THE EFFECTS OF DYNAMIC CAPABILITIES, CULTURE AND THE ROLE OF MANAGEMENT ACCOUNTANT ON THE RELATIONSHIP BETWEEN BIG DATA ANALYTICS CAPABILITIES AND INNOVATION PERFORMANCE

SABRA MUNIR

UNIVERSITI TEKNOLOGI MALAYSIA

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SABRA MUNIR

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DEDICATION

This research thesis is dedicated to my beloved children, Abdullah Bin Farrukh, Ayesha Farrukh and Fatima Farrukh, who were the biggest motivation for me. They also suffered the most when I was busy with the research work. I would like to thank my loving husband, Farrukh Jamil, who took care of our children during these times and also looked after their needs when I was not available.

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ABSTRACT

Big Data Analytics (BDA) have the power to modernize traditional ways of doing business. Nevertheless, Big Data Analytics Capabilities (BDAC) impact on a firm's innovation performance is still not fully understood. The 'Age of Data' is thriving because new data is being produced at an unprecedented rate and increasing volume due to the global usage of different electronic devices and gadgets connected through the internet and other networks. Innovation is a vital part of obtaining business value. There is very little research on how organizations need to change to leverage such innovations. An increasing number of studies have investigated and theorized about the strategies and structures that could help firms acquire the capacity to continuously innovate by introducing new products through Process Oriented Dynamic Capabilities (PODC). Most researchers explored the phenomenon of BDA from either a theoretical point of view or neglected the intermediate and moderating factors, such as PODC, Organizational Culture (OC) and the Role of Management Accountant (RMA). Drawing on the resource-based view and the socio-materiality theory and recent literature on BDA, this study attempts to fill this gap by examining the indirect relationship between BDAC and organizational innovation performance (OIP). The current study extends existing research by proposing that BDAC enable pharmaceutical companies to generate insight that can help strengthen their PODC, which positively impacts OIP. To test the proposed research model, the current study used survey data from 181 pharmaceutical companies in Pakistan. The respondents were top management of the companies. Through partial least squares structural equation modelling and bootstrapped moderated mediation analysis, the results support the current study's assumptions regarding the indirect effect BDAC has on OIP. Specifically, the results show that PODC partially mediates the relationship between BDAC and OIP. In addition, OC moderates and enhances the relationship between BDAC and OIP. Furthermore, OC did not moderate the relationship between PODC and OIP. At the same time, with RMA as a moderator, the relationship between PODC and OIP is also significant. However, RMA did not moderate the relationship between BDAC and OIP. Building on this status of valuable knowledge and the existing literature gap, the objective of the current study was to understand whether and through what latest mechanisms BDAC can lead to enhanced OIP. This study contributes theoretically and empirically to the existing literature on BDA and innovation. The findings provide practical implications for top executives in the innovative industry on implementing BDAC to enhance innovation and effective decision making to achieve competitive advantage and business value with moderating effect of OC. Results show a need to convert big data into meaningful information for strategic decision-making. Management accountant plays a vital role with the help of new skills set in BDA to develop expertise and bridge between data analysts and business executives as a moderator.

ABSTRAK

Analisis Data Raya (BDA) berupaya untuk memodenkan cara tradisional menjalankan perniagaan. Namun begitu, kesan Keupayaan Analisis Data Raya (BDAC) terhadap prestasi inovasi firma masih belum difahami sepenuhnya. 'Zaman Data' berkembang pesat kerana data baharu dihasilkan pada kadar yang tidak pernah berlaku sebelum ini dan peningkatan jumlah data disebabkan penggunaan global pelbagai jenis peranti elektronik dan gajet yang disambungkan melalui internet dan rangkaian lain. Inovasi adalah aspek penting dalam mendapatkan nilai perniagaan. Penyelidikan berkaitan bagaimana organisasi perlu berubah untuk memanfaatkan inovasi masih sangat sedikit. Semakin banyak kajian telah menyiasat dan berteori tentang strategi dan struktur yang boleh membantu firma memperoleh kapasiti untuk terus berinovasi dengan memperkenalkan produk baharu melalui Keupayaan Dinamik Berorientasikan Proses (PODC). Kebanyakan penyelidik meneroka fenomena BDA sama ada dari sudut pandangan teori atau mengabaikan faktor perantaraan dan penyederhana, seperti PODC, Budaya Organisasi (OC) dan peranan Akauntan Pengurusan (RMA). Berdasarkan teori berasaskan sumber dan teori sosio-kebendaan dan literatur terkini tentang BDA, kajian ini cuba mengisi jurang ini dengan mengkaji hubungan tidak langsung antara BDAC dan prestasi inovasi organisasi (OIP). Kajian ini mengembangkan penyelidikan sedia ada dengan mencadangkan bahawa BDAC membolehkan syarikat farmaseutikal menjana idea yang boleh membantu mengukuhkan PODC, yang memberi kesan positif kepada OIP. Untuk menguji model penyelidikan yang dicadangkan, kajian ini menggunakan data tinjauan daripada 181 syarikat farmaseutikal di Pakistan. Responden merupakan ahli pengurusan tertinggi syarikat. Melalui Pemodelan Persamaan Struktur – Kuasa Dua Terkecil Separa dan menggunakan analisis pengantaraan sederhana *bootstrapped*, keputusan mengesahkan andaian kajian berkenaan kesan tidak langsung BDAC terhadap OIP. Secara khusus, keputusan menunjukkan bahawa PODC separa mengantara bagi hubungan antara BDAC dan OIP. Di samping itu, OC menyerdahanakan hubungan antara BDAC dan OIP. Tambahan pula, OC tidak menyederhanakan hubungan antara PODC dan OIP. Pada masa yang sama, dengan RMA sebagai penyederhana, hubungan antara PODC dan OIP juga penting. Walau bagaimanapun, RMA tidak menyederhanakan hubungan antara BDAC dan OIP. Berdasarkan status pengetahuan yang berharga ini dan jurang literatur yang sedia ada, objektif kajian ini adalah untuk memahami sama ada dan melalui mekanisme terkini BDAC boleh meningkatkan OIP. Kajian ini menyumbang secara teori dan empirikal kepada literatur sedia ada mengenai BDA dan inovasi. Penemuan ini memberikan implikasi praktikal kepada eksekutif tertinggi dalam industri inovatif bagi melaksanakan BDAC untuk meningkatkan inovasi dan membuat keputusan yang berkesan untuk mencapai kelebihan daya saing dan nilai perniagaan dengan OC sebagai faktor penyederhana. Keputusan menunjukkan bahawa terdapat keperluan untuk menjadikan data raya sebagai maklumat yang bermakna dalam membuat keputusan strategik. Akauntan pengurusan memainkan peranan penting dengan bantuan set kemahiran baharu dalam BDA untuk membangunkan kepakaran dan menghubungkan antara penganalisis data dan eksekutif perniagaan sebagai penyederhana.

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LIST OF ABBREVIATIONS

AGFI	-	Adjusted Goodness of Fit Index
AVE	-	Average Variance Extracted
BDA	-	Big Data Analytics
BDA Cap	-	Big Data Analytics Capabilities
BDAC	-	Big Data Analytics Capabilities
CEO	-	Chief Executive Officer
CFA	-	Confirmatory Factor Analysis
CFO	-	Chief Financial Officer
CIO	-	Chief Information Officer
CR	-	Composite Reliability
OC	-	Organizational Culture
OIP	-	Organizational Innovation Performance
PODC	-	Process Oriented Dynamic Capabilities
RMA	-	Role of Management Accountant
SPSS	-	Statistical Package for Social Sciences
VIF	-	Variance Inflation Factor

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CHAPTER 1

INTRODUCTION

1.1 Overview of Chapter 1

This chapter provides the outline related to the overall study, starting with the background of the study, followed by the problem statement, research questions and then the research objectives. It continues with highlighting the significance as well as the scope of the study, the definitions of the key terms and then illustrates the structure of the thesis. This chapter focuses on the specific problems and the practical as well as theoretical implication of this research so that the contribution of this study to the body of knowledge related to the field of big data analytics capabilities (BDAC) as well as process oriented dynamic capabilities (PODC) via the moderating role of management accountant (RMA) and organization culture (OC) can be demonstrated.

