

**THE IMPACT OF BIG DATA MANAGEMENT ON
SUSTAINABLE ENTREPRENEURIAL PERFORMANCE IN THE
IT SECTOR OF PAKISTAN.**



**SUBMITTED BY
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This is to certify that the research work presented in this thesis, entitled “**The Impact of Big Data Management on Sustainable Entrepreneurial Performance in the IT Sector of Pakistan**” was conducted by Mr. Usman Sadiq under the supervision of Dr.Ch. Abdul Rehman.

No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Business and Management Sciences, The Superior College, Lahore in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the field of Business Administration in the Faculty of Business and Management Sciences at The Superior College, Lahore.

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DEDICATION

To my beloved late mother as it was her dream and she always motivate me to achieve this milestone. After the death of my mother, I lost hope but my loving father and wife consistently motivate me to finish my job. I would also like to dedicate it to my brother and mentor Pirzada Sami Ullah Sabri who always encouraged me when I stopped and thought I could not continue anymore! Because of all their prayers, encouragement, support, and love, I have completed this lifetime journey successfully. May God give them a long and healthy life, Ameen!

ACKNOWLEDGEMENTS

All praise to Almighty Allah (the Most Merciful, the Most Beneficial) who enabled me to complete this research thesis. I am really grateful to Him from the bottom of my heart. All respect to the Holy Prophet (Peace be Upon Him) who enabled us all to recognize our Creator and whose spiritual teachings guide us in every aspect of our lives.

First of all, I would like to extend my gratitude to a visionary man, a selfless leader, my life-changing mentor, my teacher, and my supervisor, the honorable chairman of the Superior Group, Prof.Dr.Ch. Abdul Rehman whose support, wishes, unconditional love, kind and meticulous guidance paved the way for me to complete my research work. I might not have been able to finish this dissertation without his help, guidance, encouragement, and motivation. He upgrades my knowledge through further education, which may have not been possible for someone like me.

I am also thankful to my co-supervisor Dr. Nadia Nasir, who has been extremely patient and receptive to all my inquiries and who provided me with useful information for completing this thesis.

I would like to express my indebtedness to my respected Rector Prof. Dr. Sumaira Rehman, an inspiring personality who is committed to creating a positive change in society by promoting and developing an entrepreneurial mindset among the youth to shift their minds from job seekers to the job provider. She chooses a very difficult journey, and her passion, commitment, dedication, and consistency are exemplary and create a huge impact in Pakistan. Now, she is a member of the Punjab Higher Education Commission Board and trying to promote this entrepreneurial agenda throughout Pakistan. I am blessed that I am

working under her kind guidance and she is always very courteous and concerned about her team. She inspires me and broaden my vision to create a sustainable impact in the community through entrepreneurship. She is a persistent source of encouragement and guidance for me while completing my work.

I would like to appreciate my parents and family members for their endless prayers for my success. I also wish to extend my gratitude to my elder brother, a role model, and my life coach, Pirzada Sami Ullah Sabri, Director General, The Superior Group, who always opens new horizons for me to see the world from a different perspective and always injects positivity, humbleness, and forgiveness in me and still I am trying to improve myself as he is a benchmark. He really deserves the highest praise for guiding and encouraging me.

I must acknowledge the contribution of a true friend, a very humble and dedicated person Dr. Qasim Ali Nisar who motivates me and develop my interest in research. He has a sound theoretical background and global exposure that help me in creating the link between global and local contexts in the field of big data management. I wish him simply a friend forever.

I am also very much thankful to my seniors Ms. Ayesha Zahid, Dr. Sobia Nasir, Mr. Muneeb Ahmad, my colleague Dr. Humaira Qudsia Yousuf, and my junior Syed Muhammad Ali for all the support and motivation that you people extended to me in this journey.

Abstract

Modern business organizations show agility and incorporate technological advancements in their organizations to gain a competitive edge. The most important and innovative technology developed in recent times is big data analytics, where data generation and storage are essential to creating sustainable performance for firms, especially entrepreneurial firms. The value of the big data possessed by an organization increases the more the organization uses it. Big data is considered to be self-regenerative and a unique asset that is quite different from the traditional physical assets and it is also considered to be a limited and non-renewable resource possessed by an organization. It has been argued in the literature that resources alone are not enough for an organization to create value and get involved in innovation activities, instead the proper management of these resources is also required. If an organization wants to make certain decisions based on the information obtained from big data, mere big data is not enough because the management of big data is also required. BDM capabilities, such as democratization, contextualization, experimentation and execution of big data, have been studied on an individual level in the past but the association of these capabilities with entrepreneurship at an organizational level needs more attention.

Despite its importance, little research has been conducted in this area. A lack of studies has exclusively considered big data management (BDM) capabilities and their relationship with sustainable entrepreneurial performance (SEP). This study fills this gap by investigating and exploring the impact of various dimensions of BDM capabilities on sustainable entrepreneurial orientation (SEO), exploitative innovation, and exploratory innovation. In addition, the impact of SEO on exploitative innovation, exploratory innovation, and SEP have also been explored, along with the mediating impact of SEO on the relation between BDM capabilities and SEP and the mediating role of exploitative innovation and exploratory innovation on the relation between SEO and SEP, specifically in the context of Pakistan.

Based on a positivist approach, the study followed the quantitative method and applied a survey-based approach for data collection; 1100 questionnaires were disseminated among 100 software houses in Pakistan, and 961 responses were received. Structural equation modeling, confirmatory

factor analysis, and supporting statistical tests were applied to the data through SPSS and AMOS to evaluate the data's accuracy, precision, reliability, validity, and fitness.

The study's findings suggest that big data capabilities are crucial for the development of sustainable entrepreneurial orientation of the firms and these capabilities also influence SEP. This study extends the literature on the dynamic capabilities view and entrepreneurial theory by highlighting BDM capabilities through this framework and extends knowledge-based perspectives for various firms by introducing the significant variables of BDM and capabilities. This study will help various organizations focus on implementing BDM in a local or global context. This research will help policymakers to adopt suitable leadership styles, technologies, and technology management to boost BDM capabilities, which ultimately improve SEP.

Keywords: *Big Data Management, Exploitative and Exploratory Innovation, Sustainable Entrepreneurial Orientation, Sustainable Entrepreneurial Performance.*

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List of Abbreviations

1. BDM	Big Data Management
2. BDA	Big Data Analytics
3. BDAC	Big Data Analytics Capabilities
4. SEO	Sustainable Entrepreneurial Orientation
5. SEP	Sustainable Entrepreneurial Performance
6. GDP	Gross domestic product
7. SME's	Small and Medium Enterprises
8. PASHA	Pakistan Software Houses Association
9. PSEB	Pakistan Software Export Board
10. DCV	Dynamic Capabilities View
11. KBV	Knowledge Based View
12. RBV	Resource Based View
13. KMO	Kaiser–Meyer–Olkin and Bartlett test
14. CFA	Confirmatory Factor Analysis
15. SEM	Structural Equation Modeling

Chapter 1: Introduction

1.1 introduction

This chapter contains the background of the study and the study's variables and describes their importance in the context of the study. Moreover, the research problem identified by the researcher and the gaps and limitations found in the past literature is mentioned, along with the contributions of the current study. The research questions and research objectives are stated. The scope of the study is discussed in detail, followed by the theoretical, practical, policy-making, and social significance of the study. Lastly, definitions of the key variables are also stated.

