1998). Consequently, the random effect model remains a more conservative approach compared to the fixed effects model. Moreover, the random effects model remains not subject to Type I bias in significance test of mean effect sizes as well as moderator variables because of its larger confidence intervals. Those are the two advantages that Random effect model has over fixed effect models.

Effect sizes were corrected according to Lipsey and Wilson (2001) not only for sampling errors but also for measurement errors as well as a value ( $\hat{\nu}$ ) which indicates variability related to other sources which we assume to be distributed in a random way in the selected studies.

Moreover, a 95% confidence interval (CI) was computed by us around the estimated population correlation. A random-effects model was used to compute the mean correlations (Schmidt, Oh, & Hayes, 2009). We adopted random-effects model since it renders comparatively more realistic evaluations related to average effect sizes, permits researchers to make generalizations made for a population of studies, as well as and hints about the variability in true effect sizes across different studies (Raudenbush, 2009). The heterogeneity, statistical tests of significance, as well as moderator related effects are calculated based on the sizes of the weighted effects of sample size (Hunter & Schmidt, 1990; Unger et al., 2011).

With a view to testing the hypothesized moderating associations amid contingency variables and effect sizes within the bivariate analysis, all variables were dichotomized as well as divided into mutually exclusive groups based on their underlying hypothesized moderators (Lipsey & Wilson, 2001).

Since, bivariate meta-examination is not suitable for evaluating relationships which are multivariate in nature, bivariate meta-analysis remains subjected to criticisms. To solve this constraint, we used meta-regression approach as well which takes into account the absolute exact value in case of metric moderator variable as well as 0/1-values for the categorical type of variables. Meta-regression examines the significance, as well as relative explanatory power, related to every contingency variable considering the presence of other variables (Balkundi & Harrison, 2006; Cooper, Hedges, & Valentine, 2009; Hedges & Olkin, 1985). With a view to predicting the inverse-coefficient-adjusted effect sizes related to the individual studies, Meta-regressions utilizes contextual factors as independent variables as well as effect size as the dependent variable.

The correlation related to ICT use and performance was considered as dependent variable whereas use of ICT and Gender were treated as independent variables within the meta-analytic regression model.

## **4. RESULTS:**

H1 is affirmed since both bivariate, as well as meta-regression investigations; discover a considerably stronger association between ICT as well as firm performance. The same does not apply to H2 as it is confirmed in meta-regression but rejected in Bivariate Analysis.

### **4.1. Analyses:**

#### *4.1.1. Bivariate Moderator Analysis:*

Firstly, we completed a bivariate examination (given in table 2). A significant random-effects effect size has been obtained for the ICT and overall performance relationship ( $\bar{r}_c = 0.610$ ). The considerable  $Q$ -measurement (21624.87,  $df=95$ ;  $p < .001$ ) indicates variability across the effect sizes that hints the existence of theoretically relevant moderators. Hence, it proves our conjecture that contextual variables impact the ICT-performance relationship (Hunter & Schmidt, 1990).

We found comparatively larger effect sizes for studies with e-commerce/e-business as the ICT tool ( $r = .59$ ,  $k = 9$ ) compared to those studies with mobile/telephony as the ICT tool ( $r = 0.464$ ,  $k = 4$ ), studies with ERP tool/IMIS/CRM/Cloud Computing as the ICT tool ( $r = 0.422$ ,  $k = 14$ ), studies with Internet/Broadband/Social Media/Internet communication tools (whatsapp, viber, skype)/Own website as the ICT tool ( $r = .250$ ,  $k = 7$ ), studies with a combination of ICT tools/Overall ICT as the ICT tool ( $r = 0.232$ ,  $k = 58$ ) and studies with computer /software/hardware as the ICT tool ( $r = 0.335$ ,  $k = 4$ ).

We found comparatively larger effect sizes for studies with the presence of the element of Gender ( $r = 0.36$ ,  $k = 20$ ) compared to those studies without the element of Gender ( $r = .258$ ,  $k = 76$ ).