1.2 Background of the Study

At the present time, innovation has turned into the main pillar of achievement for every organization in business environments all around the world (Ciampi, Demi, Magrini, Marzi, and Papa, 2021; Ghasemaghaei and Calic, 2020; Shahzad, Xiu, and Shahbaz, 2017; Tidd and Bessant, 2018). The rate of innovation can be increased by a number of approaches, including, but not limited to, a rapid rate of product development, product life cycles which tend to be shorter, as well as rapidly changing technology. This would lead to changes in the type and nature of economic development (Shahzad *et al.*, 2017; Survey, 2020). Innovation is treated as an inherent part of an organization's strategies and is meant to attain competitive advantage which

can be sustained within the markets (Ghasemaghaei and Calic, 2020; Tidd and Bessant, 2018).

The present time period is considered as the age of big data as newer data is being generated at an previously unmatched rate from all organizations, public organizations and other bodies as well as all industrial sectors (Mikalef, Boura, Lekakos, and Krogstie, 2019b; Mikalef, Krogstie, Pappas, and Pavlou, 2020). Data volume has increased at an exponential rate and this has resulted in big data being treated as the key source of innovation, business performance and hence competitive advantage (Chaudhary, Pandey, and Pandey, 2015; Grover, Chiang, Liang, and Zhang, 2018; Jelinek and Bergey, 2013; Mikalef *et al.*, 2019b; Shahzad *et al.*, 2017). Currently, more than 3.2 billion people from all over the world are linked to the internet, while 46% of such people are connected via their smart phones (Clement, 2020). At the same time, such a huge change of IP traffic (internet traffic and flow of data through internet) from fixed networks to networks based on wireless, will almost certainly create many challenges for the organizations. The forecasted global mobile data traffic for the period of 2017-2022 (in terms of exabytes per month) is from 11.51 to 77.49 (Clement, 2020). By 2050 such forecasted figures are expected to be almost 95% of global population (Khan, Khan, Alam, and Ali, 2018). According to Usak *et al.* (2020) the amount of available data and information in the healthcare industry is increasing at an exponential rate, as a result of the speedily increasing availability of a variety of medical devices, enterprise based software systems like electronic health record (EHR) systems, and other relevant technologies.

Organizations are required to analyze structured and unstructured data in a meaningful and systematic way, so that a much clearer insight can be obtained related to the customers' behavior, their utilisation of services and their interests on a real-time basis (Mikalef *et al.*, 2019b; Riaz, Alam, and Ali, 2017) to improve performance of the business, for carrying out innovation and for attaining competitive advantage. A number of organizations of varying sizes are looking for ways for improving their business performance, their innovations and hence their business value, by considerable use of big data analytics (BDA) tools (Mikalef *et al.*, 2019b; Shinwari and Sharma, 2018; Yin and Kaynak, 2015). The creation of new knowledge bases, the

research on the forefront of science, and the invention of new medicines as well as the improvement of the existing drugs, all comprise the fuel that projects the organisations within the pharmaceutical industry.

1.2.1 Economic Performance and Pharmaceutical Sector

According to IQVIA (2018), which is an organisation based in the United States and which focuses on the healthcare market research, the pharmaceutical industry and market of Pakistan are among the top 3 fastest growing industries and markets in the world. The domestic pharmaceutical organisations' sales in Pakistan have attained a CAGR of 13.1% over the last 4 years, thereby exceeding the multinational companies (MNCs), which had attained global growth rate of 9.34% CAGR. The pharmaceutical sector of Pakistan is growing at a rate faster than that of the other emerging markets such Brazil, India, Russia, Bangladesh and Vietnam (IQVIA, 2018). The quarterly revenues of the local companies in the pharmaceutical sector of Pakistan have crossed Rs. 320 billion in the quarter ending March 31, 2020. This can be compared to the figure of Rs. 195.75 billion of the MNCs as of March 31, 2016 (IQVIA, 2018). According to the United Nations Comtrade (2020) database related to international trade, $217.04 million worth of pharmaceutical products were exported by Pakistan in 2019.

In spite of the abovementioned facts relating to the positive trends in the pharmaceutical industry of Pakistan, some negative realities are also present. As a result of the high depreciation of the Pakistani currency, the overall industrial growth in terms of US dollar, had remained negative in the first quarter of the year 2020. In a report (IQVIA, 2018), in the past four years, the CAGR of the national companies was 2.41 % as compared to MNCs which had a CAGR of 1.01 %.

In the coming months, there would be a severe impact of the COVID 19 pandemic; the projected growth rate of the world economy has been revised downwards by the International Monetary Fund (IMF) and it is currently expected to contract by 4.9 percent 2020. The high depreciation of the Pakistani Rupee as well as

the impact of the pandemic has created a very difficult time for the Pakistani economy and the next year will also likely to be quite difficult for the Pakistani economy (Javed, 2020). Pakistan's GDP is also precarious as the growth rate related to the next fiscal year is expected to be between 1 and 2 percent. This is much less than the normal growth rate in the previous years of between 3 and 5 percent (Javed, 2020). The country's pharmaceutical sector is a very important sector and one of the most innovative sectors for the economic performance of the country (Hanif and Gul, 2014; IQVIA, 2018; Rajabion, Shaltooki, Taghikhah, Ghasemi, and Badfar, 2019; Usak *et al.*, 2020). According to Javed (2020) a few industries, including the country's pharmaceutical industry, could play a very important role in helping the country's economy. Javed (2020) suggested that the pharmaceutical industry should focus on increasing their production capacity, because crucial projects for important medicines in Pakistan can be carried out via international collaboration. There should be a focus on establishing joint ventures relating to investments in the production facilities in order to improve the country's GDP. To obtain business value and attain competitive advantage it is essential that sustained innovation should occur in the pharmaceutical industry (Hanif and Gul, 2014). Unfortunately, Pakistan is ranked among the 16 worst countries out of a total of 121 countries (GII, 2019).

1.2.2 Big Data in Relation with the Business Value

Empirical research relating to the business value of BDA is currently in a very early stage. To date, a number of reports related to the area of business value of big data have been obtained from a wide variety of sources, including consultancy firms, popular press and individual case studies. However, in such reports, there is a lack of theoretical insight (Mikalef, Boura, Lekakos, and Krogstie, 2019a; Mikalef *et al.*, 2020). As a result, there is little understanding of how organizations should focus on their big data related initiatives. At the same time, little empirical evidence exists to support the claim that such investments, in reality, do create any business value worth measuring (Mikalef *et al.*, 2019a; Mikalef *et al.*, 2020; Mikalef, Pappas, Krogstie, and Giannakos, 2018; Sahoo, 2021).

A number of studies have focused on the importance of BDAC related to the management to create applicable or practicable ideas for enabling innovation performance measurement, delivering sustained value and achieving competitive advantage (Ghasemaghaei and Calic, 2020; Mikalef *et al.*, 2018; Wamba, Akter, Edwards, Chopin, and Gnanzou, 2015; Wamba *et al.*, 2017). As a result of increased usage of innovative technologies, BDA has now become the fourth paradigm of science which has provided solutions to the management by analysing complex data and datasets (Ahmed and Saeed, 2014; Kipper, Furstenau, Hoppe, Frozza, and Iepsen, 2020; Strawn, 2012).