1.2 Background

In the modern business environment, big data has become a significant asset for most organizations (Albergaria & Jabbour, 2020). One of the most significant reasons for the increase in its importance is that organizations are rapidly moving toward digitalization; as a result, organizations are collecting vast volumes of big data from their supply chains (Frank et al., 2019). However, big data alone has no significance until the understanding of the big data is developed, and valuable information is extracted from the data using specialized tools and techniques (Aydiner et al., 2019). Researchers have argued that when the managers of an organization gain a good understanding of their big data, its effective utilization can help the organization achieve success (Chehbi-Gamoura et al., 2020; Merendino et al., 2018).

The significant benefits of big data for organizations include a reduction of costs, faster production or creation of products, and, finally, the creation of new and innovative products and services that can fulfill the rapidly changing needs and demands of customers (Choi et al., 2018; Dubey, Gunasekaran, & Childe, 2019; Dubey, Gunasekaran, Childe, Blome, et al., 2019). These benefits have increased the importance of big data analytics (BDA) in organizations, and big data has gained the attention of various researchers and authors. In addition, businesses and other organizations have invested heavily in big data-related capabilities to gain and maintain their competitive advantage in the market (Dwivedi et al., 2019).

Customers' expectations are rapidly increasing and enhanced competition worldwide; technological changes have been faster. These factors demand that organizations elevate their entrepreneurial profile to gain and maintain a competitive advantage over their rivals (Cenamor et al., 2019). Developing countries are primarily focusing on market-based policies of increasing economic growth and reducing the poverty factor. These policies have induced various organizational changes, especially structural changes, and have contributed to unbalanced growth and increased uncertainty in the environment. These changes in the business environment have shaped organizations' decision-making processes and managerial assumptions. Although the increased importance and potential of BDA have been reported not only in a practical context but also in research or theoretical context, developing countries have doubts about the outcomes, potential, and applications of BDA. Many factors lead to such doubts regarding the importance of big data, the most important of which include lack of commitment of the top management of an organization, underestimation of rivals, negligence regarding the changing needs and demands of customers, lack of differentiation, and improper marketing techniques and tools (Akhtar et al., 2019; Shah et al., 2017). The performance benefits achieved by organizations with an entrepreneurial mindset have gained the attention of various researchers who argue that innovations brought by an organization in their technological setup not only provide them with a competitive advantage in international markets but also assist them in running their routine operations (Ivanov et al., 2018).

With the advancement of technology, digital platforms, and internet services, multinational companies and other organizations have transformed their ways and methods of developing capabilities related to creating value and innovation (Ojala et al., 2018). It has become quite a challenge for organizations to meet and adapt to customers' rapidly changing needs and demands. Customers are now connected with organizations through digital platforms, such as social media platforms, websites, and mobile applications. Assessment of the massive volume of data collected through digital platforms and digital sources has become a significant concern for organizations (Coviello et al., 2017). For example, organizations that collect and analyze big data can predict customers' behaviors through online reviews and comments. The major characteristics of big data include the large volume, variety, and velocity of data (Gupta & George, 2016). With time, the volume of data increases considerably and gains higher computing power, and reduces the costs associated with data storage.

The three Vs representing the three characteristics of big data (i.e., volume, variety, and velocity) were suggested by Laney (2001). The first characteristic, volume, refers simply to the magnitude of the data, which can be reported in petabytes, terabytes, etc. There are 1024 terabytes in one petabyte, and one terabyte can store 16 million pictures. For instance, Facebook is reported to process one million photos in one second, thus indicating the massive volume of big data processed by Facebook (Beaver et al., 2010). The second characteristic, the variety of big data, refers to the heterogeneity found in the collected datasets in a structural context. Big data comprises various types of datasets that may be collected from internal or external sources to the company. The internal sources of a company, such as sensors, provide data termed internal data, whereas the external sources of a company, such as social media, provide data that is termed external data. The third characteristic, velocity, refers to the speed of data collection or creation and analysis, and usage. With the advancement of technology and the invention of various technological devices, the speed of data collection and analysis has increased considerably (Gandomi & Haider, 2015). In addition to these three Vs, three other dimensions are associated with big data: veracity, variability, and value. Veracity refers to the extent of reliability or unreliability of the big data; for example, data collected through some sources, such as social media, is considered unreliable. Variability is the flow rate of the collected data through which the consistency of the data is measured, and it has recently become quite a challenge for organizations. Lastly, the value indicates the valuableness of the collected data (Gandomi & Haider, 2015). All the aspects mentioned above or dimensions associated with big data are essential for organizations because they can exploit these aspects of the collected data to make their operations and processes efficient and effective.

The importance of BDA to better decision making in organizations has also been highlighted in recent research, along with the creation of value in various sectors, such as manufacturing, banking, media, healthcare, hospitality, and tourism (Li et al., 2018; Shamim et al., 2019; Wang, Kung, Wang, et al., 2018). Pakistan, a developing country, has undergone various technological advancements; organizations in Pakistan have developed customer relations and contacts through digital technology, such as social media platforms, websites, and mobile applications, which might prove to be a significant source of big data collection. This aspect is more commonly observed in the IT sector, especially in the software houses of Pakistan. This big data might have the capability to provide valuable insights regarding customers' needs and

demands and the operational procedures of an organization, so it is helpful to study aspects of BDA in the context of software houses in the IT sector of Pakistan.

Digital technology has facilitated organizations' and businesses' exploratory and exploitative activities through big data (McAfee et al., 2012). In past research, scholars have emphasized the skills required for both the exploratory and the exploitative activities of an organization (Janssen et al., 2017; Zeng & Glaister, 2018). The concept of ambidexterity is quite central in discussing an organization's exploratory and exploitative activities (Turner et al., 2013). Ambidexterity refers to the ability of an organization to continue two opposing activities (i.e., exploratory and exploitative innovation in the organization) in a balanced way (O'Reilly III & Tushman, 2013). Ambidexterity assists organizations in developing their global competitiveness; research has indicated that various global companies have been able to improve their global performance by being proactive in the case of exploratory innovation and by increasing their effectiveness in the case of exploitative innovation (Vahlne & Jonsson, 2017).

Big data can create great opportunities, especially for organizations in developing countries. The markets of developing countries have a dynamic and rapidly changing business environment. Moreover, there is a lack of intermediaries, and the institutions of developing countries are a bit weak; an innovation-supporting environment is in a developing phase and the financial support of governments, which are important institutions of any country, is limited (Khan et al., 2019). This immaturity of the government as an institution in a developing country is referred to as an institutional void, and it creates difficulties and challenges for developing countries to innovate in exploratory and exploitative contexts (Khan et al., 2019). In such a scenario, the importance of applying external knowledge is increased while innovating in an exploratory and exploitative context (Khan et al., 2018).