#### *4.1.1.1. Control variables:*

We found comparatively larger effect sizes for studies with Firm Growth ( $r = .412$ ,  $k = 15$ ) compared to those studies with Other Performance Measure ( $r = .301$ ,  $k = 62$ ) and studies with Firm Profitability ( $r = -.304$ ,  $k = 19$ ).

We found comparatively larger effect sizes for studies on micro sized firms ( $r = .415$ ,  $k = 8$ ) compared to those studies on mixed sized firms ( $r = .414$ ,  $k = 26$ ), those studies on SMEs ( $r = .374$ ,  $k = 46$ ) and those studies on large firms ( $r = .114$ ,  $k = 11$ ).

We found comparatively larger effect sizes for studies without 5 year average impact factor ( $r = .312$ ,  $k = 46$ ) than for those studies with 5 year average impact factor ( $r = .174$ ,  $k = 53$ ).

We found comparatively larger effect sizes for studies with no control for industry ( $r = .32$ ,  $k = 46$ ) than for those studies with control for industry ( $r = .264$ ,  $k = 50$ ).

#### *4.1.2. Meta-Regression Outcomes:*

Next, we continued with the meta-regression process that permits the comparative explanatory ability of every contingency variable to be explored considering other variables.

The Tobit regression results suggest that the ICT ( $\beta = 3139.21$ ,  $p < 0.001$ ) is significantly and positively related to performance.

The regression results suggest that the use of mobile/telephony has a positive but not significant ( $\beta = 2170.06$ , n.s.) influence on performance.

The regression outcomes indicate that the use of Internet/Broadband/Social Media/Internet communication tools like whatsapp, viber, skype/Own website has a significant and positive ( $\beta = 1800.52$ ,  $p < 0.001$ ) impact on performance.

The regression results suggest that the use of ERP tool/IMIS/other information tools (Integrated Information management System) /CRM/Cloud Computing has negative and not significant ( $\beta = -1092.77$ , n.s.) influence on performance.

The regression results suggest that the use of Computer /software/hardware as the ICT tool has negative and not significant ( $\beta = -1861.70$ , n.s.) influence on performance.

The regression results suggest that the use of a combination of ICT tools/ Overall ICT has positive but not significant ( $\beta = 1085.02$ , n.s.) influence on performance.

The results suggest that presence of gender ( $\beta = -1676.62$ ,  $p < 0.001$ ) was significantly but negatively related to performance.

*i) Control variables related Analysis:*

The regression outcomes reveal that the ICT-performance relationship remains negatively associated but statistically not significant if controlled for industry ( $\beta = -82.69$ , n.s.).

Finally, we found that control for Performance measure (Firm profitability versus Firm growth versus other performance measures ( $\beta = -2022.04$ ,  $p < 0.001$ ), Publication quality in the form of 5 years impact factors of journals ( $\beta = -364.59$ ,  $p < 0.001$ ) affected our results.

#### **4.2. Analyses:**

Our meta-analysis study can be claimed as the first one which explores the relationship between ICT and performance where the gender angle has been taken into consideration with a view to contributing to evidence-oriented research in the field of entrepreneurship.

Not each of the hypotheses in our study was completely proven. Both the bivariate analysis as well as the meta-regressions consistently proved that H1 which expected that ICT usage is positively associated with Firm Performance is confirmed. These influences change according to the types of ICT tools used. Some technological resources impacted firm performance more than the other ICT tools. But these outcomes vary between Bivariate and Meta-regression since bivariate analysis only takes into account impact of one independent variables on a dependent variable whereas meta-regression takes into account impact of other variables in calculating the relationship of one independent variable with a dependent variable. We also found some negative organizational performance for some ICT tools in the meta-regression analysis. One reason could be the very nature of ICT which makes it difficult for ICT to directly impact organizational performance without being complementary with other business functions for instance SCM and marketing (Liang et al., 2010). Another probable clarification is that there exists a wide range of various factors which could impact an organizational performance. Its impact might be outweighed by host of other different factors and thus

does not demonstrate its impact up to the statistically significant level (Liang et al., 2010). Among these factors time lag factor is in existence when we consider the effect of IT investment as argued by Kohli and Devaraj's (2003). Moreover, external environment plays a big part (Melville et al., 2004).