Based upon the upcoming research on BDAC (Bartolacci, Caputo, and Soverchia, 2020; Gupta, 2016; Mikalef *et al.*, 2018; Sahoo, 2021; Wamba *et al.*, 2017), studies have shown that although big data is an important resource, in itself it is insufficient to create any gains related to business value. There are other complementary resources which are necessary and create a synergy to drive an organization's overall BDAC; in this regard big data is supporting and giving guideline for decision making at strategic level for business value, competitive advantage and innovation performance. BDAC can be explained as firm's ability to capture and analyze data so as to be able to generate data insights by effective orchestration and usage of the organizational data, its technology as well as skills (Gupta, 2016; Mikalef *et al.*, 2018). Although there are very few studies which examine big data as a whole (Cui, Kara, and Chan, 2020; Gupta, 2016; Sabra, Rasid, Aamir, and Jamil, 2021; Wamba *et al.*, 2017), currently very little such study is available which is empirically related to the ways by which value in business can be generated by developing BDAC. It is very important to address these important gaps in the literature.

1.2.3 Big Data Analytics Capabilities and Innovation Performance

Organizations have to improve their existing processes and products on a continuous basis and develop new products which match market requirements. As a result, an increasing number of studies have investigated and theorized about the strategies and the structures which firms may need in order to build the capacity for

innovation on a continuous basis, by introducing new products with the help of Process Oriented Dynamic Capabilities (PODC) (Kim, Shin, Kim, and Lee, 2011; Kohlbacher and Reijers Hajo, 2013; Mikalef *et al.*, 2019b; Wamba *et al.*, 2017). In this regard, the organisation's dynamic resource-based view (RBV) demonstrates the dynamic capabilities as being the major source of an organisation's sustainable competitive advantage within a changing and competitive landscape (Mikalef *et al.*, 2019b; Mikalef *et al.*, 2020)

To be able to innovate, there is a need to have an organization wide culture that encourages such innovation in the first place (PWC, 2020; Shahzad *et al.*, 2017). According to (Shahzad *et al.*, 2017) a significant relationship exists between organizational innovation performance and organizational culture. The flexibility/support to alter, as well as the organizational climate, are relatively significant factors for the creativity and the innovation performance (Shahzad *et al.*, 2017). Within a particular industry in which identifiable and measurable performance is very important for survival in the existing competition, cultural influence on innovation performance is critical. It is crucial to develop an understanding of this relationship, specifically within the context of a developing economy, due to the importance of global competition in the rapidly occurring innovation related to technology, as well as economic development of the country (Shahzad *et al.*, 2017).

Organizations tend to emphasize the relationship between BDAC and the related effect on innovation, based upon the assumption that management is able to make the best possible choices from a number of different available options when faced with insights obtained from the generated data. At the same time, it would be possible that decisions may not be based on any big data related intelligence, because there may be a variety of other factors affecting the management's decision of adopting or rejecting any data-generated insight (Mikalef *et al.*, 2019b).

According to Lawson (2019), many changes are taking place in a number of existing roles and functions of professionals in terms of their requirements and scope. The utilisation of different technologies in IT, related to big data, have brought about radical changes to the businesses as a whole (Lawson, 2019). It is important that, with

the help of management accounting manufacturing organizations may improve their performance (Hadid and Al-Sayed, 2021; Ismail, Isa, and Mia, 2018). According to Lawson (2019) within accounting and finance profession, radical changes have also taken place in the scope and need of the management accountant.

However, not only is the big data important but also the ability to convert that data into meaningful information and then having the ability to utilise that information to deliver what is needed for creating and improving business value (Lawson, 2019). The data scientists, on their own, have the ability to do their technical work. However, the understanding of the relevant domain as well as knowing which questions to ask in which scenario(s) is lacking (Wadan, Teuteberg, Bensberg, and Buscher, 2019). At the same time, on their own, the business executives are unlikely to completely understand the true potential of the data analytics. This is where the role of the management accountant, acting as a bridge between these two groups of people, is so important. The management accountant also adds value for enhancing innovation performance with the help of new skill sets (Lawson, 2016).

Quantzig (2019), a leading analytics advisory firm, emphasized that BDA has created potential opportunities for organizations within the pharmaceutical industry, enabling them to deal with complex business environments which include increasingly large volumes of data sets. Similarly, BDA is enabling companies in improvement of the clinical trials of their drugs, managing risks efficiently, and improving patient safety (Quantzig, 2019). According to PACRA (2020), one of the largest populated countries in the world is Pakistan.

The pharmaceutical industry is one of the most important industries in Pakistan, whose contribution is significant in the health sector by way of manufacturing products and medicines for different diseases. The top 50 companies between them contribute 80% of the industry's revenues. In terms of market composition (in terms of sale value), national companies control 31% of the market while the remaining 69% is with the MNCs (PACRA, 2020).

It is very important to understand how BDAC are developed within high innovative industry, through which mechanisms is the value produced by the BDAC, and how such value can be obtained (Mikalef *et al.*, 2019b; Mikalef, Framnes, Danielsen, Krogstie, and Olsen, 2017). It is very important to address these areas in the pharmaceutical industries (Joshi, 2019; Quantzig, 2019) which is the context of the current study. This sector is considered as the world's largest and one of the main contributors to a country's economy (Times, 2017). It is of significant practical value, especially the innovation in this sector, keeping in view the costs of using big data related initiatives. Therefore, BDAC in relation with PODC as well as OIP with considering internal and external factors of Organizational Culture (OC) is a significantly important area in Pakistan's pharmaceutical sector. Furthermore, there is also a need to investigate the management accountants' potential role in BDAC.

1.3 Problem Statement

At present, the outlook for Pakistan's GDP is quite hazardous. This is because the GDP growth rate is expected to be barely 1-2 % for the next fiscal year, compared to rates in previous years which were in the range of 3% to 5% (Javed, 2020). The increasing trend of depreciation of the Pakistani rupee, expected to contract 4.9 % in 2020 by IMF and impact of pandemic are exerting downward pressure on the GDP of Pakistan (Survey, 2020). An economy's ability to enhance in productivity using the factors of production is called economic growth (Chughtai, Malik, and Aftab, 2015). In the present situation, since the economy of Pakistan is going through a difficult phase, Javed (2020) has stated that the pharmaceutical sector will play a crucial role in boosting the economy by attracting foreign investment through international collaboration in the form of international joint ventures. This can help in enhancing innovation performance in the pharmaceutical sector, leading to increase in production capacity (Javed, 2020).

The pharmaceutical sector has had a successful streak for decades. However, it is now facing a few challenges. As a result, companies are reconsidering their strategies. Due to the increasing availability of healthcare services, there are numerous

opportunities for the pharmaceutical companies to expand their target market. Such emerging markets are now becoming very important for the pharmaceutical companies. One of the main challenges faced by the pharmaceutical industry now is to move from a sales and marketing-based model to an access driven commercial model. The commercial atmosphere within the pharmaceutical industry is becoming harder and ruthlessly competitive. At the same time, there has been a data evolution within the healthcare analytics. As the pharmaceutical industry is becoming more and more complex and globalized, the sector needs to become more cost efficient (Quantzig, 2019). One of the biggest challenges which this industry faces is the complete freezing of prices of pharmaceutical products in Pakistan, demand forecasting, price fluctuation assessment and risk assessment (Haq, 2019). The price mechanism set by the government since 2001 has not allowed the pharma industry to increase prices of even those drugs whose costs have gone up by more than a 100 percent, whereas the price of inputs such as fuel, electricity, labour wages and raw materials have increased drastically making the survival of the industry very difficult. The number of MNCs working in Pakistan has gone down from 36 in the early 2000s to about 22 (Haq, 2019). That is a significant number of companies leaving the country. More recently, the situation has worsened with the depreciation of the Pakistani rupee. Since most of the raw material is being imported, any increase in dollar rates affects the profitability of the local manufacturers adversely (Javed, 2020).