The big data possessed by organizations can be considered an important source or form of external knowledge. It is essential to study its association with exploratory and exploitative innovation. As digital transformation is taking place rapidly in the current business environment, the data obtained from users continuously changes, which makes it quite crucial for organizations to be capable of exploiting the capabilities that are currently found in the organization and to explore their newer capabilities and integrate them with existing ones

(Perez-Martin et al., 2018). As discussed earlier, the marketplace and the overall business environment have changed considerably in recent years. There has been rapid growth and innovation in technologies. Customers' needs and demands are changing rapidly, competition has increased globally, and all these aspects demand innovation in various aspects of organizations (Menguc & Auh, 2010). Innovation is considered a significant source of competitive advantage and organizational growth and development. The resource-based view (RBV) has indicated that organizations must focus on their skills and abilities to be innovative and gain a competitive advantage. In this regard, exploration and exploitation have been considered primary organizational learning tools and are significant capabilities in innovation (Yalcinkaya et al., 2007).

In the exploitation aspect, new knowledge is developed that is specifically related to an organization's existing products and services and the existing markets served by the organization. On the other hand, exploration involves the development of new knowledge regarding the new products and services of a company and the new markets served by the organization, and the capabilities, skills, and technologies required for this purpose (March, 1991).

In the literature, the primary focus of scholars has been limited to the development of technology and products. In contrast, research on aspects other than technology and products is minimum (Vorhies et al., 2011). Accepting or rejecting products or services is the role of markets, and therefore they play an essential role in the success of organizations. If a proper and effective marketing strategy is not developed, it might fail a technologically advanced product; this shows the importance of both exploratory innovation and exploitative innovation in the development of products and the development of the marketplace so that an organization can gain a competitive advantage. In the IT sector of Pakistan, the software houses work on technology innovation heavily. There is continual product or service development and market development in this sector; thus, exploratory and exploitative innovation are exciting aspects to consider in this research.

SEO has gradually gained importance as a multi-disciplinary area of research through which aspects of management and entrepreneurship are combined (Belz & Binder, 2017). The detection, formation, and exploitation of entrepreneurial potential constitute the concept of

SEO; SEO brings certain advantages to the environment of an organization from which it can gain a competitive advantage over its competitors (Shepherd & Patzelt, 2011). The significant themes or aspects on which SEO is based include exploiting opportunities, developing the socio-economic context, and various environment settings. SEO is also considered a long-term solution to social, economic, and environmental issues (Gray et al., 2014).

The triple bottom line concept is quite essential while discussing SEO; the triple bottom line involves social, environmental, and economic perspectives (Belz & Binder, 2017). While balancing these three aspects, organizations consider their entrepreneurial activities by considering their social and environmental needs and focusing on economic prosperity (Kuckertz & Wagner, 2010). The current literature indicates that in SEO, organizations try to integrate the social and environmental aspects and, at the same time, entrepreneurship, including opportunity recognition and innovation. SEO is crucial because it is a form of entrepreneurship that improves the welfare of humans and acts for the betterment of the surrounding environment (Gray et al., 2014). The main dimensions of SEO are the welfare of society, a better economic situation, and a reduction in the pollution or degradation of the environment (Thompson et al., 2011). Pollution is usually caused by pollutants released from industries and organizations manufacturing specific products. The manufacturing process releases different types of waste that ultimately pollute the environment. Organizations that have SEO consider these missions while performing their operations and procedures; for example, conserving the environment is an essential mission of SEO (Turker, 2009). In addition, such organizations are also involved in various other social well-being activities.

The entrepreneurial context of SEO involves the entrepreneurial activities carried out by an organization in its various processes and plans. From this perspective, organizations are well aware of the new and latest technologies, the latest market trends, and other potential opportunities available in the market (Lumpkin et al., 2009). SEO perspective focuses on organizations' proactiveness, innovation, and risk-taking behaviors; proactiveness revolves around predicting future opportunities by an organization. Organizations with SEO and entrepreneurs can anticipate upcoming trends and patterns in the market. The proactiveness of an organization can be measured through a new technique of business and competitive posturing. Innovation refers to the ability of an entrepreneurial organization to create and

develop new products and services. This also involves the creative and innovative ideas in the minds of entrepreneurs that are ultimately developed into new products and services. There are various ways to measure an organization's innovativeness, such as the frequency of developing new products and services, bringing changes to product and service lines, and research and development (R & R&D) in the organization. Risk-taking involves using resources in situations when the outcomes are blurry (Kraus et al., 2012; Mahmood & Hanafi, 2013). These three dimensions are the core of entrepreneurship. The risk-taking behavior of organizations or entrepreneurs can be measured through the stance of bold and aggressive actions while exploiting opportunities. When associated with environmental, social, and economic welfare, these three dimensions become an integral part of SEO.

Specifically, the sustainability aspect of SEO involves integrating social and environmental considerations while performing regular business operations. It also involves the extent to which an organization is ready to take initiatives for sustainability (Tata & Prasad, 2015). Three major points constitute the aspect of sustainability in SEO. The first point is that sustainability involves the development of intelligence related to creating opportunities and managing risks associated with economic, social, and environmental progress. The second point is that the intelligence mentioned above must be diffused in various departments. The third point involves the openness of the people in the organization to this intelligence (Dacko et al., 2013). Again, the triple bottom line concept can be associated with the sustainability aspect of SEO. The managers or entrepreneurs at organizations with SEO show readiness to work toward social and environmental welfare with minimum profitability.

Firms need to keep innovation focused in their business operations, products, and services while striving for sustainability (Shepherd & Patzelt, 2011). Pakistan is a developing country, and its manufacturing sector is an important industrial sector. The business operations in these industries usually result in the degradation of the environment due to the release of pollutants and wastes. These industries need to check on issues resulting from their business activities by focusing on SEO and improving their sustainable entrepreneurial performance (SEP). It might be interesting to incorporate the aspect of BDM and SEO because big data might provide adequate information and insights to organizations with SEO, which might help them choose between exploratory and exploitative innovation or go for ambidexterity, balancing them both.

As the worldwide economy is quite competitive and challenging, the various industrial sectors are crucial for a country's economic growth and development (Ahmad & Pirzada, 2014; Zahra et al., 2006). This situation is apparent in developing countries; small and medium enterprises (SMEs) improve the growth and development of the economy and are the economic drivers in developing countries. However, due to the competitive and uncertain nature of the business environment worldwide, especially in developing countries, the challenges for various industrial sectors have increased. Ultimately, they impact the performance of industrial sectors (Zhu et al., 2013). Most industrial organizations have the primary goal of gaining a competitive advantage over their rivals through sustainable business growth (Seung, 2014). However, new businesses or ventures that are not large usually fail to take off in the market due to the uncertainties and challenges. The literature indicates that almost 40% of new venture businesses fail in their initial two years (Hashim et al., 2018).