The RBV helped us synthesize these internal and external perspectives which resulted in identifying what is known and what is unknown about different contextual factors which impact the ICT performance relationship. Future studies can shed more light on this.

Moreover, it was found that in the Meta-regression that the presence of gender was significantly but negatively related to performance which means that the relationship between ICT is moderated by Gender such that if the Gender is present or mentioned, the weaker the relationship. But in the bivariate analysis, a strong and positive relation was found among ICT use and Presence of Gender. So, we, partly accept this hypothesis since Meta-Regression is a stronger statistical tool as it takes into consideration all the variables while indicating the impact of the change in one variable on others.

Among the 96 studies which have been considered in the meta-analysis, 50 studies controlled for industry and 46 studies did not control for study at all. The regression results reveal that the ICT-performance relationship is negatively associated and statistically significant if controlled for the industry. Those studies which controlled for industry also took into consideration industry related factors those impact the ICT and business performance relationships. According to Bain (1951), Mason (1939) and Porter (1985), the structure of an industry directly influences the performance of different organizations within that industry. Nonetheless, the inclusion of industry related controls in the empirical studies does not directly explain how industry related characteristics limit or stimulate organizations utilize ICT for improving organizational performance. Only 50 papers directly examined difference IT business value across different industries. Even fewer studies attempted to render a theory driven argument to explain the reason of the existence of such differences. One stream of such research has applied growth accounting to explore diverse multi-factor productivity (MFP) growth at the industry level. Stiroh (2001)

finds firms in the IT industry have witnessed larger productivity related acceleration compared to other industries. According to Morrison (1997) the increase of IT benefit-cost ratio overtime does not remain uniformly distributed across different industries.

Finally, we found that control for Performance measure (Firm profitability versus Firm growth versus other performance measures) and Publication quality in the form of 5 years impact factors of journals affected the outcome significantly.

## **5. DISCUSSION:**

### **5.1. Contributions:**

It is established within the extant literature that ICT holds a positive impact on the performance of firms (Lopez-Nicolas and Soto-Acosta, 2010; Falk, 2005; Luo and Bu, 2016; Hwang and Min, 2015; Yunis et al., 2017; Liang et al., 2010, for a meta-analysis). Extant literature also shows that gender-related differences exist in terms of ICT user behavior, skills, interest, attitude (Imhof et al., 2007; Whitley, 1997, for a meta-analysis; Shashaani, 1994; Campbell, 1990; D'Amico, Baron, & Sissons, 1995; Levin & Gordon, 1989). There is also some evidence that males outperform females at ICT skill (computer task) (Imhof et al., 2007; Busch, 1996).

But whether Gender holds any kind of positive or negative impact on this ICT-Business Performance relationship is not existent in the literature. There is no existing literature which answers this question. Thus, our meta-analysis remains a major addition to the extant literature and it helps enhance the theoretical as well as the empirical understanding of the role of Gender in the ICT and Business Performance related Relationship. Moreover, this paper integrates the findings of existing literature on the impact of different ICT tools on Business Performance. Moreover, this study explores whether gender strengthens or weakens the link or not. Thus, this meta-analysis paper remains a significant addition to the extant literature and it helps enhance the theoretical as well as the empirical understanding of the moderating role of Gender in the ICT and Performance Relationship in Firms.

Findings of this meta-analysis remain pertinent for practitioners including educators, policymakers as well as for forthcoming research.

## **5.2. Potential limitations as well as avenues for further research:**

Our study on meta-analysis includes a few limitations which offer the potential for exploring it further in future studies.

Though meta-analysis remains a solution to numerous issues found in narrative literature reviews, it does not act as a solution for all issues. Potential constraints incorporate publication bias, observation biases, the impact of confounding variables, and scope. We adopted a few measures to prevent potential issues.

Since the outcome of this meta-analysis remains dependent on past research on the subject matter carried out on diverse sources at the different point in time, there remains a possibility of observation biases. However, the considerable size of the samples can enhance the robustness of the outcomes.

This meta-analysis study endeavoured to avert a publication bias via including non-published outcomes. However, access to such empirical study remains low.