In the pharmaceutical sector the management capabilities and innovation are some of the most important areas for the improvement of organisational performance, business gains and competitive advantage (Hanif and Gul, 2014). Unfortunately, Pakistan is currently facing low Annual Global Innovation Index, GII (2019), as compared to other countries, which identifies other regional leaders like India, Chile, South Africa, Israel, Singapore, China, Rwanda and Viet Nam. It is critical for Pakistan that manufacturing industries and pharmaceutical industry, in particular, needs to sustain and improve its innovation performance so as to improve their competitive advantage as well as business gains for economic development (Survey, 2020). The annual contribution of the pharmaceutical industry to the GDP of Pakistan is approximately 1% (PACRA, 2020). To increase the GDP as well as to attract foreign investment, Pakistan's pharmaceutical sector needs to improve innovation globally (PPMA, 2020).

More recently, innovation performance is being examination as it is associated with economic performance, competitive advantage and business gains of the country (Shahzad *et al.*, 2017; Soares, Del, Rocha, and Silva, 2019; Tidd and Bessant, 2018). It is becoming more and more important for the companies in the pharmaceutical sector to understand the requirement for core BDAC which helps in creating different values for these companies. This is all the more important as the companies are increasing their investments in this area so as to gain innovation and attain competitive advantage (Abbasi, Sarker, and Chiang, 2016; Joshi, 2019; PACRA, 2020; Quantzig, 2019). Many researches are showing that the usage of BDAC can help to create significant value when applied to problems in specific domains like supply chain management, health care, marketing, and manufacturing industries (PACRA, 2020; Quantzig, 2019; Raghupathi and Raghupathi, 2014; Waller and Fawcett, 2013; Wang, Gunasekaran, Ngai, and Papadopoulos, 2016).

BDA builds upon the previous work by suggesting that by analyzing large volumes of data from the perspective of different industries, actionable insights can be obtained. This can help to transform the businesses and therefore achieve innovation performance as competitive advantage (Chen, Chiang, and Storey, 2012; Joshi, 2019; Mikalef *et al.*, 2019b; Quantzig, 2019; Vidgen, Shaw, and Grant, 2017; Wamba *et al.*, 2017). To generalize the results better, within the industrial context, there is a need to search on innovation related to BDAC in the pharmaceutical sector as this is a highly innovative industry and is contributing significantly to economic development (Joshi, 2019; PWC, 2020; Tannoury and Attieh, 2017).

There are considerably few theoretical as well as empirical studies (Mikalef *et al.*, 2019b; Mikalef and Pateli, 2017; Sahoo, 2021; Wamba *et al.*, 2017) which relate to the direct and indirect relationships between PODC and Organizational Performance. So, there is limited research related to BDAC which would indicate the importance of different resources within different contexts and how the combinations of context and resources can lead to enhanced innovation in the pharmaceutical industry (Quantzig, 2019). This is a very important issue, both from a theoretical as well as from a practical point of view, but currently there is limited understanding regarding managing the organizational culture in terms of the innovation strategies to

be implemented as well as how the innovation performance will be affected (Chen, Huang, Liu, Min, and Zhou, 2018; Shahzad *et al.*, 2017).

At the same time, little is known about the contextual influence of such capabilities and the factors necessary to generate the performance related gains in specific industries, especially highly innovative organizations like pharmaceutical industry (Günther, Mehrizi, Huysman, and Feldberg, 2017; Hanif and Gul, 2014). The moderating role that organizational culture plays is considered to be a very important influencing factor in studies which have focused on Big data capabilities and innovative information systems adoption (Amui, Jabbour, Ana, and Kannan, 2017; Dubey *et al.*, 2017; Dubey *et al.*, 2019; Khazanchi, Lewis, and Boyer, 2007; Leidner and Kayworth, 2006; Liu, Weiling, Kee, Jibao, and Chen, 2010; Sjusdal and Lunde, 2019). Consequently, this study is focusing on the moderating role of organizational culture on the relationship between BDAC and OIP.

The strategic involvement of management accountants in the processes related to decision-making for the purpose of achieving competitive advantage and improving business performance (Gebhardt, Grimm, and Neugebauer, 2015; Horváth and Aschenbrücker, 2015; Kagermann, Wahlster, and Helbig, 2013) mainly involves understanding the new skills set required from such management accountants. It is understood that in the current big data related environment, which involves the usage of modern technologies for transforming business processes and thereby achieving business value, there is also a need to investigate the role of the management accountants in relation to BDAC and OIP (Grangel-González *et al.*, 2016; Obermaier, 2016).

Empirical studies are based upon the understanding that resources required for developing BDAC are of equal importance. This does not include the different contexts, process oriented dynamic capabilities, and internal and external factors of (OC) (Gupta, 2016; Mikalef *et al.*, 2019b; Wamba *et al.*, 2017). Pharmaceutical companies need to alter a process oriented dynamic capability better than its competitor(s). In order to outperform the competition and to gain competitive

advantage, pharmaceutical companies must be able to change itself in direction of BDAC to attain innovation (Quantzig, 2019).

1.4 Research Questions

The current study anticipates examining the effect of BDAC on the Organizational Innovation performance (OIP) via its impact on the process oriented dynamic capabilities (PODC). It also examines this relationship considering the organizational culture (OC) and role of management accountant (RMA) as moderators. More specifically, the current study focuses on examining the research questions given below:

1. To what extent does BDAC affect OIP?
2. Does PODC mediate the relationship between BDAC and OIP?
3. Does OC moderate the relationship between BDAC, PODC and OIP?
4. Does the RMA moderate the relationship between BDAC, PODC and OIP?

1.5 Research Objectives

Based on the above-mentioned research questions, the following are the research objectives of this research.

1. To examine the impact of BDAC on OIP.
2. To examine the mediating effect of PODC on the relationship between BDAC and OIP.
3. To examine the moderating effect of OC on the relationship between BDAC, PODC and OIP.
4. To examine the moderating effect of RMA on the relationship between BDAC, PODC and OIP.

1.6 Significance of the Study

This study contributes to the existing knowledge in the domain of BDAC and innovation performance theoretically and practically. There are many ways in which this study will play an important role to the body of literature in a theoretical way. First, this study focuses on the effect that BDAC, as well as its components, is likely to have on an organization's innovation performance. These components include BDA Intangible Capability, BDA Tangible Capability as well as BDA Human Skills and Knowledge Capability.

There are a number of studies which have examined the impact of BDAC and its components on the organization's performance but the impact on organization's innovation performance is yet to be examined with integration of two important recognized theories, which are the resource-based theory and the socio-materiality theory. Second, this study further considers the impact of BDAC on organization's innovation performance through the mediating role of process oriented dynamic capabilities. A study in which such a mediating role of process oriented dynamic capabilities is considered is yet to be conducted. In this way, both the direct impact which BDAC is likely to have on the innovation performance as well as the mediating effect of process oriented dynamic capabilities on this relationship has tested in this study.

In order for innovation to be carried out throughout the organization, the role of organizational culture is very important. A culture that encourages innovation is crucial in innovative organizations because only through encouraging the workforce to be innovative can the actual results of innovation be obtained. Third, as a result, this study includes the organizational culture as a moderating role on the above-mentioned relationship between BDAC, PODC and innovation performance of organization. In a similar manner, since the management accountant establishes a bridge between the business and the data scientists for obtaining and providing relevant information to the decision makers, study of the role of management accountant is also very important. Therefore, this moderating role of the management accountant is also considered in this study.