Again, this situation is more prominent in developing countries, such as Pakistan, which is the context of the current study. In Pakistan, the business ecosystem is quite challenging and competitive, and the business environment is also considered quite unfavorable for businesses, especially SMEs (Beugre, 2016). Therefore, these businesses need to consider the best strategies for utilizing their available resources so that their sustainable growth is ensured, despite all the competitive and challenging scenarios in the economic canvas of Pakistan (Hyder & Lussier, 2016). Organizations strive to overcome the unhealthy and unfavorable business environment, achieve sustainable business growth and development, and improve performance.

For several years, sustainable entrepreneurship has been viewed as the capability top organizations possess to prioritize creative and innovative ideas to bring sustainable innovations and gain a competitive advantage (Shepherd & Patzelt, 2011). In developing countries, in particular, entrepreneurs are focusing on sustainable ways of doing business so that the economic situation of their countries may improve (Al-Aali & Teece, 2014). Several products or commodities, such as self-driving hybrid cars, mobile phones, microcomputers, the internet, and drones, have brought significant change to the economic situation of these countries. Organizations that are sustainable entrepreneurship oriented consistently adopt sustainable practices in nature. They ensure that these innovations can be scaled up to future

sustainable business activities. Organizations with sustainable entrepreneurship are shown by social and environmental or ecological betterment measures. Organizations with sustainable entrepreneurship develop the processes used to develop products and services.

Increased SEP leads to the betterment of the economic situation of a country and the removal of the poverty factor (Werhane et al., 2020). Organizations and businesses of developing countries have recently focused on sustainable entrepreneurial activities in response to the economic crisis, notably the novel coronavirus pandemic; these organizations are now developing and planning strategies to bring sustainable innovations to their businesses to mitigate economic issues caused by the economic crisis (Cohen, 2020). Moreover, social and ecological issues have also emerged, associated with specific challenges that demand timely solutions, compelling organizations to consider sustainable entrepreneurship. In the same way, increased competition in the market has also propelled organizations to bring sustainable innovations to their primary business practices (Cillo et al., 2019).

When organizations focus on sustainable entrepreneurship as their primary or central business policy, they are integrating concerns specifically related to society's needs and the environment in their decision-making processes (Vuorio et al., 2018) instead of focusing only on the development of new products or services and the processes or procedures to develop them; these organizations also encourage a sustainable managerial style for the promotion and development of a sustainable mindset and innovativeness to make some differences (Schaltegger et al., 2018), leads to integrating economic, social, and environmental aspects in the performance of sustainable entrepreneurship in organizations.

In other words, SEP is quite different from the usual primary competitive objectives of a firm (i.e., to capture new markets by keeping a competitive advantage in the market) as SEP connects economic, environmental, and social aspects to gain competitive advantage and improve the welfare of society and the environment. Researchers have argued that entrepreneurs and new ventures can regulate, develop, and exploit great opportunities for sustainability by focusing on major social and technological innovations to transform organizations, markets, and society (Dean & McMullen, 2007). In the context of the software houses of the IT sector in Pakistan, the nature of their operations, processes, products, and services is quite innovative, and the number of new ventures developing in this particular field

or sector is increasing. It is expected to increase at this rate, indicating that ns or businesses associated with this particular sector need to focus on sustainable entrepreneurship.

IT is among the most rapidly emerging sectors in Pakistan, assuming an essential role in developing a knowledge economy and a knowledge-centric society. The Pakistani IT sector has carved a distinguished position as the preferred source for business process outsourcing, freelancing, and software development (Hassan, 2020). The country has been ranked number four for freelance development, and IT-related exports have increased by 70% in the last three years. Digital growth in the country has witnessed a rapid evolution as well. The IT sector is among the fastest-growing sectors and contributes 1% to the overall US\$ 3.5 billion GDP. The contribution has quadrupled over the past few years, and the sector is expected to grow at 100% in the next five years toward US\$ 7 billion. Pakistan is also witnessing the change in the 4th industrial revolution; for example, there has been a remarkable increase in e-commerce businesses and digitization (Nawaz et al., 2015).

The software-related exports of Pakistan are currently worth US\$700 million, according to the State Bank of Pakistan. Moreover, there has been a rapid increase in the freelancing community of the country, which is estimated to earn another US\$1.2 billion in exports, an amount not recorded by the central bank as they are not registered. Moreover, another US\$600 million is generated in exports from companies that do not bring their revenues to Pakistan. In line with the Pakistan Vision 2025 of Pakistan's Planning Commission and accordance with the Digital Pakistan Policy of 2018, Pakistan's information and communications technology industry is targeted to reach US\$20 billion by 2025. There has been an increase in technology-based startups, such as Careem and Daraz. pk, Zameen.com and Rozee. pk. Their success is bringing investment into Pakistan, as evident from Alibaba's recent acquisition of Daraz. pk and Easypaisa (Ahmed, 2019).

1.3 Problem Statement

The analytical capabilities of big data for organizations are immeasurable and contribute toward effective organizational performance. For example, business models have revolutionized organizational knowledge management due to big data-related capabilities (Khan & Vorley, 2017; McAfee et al., 2012). Managers' knowledge regarding the organization,

businesses, competitors, and products and services has increased due to big data (Wang, Kung, & Byrd, 2018). In the same way, the performance of business units and business assets are known, and bottlenecks in the supply chains of businesses have been found due to big data availability (Cappellesso & Thome, 2019). Information about the competitors of a company can be found through big data, and the behavior and attitudes of customers can also be identified through big data (Hofacker et al., 2016). All the aspects mentioned above enable organizations to gain perspectives on their customers and competitors, ultimately gaining a competitive advantage. The most critical capabilities associated with an organization's big data play a significant role in getting a competitive advantage, including infrastructure flexibility, BDM capabilities, and personnel expertise related to big data (Wamba & Mishra, 2017).

In recent years, big data application and growth have attracted considerable attention. Academics and industrial experts have emphasized big data's importance and competitive advantage. Recent literature suggests that innovation processes are essential, and organizations need to concentrate on creating sustainable capabilities, such as BDA capabilities (BDAC). Moreover, some studies have also suggested that the integration of BDAC in a business model creates an opportunity for the application of sustainability (Aker & Wamba, 2016; Hao et al., 2019; Oncioiu et al., 2019). Some studies highlighted that big data is an essential sustainable resource for organizations. It creates sustainable entrepreneurial opportunities by using new technologies for managing massive information and data resources (Oncioiu et al., 2019).

The present research considers all of these factors and focuses on the influence of BDM or big data capabilities on SEP in organizations. Big data implementation and inculcation in organizations and their business model is in line with the realization of several sustainable capabilities and can boost the SEP of organizations, especially for SMEs. Researchers have provided evidence that organizations and businesses have an essential role or influence over the environment and society (Mahmood et al., 2017). When organizations are involved in sustainable development activities, especially related to entrepreneurship, their performance in this regard is increased. This shows the importance of BDM capabilities in SEO, ultimately enhancing the SEP of organizations. The role of exploratory and exploitative innovation is also essential, as entrepreneurial activities have an essential aspect of innovation and other aspects such as proactiveness and risk-taking.