We likewise observed that quantitative ICT-Firm Performance study remains dictated by cross-sectional research. Nonetheless, longitudinal investigations could uncover that an ICT holds positive long-term impacts. Hence, the cross-sectional primary examinations that dictate the existing meta-investigation might have underestimated performance related impacts.

Despite the fact that a considerable number of researches have explored the iCT-business performance relationship, numerous aspects of it are still understudied. Especially in future, more empirical research might explore how different types of ICT tools, impacts different dimensions of ICT specifically the recent additions in ICT tools such as social media, cloud Computing etc.

Future research might also pursue some moderators to capture other angles of ICT and Business Performance Relationship in Firms.

## **6. Concluding remarks:**

The robustness of the relationship between ICT and performance in firms renders a valuable as well as reliable instrument for policymakers along with practitioners. Being the pioneer meta-analysis that investigates the moderating role of Gender in the ICT and business relationship, this meta-analysis renders a building block upon which a wider comprehension of the impact of ICT on performance in firms can be undertaken.

By and large, this investigation distinguished various critical contextual factors that affect the relationship between ICT and Performance. In this process, we expect to catalyse a more contextual comprehension of the phenomena of entrepreneurship. The identified variables remain indicators of various salient contextual aspects; yet, we would prefer not to propose that the distinguished factors remain the only ones. Additional research can be conducted to reveal diverse moderators as well as outlining precise mechanisms how ICT influences Performance in firms.

## APPENDICES:

**Table 1: Overview of hypotheses treatment according to bivariate and meta-regression analyses:**

Hypothesis	Confirmed in ...		Conclusion for hypothesis
	Bivariate analysis	Meta-regression	
H1: Use of ICT tools is positively associated with SME Performance.	Yes	Yes	Accepted
H2: Presence of gender differences act as a negative moderator within the ICT-performance relationship, in the sense the presence of	No	Yes	Partly accepted

gender as a control in the previous studies, weakens the primary ICT-performance relationship.			
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**Table 2: Correlations between ICT and performance: Main effect and bivariate moderator analysis:**

	<b>K</b>	<b>N</b>	<b>r</b>	<b>95% CI</b>
<b>H1:</b> ICT→Business performance	96	158497	0.610	0.266 to 0.275
<b>H1a:</b> Mobile/telephony→Business performance	4	832	0.464	0.409 to 0.517
<b>H1b:</b> Computer /software/hardware→Business performance	4	660	0.335	0.265 to 0.401
<b>H1c:</b> Internet/Broadband/Social Media/Internet communication tools like whatsapp, viber, skype/Own website→Business performance	7	69831	0.25	0.243 to 0.257
<b>H1d:</b> e-commerce/e-business→ Business performance	9	9774	.59	0.581 to 0.607
<b>H1e:</b> ERP tool/IMIS(Integrated Information management System)/other information tools /CRM/Cloud Computing→ Business performance	14	2502	0.422	0.389 to 0.454
<b>H1f:</b> A combination of ICT tools/Overall ICT → Business performance	58	74898	0.232	0.225 to 0.238
<b>H2:</b> Gender→Business performance	20	19716	0.36	0.346 to 0.371
<b>Controls</b>				

<b>Study quality</b>				
1. Low quality	43	110057	0.312	0.306 to 0.317
2. High quality	53	48440	0.174	0.165 to 0.182
<b>Industry</b>				
No Control for industry	46	20585	0.32	0.304 to 0.329
Control for industry	50	137912	0.264	0.259 to 0.269
<b>Performance Measure</b>				
Firm Profitability	19	15480	-.304	-0.319 to -0.29
Firm Growth	15	34942	.412	0.404 to 0.421
Other Performance Measure	62	108075	.301	0.295 to 0.306
<b>Firm Size</b>				
Micro	8	7467	.415	0.396 to 0.434
SME	46	52591	.374	0.367 to 0.382
Large	11	75996	.114	0.107 to 0.121
Mixed	26	12087	.414	0.399 to 0.429

All values are significant at  $p < 0.01$  unless otherwise indicated.

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