This study will make practical contributions as well as provide guidance to the professionals within the industry, the top management and the decision makers of the relevant organizations and to Pakistan's industrial sector in general and high innovation sector like pharmaceuticals sector in particular. This study will also provide guidance to innovative organizations in terms of how they can use big data to further improve their innovation performances and also be able to create greater value for their business. Since this study involves the impact that big data and its components have on the organisations' innovation performances, such organizations will be able to better understand how to reconfigure their existing resources so as to be able to enhance their dynamic capabilities, particularly the process oriented dynamic capabilities. By reconfiguring their resources to enhance their process oriented dynamic capabilities, they will be able to improve their innovation performances and hence understand how to add value and attain sustainable competitive advantages.

At the same time, organizations will also be able to understand the roles and responsibilities which the data scientists have to play. They also need to apply their skills, knowledge and expertise to the related data and so understand how the related information needs to be obtained. The practical application of this study will help organizations to understand the role which can be played by the management accountants, how they can establish the bridge between businesses and the data scientists so as better to understand the information needs of the business and how the data scientists can obtain and provide relevant information through the analysis of big data. Furthermore, the role of organizational culture, which is considered very important in implementing the approach mentioned above, can be understood in a better way and practically applied so that the results of big data and its impact on the organizational innovation performance can be better carried out and sustained.

Finally, data for this study has analyzed using the latent variable structural modeling by applying the method of Partial Least Squares (PLS). The PLS method used in this study is a relatively new method to be used in the BDAC research. This method can handle both formative and reflective measures. It also offers a very comprehensive view on relationships within the framework and helps in testing the causal models with multiple independent, dependent, moderating and mediating

variables, involving multiple indicators or measures (Hair, Ringle, and Sarstedt, 2011a; Hair and Sarstedt, 2012; Hartmann, 2005). Therefore, it contributes to the development of the methodology in the BDAC and innovative research field.

1.7 Scope of the Study

This study investigated the impact which BDAC have on the organizational innovation performance through the development of process oriented dynamic capabilities. It also included the impact of the organizational culture and role of management accountant. Here organizational innovation performance is taken as the dependent variable and BDAC are taken as the independent variable. Process oriented dynamic capability is the mediator. Organizational culture and role of management accountant act as moderators.

For developing a sound foundation of the framework, extensive literature review related to the relationships involved in this study has been carried out. In this research study, the framework for it and the relationship amongst the selected variables bases its foundation on integrating the two important and well recognized theories, being the resource-based theory and the socio-materiality theory. After the model for this study has been developed, it has tested empirically. According to Quantzig (2019), BDAC has created potential opportunities for organizations within the pharmaceutical industry, enabling them to deal with complex business environments which include increasingly large volumes of data sets. Therefore, the respondent of this study included all pharmaceutical companies of Pakistan. On the behalf of pharmaceutical companies, CEOs, CIOs, CFOs and other executive management were contacted through a questionnaire-based survey to collect data. Finally, most important, Smart PLS version 3 with the statistical tool of Structural Equation Modeling (SEM) was used to analyse data collected in the current study.

1.8 Operational Definitions of the Variables

Operational definitions for each construct are intended to be used to show the meaning of each variable and to make them clear for possible investigation in future.

1.8.1 Innovation Performance

"Industrial innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment" (Freeman, 1982) (p.9). "Innovation is the specific tool of entrepreneurs, the means by which they exploit change as an opportunity for a different business or service" (Drucker, 1985) (p.10). Organizational Innovation performance, being considered in the current study, is defined as creating and implementing new products, services, processes and methods of delivery, the results of which are developed in terms of outcomes, quality, efficiency and effectiveness.(Albury, 2005).

1.8.2 Big Data Analytics Capabilities

According to (Garmaki, Boughzala, and Wamba (2016); Mikalef *et al.*, 2019b), the BDAC helps in mobilizing and deploying the BDA resources in an effectively manner, utilizing the components of BDA Intangible Capability, BDA Tangible Capability and BDA Human Knowledge and Skills Capability and supporting the BDA related planning via the application of the organization's long term strategy in order to achieve the competitive advantage and hence improve the innovation performance. The concept of BDAC is suggested for the current study. The general definition of BDAC is considered as the organization's capability to provide insights relating to the usage of data management, infrastructure and the human capabilities for transforming a business into a competitive force (Akter, Wamba, Gunasekaran, Dubey, and Childe, 2016; Kiron, Prentice, and Ferguson, 2014).

1.8.3 Process Oriented Dynamic Capabilities

According to different scholars, dynamic capabilities definitions can be that of a process (Eisenhardt and Martin, 2000; Eriksson, 2014; Galunic and Eisenhardt, 2001; Shuen, Feiler, and Teece, 2014), an expertise (Al–Aali and Teece, 2014; Andreeva and Chayka, 2006; Davies, Dodgson, and Gann, 2016; Helfat and Peteraf, 2015; Teece, 2007, 2012, 2016; Teece, Pisano, and Shuen, 1997) and as an ability (Winter, 2003; Zahra and George, 2002; Zahra, Sapienza, and Davidsson, 2006) so as to be able to incorporate, combine, build, adjust and alter organization wide resources and activities or processes to bring about changes and hence attain competitive advantages.

In this study PODCs relates to a firm's ability to alter the organization's processes so as to attain integrated, cost-effective performance, and business intelligence. As a result, enhanced PODCs should result in a firm's operational processes becoming more effective by facilitating the acquisition and integration of internal and external knowledge, effective alteration of the resource base, and usage of the resources being aligned with the corporate vision of the organization (Butler and Murphy, 2008; Eisenhardt and Martin, 2000; Liao, Kickul, and Ma, 2009).

1.8.4 Organizational Culture

Different alternative ways for categorization of organizational culture have been suggested by different scholars. Some examples of these are focus-and control-oriented culture (Khazanchi *et al.*, 2007; Lewis and Boyer, 2002; McDermott and Stock, 1999) relationship and transaction-oriented culture (McAfee, Glassman, and Jr, 2002). In current study, an organization's culture relates to collection of assumptions, beliefs and values shared amongst the work force, which are reflected in the organization wide goals and practices and this shared collection helps the organization's members to develop and maintain an understanding of how the organization functions (Deshpandé, Farley, and Webster Jr, 1993; Gerido, DeRosa, Richard, and White, 2007; Khazanchi *et al.*, 2007; Lewis and Boyer, 2002).

It affect show the organization reacts to the external events and makes strategic decisions (Deshpandé *et al.*, 1993; Zammuto and O'Connor, 1992). In the current research, the framework of flexibility-control orientation has been adopted, with respect to the Competing Values Model (CVM) which had been proposed by Quinn and Rohrbaugh (1983).

1.8.5 Management Accountant

The role of the management accountant is considered in the current study, ranging from their clerical role to their role as strategic partners in businesses (Baldvinsdottir, Burns, Nørreklit, and Scapens, 2009; Malmi, Seppala, and Rantanen, 2001). Presently, the primary focus of these accountants has involved improving the organizational performance and profitability through the development of new skills (Wadan *et al.*, 2019). Tarigan and Kunto (2008) have stated that the management accountant can be a key player when involved in planning at the strategic level or providing information to those top-level managers involved in the strategic planning and decision-making process (Wold, 1975).

1.9 Structure of the Thesis

This thesis would consist of total of 5 chapters: (1) Introduction, (2) Literature Review, (3) Research Methodology, (4) Data Analysis (5) Conclusion and Recommendations.

The first chapter would relate to the background of the study, the problem statement, research questions, as well as the objectives of the study. It would also consider the significance and the scope of the study followed by conceptual and operational definitions of the related variables.

The second chapter would include the literary foundation of this study. It would start with the concepts as well as the theoretical backgrounds of the variables. The

theoretical background would help in establishing the theoretical framework for the study. After this conceptual framework, empirical support is provided to hypothesize conjectured relationships.

Chapter 3 would elaborate the study's research methodology. It would explain the research design, target population, sample, sampling strategy, data collection method, as well as data analysis techniques adopted for the study. Furthermore, the instrument used for the measurement of the variables and their reliability and validity are also explained in this chapter.