The IT sector of Pakistan is developing, and most organizations are not attuned to implementing sustainable entrepreneurial practices. The lack of SEO affects the economic situation of organizations, but it also contributes to the miserable environmental and social situations. Moreover, these aspects need to be investigated further so that the sustainable entrepreneurial side of software houses can be improved and entrepreneurs can see the importance of exploratory and exploitative innovation activities in increasing the SEP of these organizations. This will improve the economic situation of organizations and result in the sustainability of the environment and social aspects. Failure to consider environmental and social issues might have serious economic, social and environmental consequences in Pakistan, which already faces such issues and challenges, and the situation might worsen.

Although there has been extensive research on the aspects under study in the current research, several gaps have been identified in the literature. The researcher intends to bridge these gaps in the current research. The significant gaps and the relative novelty and contributions of the current research are described in this section. BDA and management of big data are emerging technologies that have attracted the attention of researchers for the past few years; thus, there have been several research studies based on big data and the capabilities and skills related to big data (Ghani et al., 2019; Mikalef et al., 2019a; Saggi & Jain, 2018; Tiwari et al., 2018). In addition, with the increase in the importance of entrepreneurship, several researchers have also studied entrepreneurship orientation in recent years (Criado-Gomis et al., 2017; Criado-Gomis et al., 2018b; Hernández-Perlines & Ibarra Cisneros, 2018; Pratono et al., 2019). However, a significant gap that has been identified in this regard is that very few studies, to the best knowledge of the researcher, have associated sustainability with entrepreneurial orientation (i.e., SEO); this is mainly the case in the field of IT (i.e., research regarding SEO is quite scarce). In addition, the majority of the studies have considered the significant dimensions of big data capabilities overall. These dimensions include infrastructure flexibility, BDM, and personnel expertise in big data. The researcher could not find any studies that exclusively considered one significant dimension of BDA, that is, BDM capabilities. Moreover, these gaps will be bridged in the current study as the researcher investigates the impact of the four dimensions of BDM capabilities (i.e., democratization, contextualization, experimentation, and execution) on the SEO of the software houses of Pakistan.

Moreover, exploratory and exploitative innovation activities have been an area of focus in various research studies, especially in ambidexterity in organizations. As these activities are innovation-based, they are considered essential dimensions of entrepreneurial orientation (Bachmann et al., 2021; Khan et al., 2019; Zhang & Luo, 2020). However, no adequate research could be found in the literature that associated exploratory and exploitative innovation activities with SEO, especially in the context of the software houses of Pakistan, which is a significant gap. The researcher intends to bridge this gap in the current study by taking exploratory and exploitative activities as dependent variables for the four dimensions of BDM capabilities and as mediators between SEO and SEP in the context of the software houses of Pakistan. This contribution of the current research will shed light on the role of organizations in adopting either exploratory or exploitative activities related to innovation or both types of activities simultaneously, following the concept of ambidexterity.

SEO and SEP are very much associated with each other: sustainable entrepreneurial-oriented organizations show better SEP than those who do not have SEO. The association between these two concepts is primarily due to the sustainability and entrepreneurship factors. Sustainability involves three dimensions (i.e., economic, social, and environmental betterment and welfare), while entrepreneurship involves three dimensions (i.e., innovation, proactiveness, and risk-taking) (Criado-Gomis et al., 2017; Criado-Gomis et al., 2018b; Hernández-Perlines & Ibarra Cisneros, 2018; Pratono et al., 2019). Despite the strong association between SEO and SEP, there is a scarcity of research or studies that have explored the association between the two, especially in the context of the software houses of Pakistan. In addition, there is another gap due to insufficient research into the roles of exploitative and exploratory innovation as mediators between SEO and SEP. This research contribution will indicate how the software houses of Pakistan can have SEO and carry out exploitative and exploratory activities so that their SEP is increased considerably.

Lastly, research related to BDA and management, SEO, and SEP in the context of Pakistan is quite rare. As Pakistan is a developing country, its organizations and businesses stick to traditional business methods and carry out specific operations. Businesses in Pakistan are not focusing on BDA and management, SEO, and SEP, and, as a result, research regarding these aspects is also quite insufficient. This is alarming for the country; its business ranking is getting

worse and environmental indices do not show positive results. These situations might be due to the lack of focus on big data, entrepreneurship, and sustainability of social and environmental aspects (Malik et al., 2019; Nawaz & Alvi, 2018). This calls for extensive research and investigation regarding the aspects mentioned above in the context of Pakistan.

Furthermore, software houses are an essential and significant slice of the IT sector under the umbrella of the business sector in Pakistan, and there is enormous utilization and generation of big data in these software houses, which makes BDM a significant issue for these businesses; however, there is a gap regarding research related to big data for this particular sector, and it is bridged in the current study. Thus, based on the gaps mentioned above identified by the researcher and based on the recommendation on BDM capabilities and value creation, the current study has been designed to investigate and explore the impact of various dimensions of BDM capabilities on SEO and exploratory exploitative innovation. In addition, the impact of SEO on exploratory innovation, exploitative innovation, and SEP will also be explored, along with the mediating impact of SEO on the relation between BDM capabilities and SEP and on the mediating role of exploratory innovation and exploitative innovation on the relation between SEO and SEP, specifically in the context of software houses in the IT sector of Pakistan.

1.4 Research Objectives

The objectives of the research indicate what the research is trying to achieve. Research objectives indicate the accomplishments that a researcher wants to achieve through the study, and the direction of the research is obtained in this way. Based on the identification of various gaps in the past literature and the novelty this research is trying to bring, it can be stated that the current research aims to find out the influence of BDM capabilities on SEO, exploratory innovation, and exploitative innovation and the influence of SEO on SEP along with the mediating role of SEO on the relation between BDM and exploratory and exploitative innovation and the mediating impact of exploratory and exploitative innovation on the relation between SEO and SEP. The key objectives of the study are as follows:

- To investigate the effect of BDM dimensions on SEO in the context of software houses.
- To explore the effect of BDM innovation in the context of software houses.

- To explore the mediating effect of SEO on the association between BDM and innovation in the context of software houses.
- To examine the effect of SEO on SEP aspects
- To explore the effect of SEO on innovation in the context of software houses.
- To examine the mediating effect of innovation on the relation between SEO and SEP aspects (economic, social and environmental) in software houses.

The above-stated research objectives lead to the following research questions, which are answered at the end of the research, and they have been listed as follows:

- What is the effect of BDM dimensions (democratization, contextualization, experimentation, and execution) on SEO in the context of software houses?
- What is the effect of BDM dimensions (democratization, contextualization, experimentation, and execution) on exploitative innovation in the context of software houses?
- What is the effect of BDM dimensions (democratization, contextualization, experimentation, and execution) on exploratory innovation in the context of software houses?
- What is the mediating effect of SEO on the relation between BDM dimensions (democratization, contextualization, experimentation, and execution) and exploitative innovation in the context of software houses?
- What is the mediating effect of SEO on the relation between BDM (democratization, contextualization, experimentation, and execution) and exploratory innovation in the context of software houses?
- What is the effect of SEO on SEP aspects (economic, social, and environmental) in the context of software houses in the IT sector in Pakistan?
- What is the effect of SEO on exploitative innovation in the context of software houses?
- What is the effect of SEO on exploratory innovation in the context of software houses?
- What is the mediating effect of exploitative innovation on the relation between SEO aspects (economic, social, and environmental) and SEP in the context of software houses?
- What is the mediating effect of exploratory innovation on the relation between SEO aspects (economic, social, and environmental) and SEP in the context of software houses?

1.5 Scope of the Study

The scope of the current study revolves around the software houses of Pakistan, that is, the IT sector of Pakistan. The telecommunications and technology sector has seen growth in recent years based on the country's economic developments; for example, mobile subscriptions reached 153.8 million in 2015. Moreover, the fiberoptic system has also been extended in Pakistan (PSEB, 2016). The software industry or software houses come under the umbrella of the IT sector; the IT sector is considered a powerful sector of the country from an economic perspective. It can change the underdeveloped or developing status to developed status. Countries like China, Thailand, and India have had remarkable success in this sector. Other developing countries are on the same route because the speed and volume of the development in this sector are quite rapid.

The Government of Pakistan has developed favorable policies for software houses, such as exemption of taxes, the construction of low-rent IT parks, and the return of the total amount of profit to software houses. The IT industry has shown remarkable improvement in recent years; for example, the export graph of software houses has shown positive figures (PSEB, 2016).

There are 1306 software houses in Pakistan, and the major centers of these software houses with the highest number of software houses, including Lahore, Karachi, and Islamabad. In addition, 60 foreign software and IT-related companies work in Pakistan (PSEB, 2016). As per the World Trade Organization, the total size of the software industry in Pakistan is US\$2.8 billion, and the total exports of software are US\$1.4 billion. About 110 educational institutes in the country provide IT and software-related education, from which almost 20,000 students graduate each year. Among the 110,000 IT and software specialists in the country, almost 15,000 are specialists in the export-related practices of this particular sector. The total number of IT parks in the country is 11, and these parks cover an area of 750,000 square feet. An IT park refers to buildings that are dedicated to IT-related activities. In the software houses sector, the major attractions for clients include high-quality software, easy and fast business, reduced costs, and the development of out-of-the-box infrastructure related to telecommunications and IT. It has been estimated that the annual growth of the sector is 33%, and it is expected to show growth of about US\$10 billion in the coming years (PSEB, 2016).

In Pakistan, about 60% of the population is 15 to 29 years old, a considerable amount of young human capital. More than 2000 IT-related companies employ IT, and software-related professionals and the number of such companies increases with every passing year (Raza, 2018). IT and software-related exports of Pakistan have increased by 20 times in the last ten years, providing considerable revenue to this sector. Pakistan imported 78.57 billion Rs of mobile phones in 2015/2016, which shows a strong background of IT in Pakistan. This also indicates the great potential of the IT sector and its subsectors, such as the software houses of Pakistan, as although their products are usually sold to local customers, they also provide products for international clients and companies. The Pakistan Software Houses Association (PASHA) indicates that the IT sector of Pakistan comprises hundreds of SMEs. As per this estimation, the size of this industry is US\$2 billion, which has doubled in size over the past few years. About 12,000 employees and 370 software houses have been associated with PASHA (Raza, 2018).

The global players or the leaders of this sector, such as Cisco, Microsoft, and IBM, have expanded their operations in Pakistan. Following them, other investments have also been captured from companies such as Adobe, ePlanet, and Motorola. Another association linked with the software industry of Pakistan is the Pakistan Software Export Board (PSEB), which is dedicated to the promotion and expansion of the IT and software industry of Pakistan. The role of the PSEB is to expand research related to the IT sector of Pakistan and develop strategies that increase the sustainable development of the sector. Apart from the registration process of IT companies and the creation of IT parks in the country, PSEB is also involved in collaborating with government IT-related institutions, such as the Pakistan Telecommunication Authority, and tracks the IT sector's performance and provides recommendations for improvement (Raza, 2018). PSEB also provides facilitation services in acquisitions and mergers of companies and other related institutions. The above discussion indicates the importance of Pakistan's software houses and IT sector; thus, this sector has been selected for the current study. The applications of big data in this sector are numerous, and so is the scope of SEO. The study focuses only on companies that are registered with the PSEB.

1.6 Significance of the Study

The purpose of conducting the current study is to find out the influence of BDM capabilities on SEO, exploratory innovation, and exploitative innovation and the influence of SEO on SEP, along with the mediating role of SEO on the relation between BDM and exploratory and exploitative innovation and the mediating effect of exploratory and exploitative innovation on the relation between SEO and SEP. Various benefits will be associated with achieving the objectives of the current study.

1.6.1 Theoretical Significance

This study has bridged various theoretical gaps found in the literature. It has taken specific dimensions of BDAC (i.e., BDM and its four dimensions of big data democratization, contextualization, experimentation, and execution of big data) and associated these dimensions with SEO, representing a novel contribution of this study to the literature. The study also investigated the effects of SEO concerning two types of innovation (i.e., exploratory and exploitative innovation), another theoretical contribution of the study. Lastly, from the economic, social, and environmental points of view, the effects of SEO on SEP in all of the three aspects mentioned above were investigated. Furthermore, this perspective has not been researched sufficiently in the context of the software houses of the IT sector in Pakistan. The contribution of the current study is that this sector of Pakistan has been selected for the research. Lastly, the use of two theories – the dynamic capabilities view (DCV) and entrepreneurship theory – to develop the various assumptions in the current study contributes to the theoretical significance of this research. All these points highlight the theoretical significance of the study.

1.6.2 Practical Significance

In terms of the study's practical significance, software houses, particularly those in Pakistan, will get important insights regarding the collection, usage, analysis, and management of big data in different dimensions: democratization, contextualization, experimentation, and execution of the big data. As software houses are experiencing good growth and expansion in Pakistan, their data is also increasing in volume, resulting in the development of big data. Therefore, big data management is essential for companies in this sector. In addition, these

companies will also get valuable insights regarding the development of SEO, combining both aspects of entrepreneurship and sustainability. The IT sector, including software houses, is innovative, and new developments frequently occur in this sector, thus making entrepreneurship necessary for these organizations. The SEP of these companies is heavily dependent on their SEO, and the current study will provide this insight. Lastly, the current study also provides valuable information regarding the implementation of exploratory or exploitative innovation and keeping these two types of activities in balance, which are essential aspects to be considered by the software houses of Pakistan. Overall, based on the practical significance of the current study, the software houses of Pakistan will be able to manage big data effectively and utilize it to improve their SEO and increase activities related to exploratory and exploitative innovation so that, ultimately, the SEP of these companies can be enhanced.