The fourth chapter would contain the analysis of the collected data via questionnaire. It would explain the data screening, assumptions for SEM Test, descriptive statistics, confirmatory factor analysis, and hypothesis testing.

The fifth and final chapter would include the discussion of the findings, theoretical and practical implications of the study, limitations of the study, direction for future research and conclusion of the study. This chapter would be followed by a reference list and appendices.

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APPENDIX A

QUESTIONNAIRE

Cover Letter & Consent Form

Dear Participant,

I invite you to participate in a research study entitled **"Big Data Analytics Capabilities and Innovation Effect of Dynamic Capabilities, Culture and Management Accountant."** I am currently enrolled in the Doctor of Philosophy (PhD) at Azman Hashim International Business School, Kuala Lumpur, and in the process of writing my PhD thesis. The purpose of the research is to examine: The relationship between big data analytics capabilities, organizational innovation performance, process oriented dynamic capabilities, organization culture and role of management accountant. The pharmaceutical sector of Pakistan has been selected for the current study as it is one of the more innovative sectors and a very crucial one for the economic performance of country. The enclosed questionnaire has been designed to collect related information on the study. Your participation in this research project is completely voluntary. You may decline altogether, or leave blank any questions you don't wish to answer. There are no known risks to participation beyond those encountered in everyday life. Your response will remain confidential and anonymous. Data from this research will be kept under lock and key and reported only as a collective combined total. No one other than the researcher will know your individual answers to this questionnaire. By completing the one designed questionnaire, you are indicating your consent to participate in the study.

Thank you for your assistance in this important endeavor.

Sincerely yours,

SABRA MUNIR

Principal Investigator

0092-3004496900

PART A: BIG DATA ANALYTICS CAPABILITIES

Big Data Analytics Capabilities helps in mobilization and deployment of BDA resources effectively, utilization, constitution of BDA Tangible Capability, BDA Intangible Capability and BDA Human Skills, which support BDA planning through organization's long-term strategy to attain competitive advantage and enhance innovation performance. This section assesses the level of an organizational capability to provide insights into the use of data management, infrastructure, and human capabilities to convert business into a competitive force.

Strongly Disagree	Disagree	Some What Disagree	Neutral	Some What Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

No.	Statement	Scale
BDA Tangible Capability		
1	We have access to very large, unstructured, or fast-moving data for analysis	1 2 3 4 5 6 7
2	We integrate data from multiple internal sources into a data warehouse or mart for easy access	1 2 3 4 5 6 7
3	We integrate external data with internal to facilitate high-value analysis of our business	1 2 3 4 5 6 7
4	We have explored or adopted parallel computing approaches (e.g. Hadoop) to big data processing	1 2 3 4 5 6 7
5	We have explored or adopted different data visualization tools	1 2 3 4 5 6 7
6	We have explored or adopted cloud-based services for processing data and performing analytics	1 2 3 4 5 6 7
7	We have explored or adopted open-source software for big data analytics	1 2 3 4 5 6 7
8	We have explored or adopted new forms of databases such as Not Only SQL (NoSQL) for storing data.	1 2 3 4 5 6 7
9	Our big data analytics projects are adequately funded	1 2 3 4 5 6 7
10	Our big data analytics projects are given enough time to achieve their objectives	1 2 3 4 5 6 7
BDA Human Skills		
1	We provide big data analytics training to our own employees	1 2 3 4 5 6 7
2	We hire new employees that already have the big data analytics skills	1 2 3 4 5 6 7
3	Our big data analytics staff has the right skills to accomplish their jobs successfully	1 2 3 4 5 6 7
4	Our big data analytics staff has suitable education to fulfill their jobs	1 2 3 4 5 6 7

No.	Statement	Scale
5	Our big data analytics staff holds suitable work experience to accomplish their jobs successfully	1 2 3 4 5 6 7
6	Our big data analytics staff is well trained	1 2 3 4 5 6 7
7	Our big data analytics managers understand and appreciate the business needs of other functional managers, suppliers, and customers.	1 2 3 4 5 6 7
8	Our big data analytics managers are able to work with functional managers, suppliers, and customers to determine opportunities that big data might bring to our business	1 2 3 4 5 6 7
9	Our big data analytics managers are able to coordinate big data-related activities in ways that support other functional managers, suppliers, and customers	1 2 3 4 5 6 7
10	Our big data analytics managers are able to anticipate the future business needs of functional managers, suppliers, and customers	1 2 3 4 5 6 7
11	Our big data analytics managers have a good sense of where to apply big data	1 2 3 4 5 6 7
12	Our big data analytics managers are able to understand and evaluate the output extracted from big data	1 2 3 4 5 6 7
BDA Intangible Capability		
1	We consider data an intangible asset	1 2 3 4 5 6 7
2	We base our decisions on data rather than on instinct	1 2 3 4 5 6 7
3	We are willing to override our own intuition when data contradict our viewpoints	1 2 3 4 5 6 7
4	We continuously assess and improve the business rules in response to insights extracted from data	1 2 3 4 5 6 7
5	We continuously coach our employees to make decisions based on data	1 2 3 4 5 6 7
6	We are able to search for new and relevant knowledge	1 2 3 4 5 6 7
7	We are able to acquire new and relevant knowledge	1 2 3 4 5 6 7
8	We are able to assimilate relevant knowledge	1 2 3 4 5 6 7
9	We are able to apply relevant knowledge	1 2 3 4 5 6 7
10	We have made concerted efforts for the exploitation of existing competencies and exploration of new knowledge.	1 2 3 4 5 6 7

PART B: ORGANIZATIONAL INNOVATION PERFORMANCE

This section assesses the level of an organizational innovation performance as creation and implementation of new processes, products, services and methods of delivery which result are developed in outcomes, efficiency, effectiveness or quality.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

No.	Statement	Scale
New Product Introduction		
1	New products have launched in the past three years which are also new to the pharmaceutical industry.	1 2 3 4 5
2	Paying attention to product specification during product development is essential.	1 2 3 4 5
3	Our customers provide specifications for new products.	1 2 3 4 5
4	The firm's growth rate of sales has increased because of introducing new product/service.	1 2 3 4 5
New Organizational Practice		
1	Implementation of new business concepts and practices will enhance employee's innovation skills	1 2 3 4 5
2	Changing organizational structure is significant to promote organizational innovation.	1 2 3 4 5
3	Introduce technology innovation programs to employees will boost the organizational innovation.	1 2 3 4 5

PART C: PROCESS ORIENTED DYNAMIC CAPABILITIES

This section assesses the level of process oriented dynamic capabilities relates to a firm’s ability to alter the organization’s processes so as to attain integrated, cost effective performance, and business intelligence.

Strongly Disagree	Disagree	Some What Disagree	Neutral	Some What Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

No.	Statement	Scale						
1	Our company is better than competitors in connecting (e.g., communication and information sharing) parties within a business process.	1	2	3	4	5	6	7
2	Our company is better than competitors in reducing cost within a business process.	1	2	3	4	5	6	7

No.	Statement	Scale						
3	Our company is better than competitors in bringing complex analytical methods to bear on a business process.	1	2	3	4	5	6	7
4	Our company is better than competitors in bringing detailed information into a business process.	1	2	3	4	5	6	7

PART D: ORGANIZATIONAL CULTURE

This section assesses the level of an organization's culture relates to collection of assumptions, beliefs and values, shared amongst the work force, which reflects in the organization wide goals and practices and this shared collection helps the organization's members to develop and maintain an understanding of how the organization functions.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

No.	Statement	Scale
Flexible Oriented		
1	We have less formal structure (flat structure)	1 2 3 4 5
2	We focus less on traditions	1 2 3 4 5
3	Our organization believes in equality and merit	1 2 3 4 5
4	Commitment to innovation and development holds our organization together	1 2 3 4 5
5	We are less concerned for security	1 2 3 4 5
Control Oriented		
1	Highly structured, hierarchical and oriented toward chains of command	1 2 3 4 5
2	Loyalty and tradition hold our organization together	1 2 3 4 5
3	Our organization respect age, experience and seniority	1 2 3 4 5
4	We are focused on attaining mission goals (both explicit and implied)	1 2 3 4 5
5	We are trained to be secretive for operational security	1 2 3 4 5

PART E: ROLE OF MANAGEMENT ACCOUNTANT

This section assesses the management accountant's role is carried out in current study, from clerical role to strategic partners in. Currently, the primary focus of these accountants has to improve the organizational performance and profitability with the help of new skills development.