1.6.3 Policy-making Significance

The policy-making significance of the study is that the Government of Pakistan and IT-related government institutions will get guidance from the study in two forms: (1) to help them develop and devise policies that are favorable to software houses, and (2) support to manage and utilize big data in the interest of the sector and the overall country's economic development. Moreover, the software houses of Pakistan can get insights into developing favorable policies regarding the collection, utilization, and management of big data internally and improve their SEO and SEP by utilizing the information obtained from BDA in carrying out exploratory and exploitative innovation activities.

1.6.4 Societal Significance

Lastly, the study offers some social benefits. Sustainability involves economic, social, and environmental aspects, where the economic aspect is specifically associated with the company itself and the country's overall economy. In contrast, the social aspect revolves around the social welfare of the country, the people of that country, and those associated with the company itself. The environmental aspect is related to the betterment of the surrounding environment and protecting it from pollutants and other harmful wastes. The social and environmental aspects are more related to the social significance of the current study because by improving

the SEP of the software houses of Pakistan and economic growth, social welfare and environmental protection can be enhanced.

1.7 Definitions of Key Variables

1.7.1 Big Data Management

BDM has four dimensions in the current research: democratization, contextualization, experimentation, and execution. The first dimension of BDM capabilities is big data democratization, which involves the ability of a firm to integrate BDA in the organization, in its various sections and departments, in such a way that various benefits and applications of the big data can be acquired any time (Zeng & Glaister, 2018).

Contextualization of big data refers to the interpretation of big data to obtain specific meanings from different perspectives. All sorts of big data need to be contextualized by the organization with the core aim to get an overall view of the situation and, ultimately, to create value from it for the organization (Zeng & Glaister, 2018).

Experimentation with big data usually involves trial and error and an intrusive attitude toward the collected big data. It enhances the courage of the employees of an organization to frequently experiment with the big data and carefully analyze the results (Zeng & Glaister, 2018).

Big data execution refers to the idea that an organization must develop strategies and actions that are responsive and agile so that new and better opportunities can be identified. Value can be obtained from them (Zeng & Glaister, 2018).

1.7.2 Sustainable Entrepreneurial Orientation

SEO has been defined through three dimensions (i.e., innovativeness, proactiveness, and risk-taking) that represent the entrepreneurial behavior of an organization (Miller, 1983). When integrated, the three dimensions mentioned above of entrepreneurial orientation result in a renewing of the firm and providing a value proposition by the firm that is considered competitively superior by the customer. The first dimension, innovativeness, involves the

usage and scanning market information to acquire knowledge. The second dimension, proactiveness, involves pursuing market opportunities from a future-looking perspective. Finally, the third dimension, risk-taking, involves the trial and error aspect of creating a knowledge base (Miller, 1983).

1.7.3 Exploitative Innovation

Exploitative or incremental innovation refers to small changes in the technology-related capabilities of an organization and involves focusing on existing customers and markets. Exploitative innovation involves routine learning. Organizations that pursue exploitative innovation search for opportunities in their primary landscape and rely on their primary search activities (March, 1991).

1.7.4 Exploratory Innovation

Explorative or radical innovation refers to changes in the overall technological path and involves exploring new and emerging customers and markets. It also involves breaking with the current dominant research logic. Firms that carry out exploratory innovation see far beyond the current domestic research so that limitations or gaps related to internal search can be bridged. In exploratory innovation, new and modern knowledge must shift from current knowledge to new knowledge (March, 1991).

1.7.5 Sustainable Entrepreneurial Performance

SEP has been defined as the integration of three aspects of performance (i.e., economic performance, environmental performance, and social performance), which leads to economic growth and development and the organization's growth. In addition, sustainability performance also positively influences the environment and society (Carter & Rogers, 2008).

According to another perspective, sustainability performance refers to those activities performed by an organization that focuses on that organization's objectives. These objectives revolve around economic, social, and environmental performance (Adebambo et al., 2015). Sustainable performance can also be classified into two classes or categories. The first category

is related to the organization's financial performance or profit, and the second category is related to the organization's non-financial performance or non-financial profit (Ahmad et al., 2018). Non-financial performance covers the satisfaction of an organization's employees, customers, suppliers, and the organization's image.

1.8 Summary of the chapter

This section presents a summary of the first chapter of this dissertation. In this chapter, the researcher presented the problem statement for the study and the background for the research variables. The research questions and research objectives have been mentioned explicitly. The scope of the study was discussed in detail, followed by the theoretical, practical, policy-making, and social significance of the study. This chapter argued that the BDM capabilities of the firm have a resultant impact on the SEO and innovation performance of the software companies of Pakistan. This chapter also contended for the association between SEO and SEP. It highlighted the mediating role of the exploitative and exploratory innovation between SEO and BDM and SEO and SEP. In the next chapter, the researcher will present a literature review.

Chapter 2: Literature Review

2.1.Introduction

This chapter presents the literature review for the variables selected in the study. The chapter initiates with a discussion of the variable based literature and a discussion of the theories supporting the theories between the variables. Then the relational literature review is discussed based on two theories (i.e., DCV and entrepreneurship theory), and the research hypotheses are drawn through the relational literature review. Relational literature regarding the relationships between different variables has also been reviewed and developed concerning the hypotheses.

2.2.Big Data Management

This section covers details related to dynamic firm capabilities, big data capabilities and dimensions of BDM.

2.2.1. Dynamic Firm Capabilities

The role of big data has gained great significance and this significance is even higher for the developing economies of the world. The reason for the great significance of big data is that organizations in developing economies have to use external knowledge and data continually so that they can acquire new capabilities, which gradually become the internal capabilities of that firm, and these are then used by the organization to create value for prospective customers. The research literature revealed that external knowledge from international markets provides alternatives for the organizations of developing economies to bridge the institutional gap found in the market (Khan et al., 2019). Moreover, some research studies focused on the relationships that exist between different organizations, whether these are vertical or horizontal, and these relationships become a major source of accessibility to, and development of, external knowledge. Xu et al. (2018) stated that organizations in developing countries use inter-firm relationships as sources of external knowledge and then use that knowledge to gain benefit through entrepreneurial orientation.

Research regarding external knowledge and big data is related to several disciplines, such as innovation, institutional theories, evolution in management, strategic management and

international marketing to name a few (Casson & Wadeson, 2018; Cooke et al., 2018; Nguyen & Diez, 2019; Nuruzzaman et al., 2019; Pandit et al., 2018; Peng et al., 2018). Kumar and Puranam's (2012) study indicated the growth of Indian companies that were working with large multinational corporations and the reason for their growth was their innovative practices and external knowledge-based capabilities; although these capabilities were not visible to their end customers, they were extremely valued by the multinational corporations with which they were working.