Not at All Involved	Low Involved	Some What Involved	Neutral	Moderate Involved	High Involve	Fully Involved
1	2	3	4	5	6	7

No.	Statement	Scale
Championing Alternatives		
1	Justify and define new programs	1 2 3 4 5 6 7
2	Evaluate the merits of new proposals	1 2 3 4 5 6 7
3	Search for new opportunities	1 2 3 4 5 6 7
4	Propose programs or projects to higher level managers	1 2 3 4 5 6 7
5	Justify programs that have already been established	1 2 3 4 5 6 7
Facilitating Adaptability		
1	Encourage informal discussion and information sharing	1 2 3 4 5 6 7
2	Relax regulations to get new projects started	1 2 3 4 5 6 7
3	'Buy time' for experimental programs	1 2 3 4 5 6 7
4	Develop objectives and strategies for unofficial projects	1 2 3 4 5 6 7
5	Encourage multidisciplinary problem-solving teams	1 2 3 4 5 6 7
6	Locate and provide resources for trial projects	1 2 3 4 5 6 7
7	Provide a safe haven for experimental programs	1 2 3 4 5 6 7
Synthesizing Information		
1	Gather information on the feasibility of new programs	1 2 3 4 5 6 7
2	Communicate the activities of competitors, suppliers, etc.	1 2 3 4 5 6 7
3	Assess changes in the external environment	1 2 3 4 5 6 7
4	Communicate implications of new information	1 2 3 4 5 6 7
Implementing Deliberate Strategy		
1	Monitor activities to support top management objectives	1 2 3 4 5 6 7
2	Implement action plans designed to meet objectives	1 2 3 4 5 6 7
3	Translate goals into action plans	1 2 3 4 5 6 7
4	Translate goals into individual objectives	1 2 3 4 5 6 7
5	Sell top management initiatives to subordinates	1 2 3 4 5 6 7

PART F: RESPONDENT'S INFORMATION

Instructions: Please tick √ for the appropriate answer.

1. Does your company use BDAC (In house and outsourced)?

Yes	No

2. Gender

Male	Female

3. Company

Public Limited	Private Limited

4. Designation

CEO	CFO
CIO	Others: _____

5. Experiences in Profession

Less than 5 years	5 to 9 years
10 to 14 years	15 years or more

6. Length of Services in Current Work Area/Unit/Department

Less than 1 year	1 to 4 years
5 to 9 years	10 years or more

7. Annual Sales (Millions Rs.)

Under 100	101 to 200
301 to 400	201 to 300

8. Number of Employees

Less 300	301 to 500
501 to 700	701 to 900
Above 900	

9. How long your company is operating in this sector?

Less than 10 Years	11 to 15 Years
16 to 20 Years	21 to 25 Years
More than 25 Years	

"Thank you for spending the time to answer this questionnaire"

-END OF QUESTIONNAIRE-

APPENDIX B T-TEST FOR NON-RESPONSE BIAS (PAIRED SAMPLES TEST)

Pair and Relationship		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	BDA_TC1_Early - BDA_TC1_Late	.150	2.111	.236	-.320	.620	.635	79	.263	.527
Pair 2	BDA_TC2_Early - BDA_TC2_Late	.025	2.176	.243	-.459	.509	.103	79	.459	.918
Pair 3	BDA_TC3_Early - BDA_TC3_Late	.000	2.006	.224	-.446	.446	.000	79	.500	1.000
Pair 4	BDA_TC4_Early - BDA_TC4_Late	.013	2.498	.279	-.543	.568	.045	79	.482	.964
Pair 5	BDA_TC5_Early - BDA_TC5_Late	.138	2.180	.244	-.348	.623	.564	79	.287	.574
Pair 6	BDA_TC6_Early - BDA_TC6_Late	-.038	2.483	.278	-.590	.515	-.135	79	.446	.893
Pair 7	BDA_TC7_Early - BDA_TC7_Late	.112	2.418	.270	-.426	.651	.416	79	.339	.678
Pair 8	BDA_TC8_Early - BDA_TC8_Late	.063	2.436	.272	-.480	.605	.230	79	.410	.819
Pair 9	BDA_TC9_Early - BDA_TC9_Late	.037	2.558	.286	-.532	.607	.131	79	.448	.896
Pair 10	BDA_TC10_Early - BDA_TC10_Late	.050	2.250	.252	-.451	.551	.199	79	.421	.843
Pair 11	BDA_HS1_Early - BDA_HS1_Late	.112	1.896	.212	-.309	.534	.531	79	.299	.597
Pair 12	BDA_HS2_Early - BDA_HS2_Late	.125	2.021	.226	-.325	.575	.553	79	.291	.582
Pair 13	BDA_HS3_Early - BDA_HS3_Late	-.075	2.238	.250	-.573	.423	-.300	79	.383	.765
Pair 14	BDA_HS4_Early - BDA_HS4_Late	.063	2.034	.227	-.390	.515	.275	79	.392	.784
Pair 15	BDA_HS5_Early - BDA_HS5_Late	.013	1.945	.218	-.420	.445	.057	79	.477	.954
Pair 16	BDA_HS6_Early - BDA_HS6_Late	.063	1.989	.222	-.380	.505	.281	79	.390	.779
Pair 17	BDA_HS7_Early - BDA_HS7_Late	.063	1.970	.220	-.376	.501	.284	79	.389	.777
Pair 18	BDA_HS8_Early - BDA_HS8_Late	.087	1.917	.214	-.339	.514	.408	79	.342	.684
Pair 19	BDA_HS9_Early - BDA_HS9_Late	-.037	2.015	.225	-.486	.411	-.166	79	.434	.868
Pair 20	BDA_HS10_Early - BDA_HS10_Late	.075	2.017	.226	-.374	.524	.333	79	.370	.740
Pair 21	BDA_HS11_Early - BDA_HS11_Late	.138	1.927	.215	-.291	.566	.638	79	.263	.525
Pair 22	BDA_HS12_Early - BDA_HS12_Late	.188	1.822	.204	-.218	.593	.921	79	.180	.360

Pair and Relationship		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
					Lower	Upper			One-Sided p	Two-Sided p
Pair 23	BDA_IC1_Early - BDA_IC1_Late	.125	2.131	.238	-.349	.599	.525	79	.301	.601
Pair 24	BDA_IC2_Early - BDA_IC2_Late	.025	1.622	.181	-.336	.386	.138	79	.445	.891
Pair 25	BDA_IC3_Early - BDA_IC3_Late	.225	1.889	.211	-.195	.645	1.065	79	.145	.290
Pair 26	BDA_IC4_Early - BDA_IC4_Late	.088	1.663	.186	-.283	.458	.471	79	.320	.639
Pair 27	BDA_IC5_Early - BDA_IC5_Late	.025	1.638	.183	-.340	.390	.137	79	.446	.892
Pair 28	BDA_IC6_Early - BDA_IC6_Late	-.013	1.619	.181	-.373	.348	-.069	79	.473	.945
Pair 29	BDA_IC7_Early - BDA_IC7_Late	.125	1.610	.180	-.233	.483	.694	79	.245	.489
Pair 30	BDA_IC8_Early - BDA_IC8_Late	.150	1.662	.186	-.220	.520	.807	79	.211	.422
Pair 31	BDA_IC9_Early - BDA_IC9_Late	.025	1.676	.187	-.348	.398	.133	79	.447	.894
Pair 32	BDA_IC10_Early - BDA_IC10_Late	.100	1.688	.189	-.276	.476	.530	79	.299	.598
Pair 33	OC_FO1_Early - OC_FO1_Late	-.175	1.339	.150	-.473	.123	-1.169	79	.123	.246
Pair 34	OC_FO2_Early - OC_FO2_Late	.000	1.441	.161	-.321	.321	.000	79	.500	1.000
Pair 35	OC_FO3_Early - OC_FO3_Late	-.037	1.084	.121	-.279	.204	-.309	79	.379	.758
Pair 36	OC_FO4_Early - OC_FO4_Late	-.075	1.156	.129	-.332	.182	-.580	79	.282	.563
Pair 37	OC_FO5_Early - OC_FO5_Late	.050	1.653	.185	-.318	.418	.271	79	.394	.787
Pair 38	OC_CO1_Early - OC_CO1_Late	.100	1.176	.131	-.162	.362	.761	79	.225	.449
Pair 39	OC_CO2_Early - OC_CO2_Late	.050	1.090	.122	-.192	.292	.410	79	.341	.683
Pair 40	OC_CO3_Early - OC_CO3_Late	.050	.953	.107	-.162	.262	.469	79	.320	.640
Pair 41	OC_CO4_Early - OC_CO4_Late	-.062	.946	.106	-.273	.148	-.591	79	.278	.556
Pair 42	OC_CO5_Early - OC_CO5_Late	.037	1.049	.117	-.196	.271	.320	79	.375	.750
Pair 43	RMA_CA1_Early - RMA_CA1_Late	.112	1.359	.152	-.190	.415	.740	79	.231	.461
Pair 44	RMA_CA2_Early - RMA_CA2_Late	.150	1.450	.162	-.173	.473	.925	79	.179	.358
Pair 45	RMA_CA3_Early - RMA_CA3_Late	-.062	1.453	.162	-.386	.261	-.385	79	.351	.701
Pair 46	RMA_CA4_Early - RMA_CA4_Late	.088	1.655	.185	-.281	.456	.473	79	.319	.638

Pair and Relationship		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pair 47	RMA_CA5_Early - RMA_CA5_Late	-.088	1.569	.175	-.437	.262	-.499	79	.310	.619
Pair 48	RMA_FA1_Early - RMA_FA1_Late	.138	1.589	.178	-.216	.491	.774	79	.221	.441
Pair 49	RMA_FA2_Early - RMA_FA2_Late	-.162	1.546	.173	-.507	.182	-.940	79	.175	.350
Pair 50	RMA_FA3_Early - RMA_FA3_Late	-.075	1.682	.188	-.449	.299	-.399	79	.346	.691
Pair 51	RMA_FA4_Early - RMA_FA4_Late	-.038	1.768	.198	-.431	.356	-.190	79	.425	.850
Pair 52	RMA_FA5_Early - RMA_FA5_Late	.063	1.487	.166	-.268	.393	.376	79	.354	.708
Pair 53	RMA_FA6_Early - RMA_FA6_Late	.112	1.607	.180	-.245	.470	.626	79	.266	.533
Pair 54	RMA_FA7_Early - RMA_FA7_Late	-.050	1.422	.159	-.367	.267	-.314	79	.377	.754
Pair 55	RMA_SI1_Early - RMA_SI1_Late	.025	1.396	.156	-.286	.336	.160	79	.437	.873
Pair 56	RMA_SI2_Early - RMA_SI2_Late	-.087	1.552	.174	-.433	.258	-.504	79	.308	.616
Pair 57	RMA_SI3_Early - RMA_SI3_Late	-.050	1.404	.157	-.363	.263	-.318	79	.375	.751
Pair 58	RMA_SI4_Early - RMA_SI4_Late	.025	1.467	.164	-.301	.351	.152	79	.440	.879
Pair 59	RMA_IDS1_Early - RMA_IDS1_Late	-.013	1.175	.131	-.274	.249	-.095	79	.462	.924
Pair 60	RMA_IDS2_Early - RMA_IDS2_Late	.100	1.279	.143	-.185	.385	.699	79	.243	.486
Pair 61	RMA_IDS3_Early - RMA_IDS3_Late	-.013	1.401	.157	-.324	.299	-.080	79	.468	.937
Pair 62	RMA_IDS4_Early - RMA_IDS4_Late	.037	1.530	.171	-.303	.378	.219	79	.414	.827
Pair 63	RMA_IDS5_Early - RMA_IDS5_Late	.125	1.195	.134	-.141	.391	.936	79	.176	.352
Pair 64	OIP_NPI1_Early - OIP_NPI1_Late	.088	1.285	.144	-.198	.373	.609	79	.272	.544
Pair 65	OIP_NPI2_Early - OIP_NPI2_Late	.063	1.023	.114	-.165	.290	.546	79	.293	.586
Pair 66	OIP_NPI3_Early - OIP_NPI3_Late	.125	1.470	.164	-.202	.452	.760	79	.225	.449
Pair 67	OIP_NPI4_Early - OIP_NPI4_Late	.063	1.011	.113	-.162	.287	.553	79	.291	.582
Pair 68	OIP_NOP1_Early - OIP_NOP1_Late	.038	1.012	.113	-.188	.263	.331	79	.371	.741
Pair 69	OIP_NOP2_Early - OIP_NOP2_Late	.038	1.073	.120	-.201	.276	.313	79	.378	.755
Pair 70	OIP_NOP3_Early - OIP_NOP3_Late	.113	1.102	.123	-.133	.358	.913	79	.182	.364

Pair and Relationship		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
					Lower	Upper				
Pair 71	PODC1_Early - PODC1_Late	.237	1.545	.173	-.106	.581	1.375	79	.086	.173
Pair 72	PODC2_Early - PODC2_Late	.063	1.625	.182	-.299	.424	.344	79	.366	.732
Pair 73	PODC3_Early - PODC3_Late	.013	1.563	.175	-.335	.360	.072	79	.472	.943
Pair 74	PODC4_Early - PODC4_Late	.050	1.395	.156	-.261	.361	.321	79	.375	.749

LIST OF PUBLICATIONS

1. **Munir, S.,** Rasid, S. Z. A., Aamir, M., Jamil, F., & Ahmed, I. (2022). Big data analytics capabilities and innovation effect of dynamic capabilities, organizational culture and role of management accountants. *foresight*. Emerald Publisher **(HEC X, WOS & SCOPUS)**
2. **Munir, S.,** Rasid, S. Z. A., Aamir, M., & Ahmed, I. (2022). Big data analytics capabilities, innovation and organizational culture: systematic literature review and future research agenda. *3c Tecnología: glosas de innovación aplicadas a la pyme*, *11*(1), 209-235. **(HEC Y & WOS)**
3. **Sabra Munir,** Siti Zaleha, Abdul Rasid, Farrukh Jamil (2022) Big Data Analytics Capabilities & Innovation Performance through Process Oriented Dynamic Capabilities. Leadership and Organizational Behavior Journal – LOBJ Volume-1 Issue- 2 Volume-1 - Issue-2 pg: 82 – 98
4. **Munir, S.,** Rasid, S. Z. A., Jamil, F., & Aamir, M. (2021). Organizational innovation performance through big data analytics with moderating role of management accountant. In *The 2nd International Professional Doctorate and Postgraduate Symposium Universiti Teknologi Malaysia, 25th September 2021* (p. 437).
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