Other studies have focused on organizational and institutional perspectives and the interaction between the internal strategies of organizations and local institutions in developing countries (Duan et al., 2019; Mikalef et al., 2019a). These studies indicated that the domestic organizations of Argentina utilized institutional and relational mechanisms to upgrade their products as well as processes. In contrast, other studies suggested that linking with certain institutional and relational networks did not result in the up-gradation of the products and processes of organizations, but organizations should put effort into getting access to such linkages and networks that generate value (Corredoira & McDermott, 2014; McDermott & Corredoira, 2010). A similar study attempted to identify the international networks that can be used to develop exploratory innovation (Khan et al., 2019).

2.2.2. Big Data Capabilities

The existing literature that is specifically focused on developing countries has indicated that organizations considered to be successful can source external knowledge and data, and by using this knowledge and data they can develop new and innovative capabilities. Specifically, studies that focused on international management and strategic management explored the determinants and consequences of supplier capabilities using a quantitative survey method. For example, a study explored suppliers' use of two approaches (RBV and transaction cost approach) to increase their performance in business-to-business markets (Jean et al., 2010; Mikalef et al., 2019b). The IT capabilities that were reported by the study included human IT capabilities, electronic integration and organizational complementary capabilities. All these capabilities have been reported to contribute to various organizational processes, such as monitoring, absorptive capacity and coordination, which are expected to increase the overall operational and strategic performance of suppliers in business-to-business markets. Another study in a

similar context suggested that advanced IT-related capabilities improve the ability of suppliers to develop and improve their relationships with their global customers (Jer, 2014).

The literature has highlighted the importance of big data in increasing value creation and the development of organizations' capabilities. One such study showed that if big data decision-making capabilities are acquired and used by organizations, especially in China, this increases the efficiency and effectiveness of the decision making of these firms (Shamim et al., 2019). They further indicated that if organizations possess the capability to manage all their internal challenges, then these organizations will acquire big data decision-making capabilities. Another related study indicated that entrepreneurial orientation is also an important factor that helps organizations obtain value from the big data they acquire (Zeng & Glaister, 2018). However, organizations can fail to derive value from their big data; this aspect was highlighted by research in the context of India that indicated if employees and other members of the organization are not willing to develop an internal change and become adapted to environmental turbulence, they will be unable to derive strategic value from BDA (Verma & Bhattacharyya, 2017).

2.2.3. Dimensions of Big Data Management

2.2.3.1. Big Data Democratization

The first dimension of BDM capabilities is big data democratization which involves the ability of the firm to integrate the BDA in the organization in its various sections and departments in such a way that various benefits and applications of the big data can be acquired at any time (Zeng & Glaister, 2018). Research has indicated that a special sort of individual expertise is required for BDM and this expertise is provided by data scientists who possess the highly specialized skills and abilities necessary to analyze and manage big data (Davenport & Patil, 2012). Research has also elaborated that big data has a wide range of applications and uses, and all these applications result in the creation of value for that particular organization (Khan & Vorley, 2017).

Research also suggested that if the organization have the capabilities and expertise to democratize big data to obtain a large number of applications of the big data, it will result in a

greater amount of value creation through the big data. In this scenario, at the individual level in an organization, micro-level interactions among the employees of different departments of that particular organization have the core purpose of integrating big data in the organization. This is a continuous process to access larger volumes of the big data, and the interactions that take place with the purpose of accessing big data result in a better response to the changing needs of customers and the changing business environment (Ajayi et al., 2017).

2.2.3.2. Big Data Contextualization

The contextualization of big data involves the interpretation of big data so that certain meanings can be obtained from different perspectives. It is quite clear that a huge variety of data is found in firms, such as data regarding consumer behaviour, data about market trends and data related to the changing needs and demands of customers. All these sorts of big data need to be contextualized by the organization with the core aim to get an overall view of the situation and, ultimately, to create value from it for the organization (Zeng & Glaister, 2018). The rationale behind the contextualization process of big data is that big data has a huge volume and size, and it is collected at different points in time and different scenarios and circumstances. Therefore, if big data is not contextualized according to the time and circumstances of the data collection, it might not provide useful insights and applications. The importance of big data contextualization is even greater for organizations that are based on digital services or IT-based services because they need to develop a deeper understanding of their customers in the international market (Shamim et al., 2019).

2.2.3.3. Big Data Experimentation

As the name indicates, this dimension of BDM is strongly related to experimentation on the collected big data. It usually involves trial and error as well as an intrusive attitude toward the collected big data. It enhances the courage of the employees of an organization to frequently experiment with the big data and carefully analyze the results (Zeng & Glaister, 2018). The experimentation perspective of big data also results in the creation of value for that particular organization. A study in this context suggested that ambidextrous enterprises that have staff and people who are continually involved in the generation of new and innovative ideas related to big data are likely to upgrade their big data capabilities (Deng, 2012; Khan et al., 2018).

Various dilemmas can result from the difference between the exploration process of certain possibilities and the exploitation process of certainties and these dilemmas are usually related to the firm's behavior and are very important to the survival and growth of an organization. By experimenting with big data, organizations can get new information and test creative and innovative ideas in real-time and, finally, make adjustments to their strategies under the opportunities.

2.2.3.4. Big Data Execution

The last dimension of BDM is big data execution, which means that once the big data has been collected and valuable insights have been obtained from it, the next step should be that the organization develops strategies and actions that are responsive and agile so that new and better opportunities can be identified and value can be obtained from them (Zeng & Glaister, 2018). It has been noted in the past that various organizations get access to big data, but they fail to interpret it and fail to obtain insights related to the opportunities obtained from the collected data. This is due to a lack of big data execution capabilities by the firms and in the absence of such capabilities, the organizations can't transform their resources into the value created for the organization. The past literature has not related SEO with these BDM capabilities, which is an interesting area to be considered; this gap has been bridged in the current study.

2.3. Sustainable Entrepreneurial Orientation

In the literature, it has been made quite clear that entrepreneurship is very much connected with stability issues; however, understanding regarding the usage of sustainable development opportunities by entrepreneurship firms in the markets has scarcely been developed (De Clercq & Voronov, 2011; Dobers & Wolff, 2000; Wagner, 2012). Various researchers have studied entrepreneurship from the perspective of sustainability (Cohen et al., 2008; Cohen & Winn, 2007; Dean & McMullen, 2007; Stål & Bonnedahl, 2016). One of these studies suggested that the identification of opportunities and possibilities and their impact on the stakeholders of an organization, the organization itself and the overall society provides a clearer view of the creation of value in the field of entrepreneurship (Cohen et al., 2008). It has been argued by researchers that the economic, environmental and social aspects of sustainability are very much related to each other. Therefore, the consideration of only the economic perspective while

studying and analyzing entrepreneurship activity is not enough at any level, such as individual level, organizational level or contextual level. Although entrepreneurial activities are considered to be related to sustainable development through their promotion, the reality is that there are very few entrepreneurial activities that contribute toward sustainability positively. This is the reason why the environmental and social aspects are considered in addition to the actual economic perspective in a collective way and in this way the global value can be maximized (Cohen et al., 2008).

2.3.1. Dimensions and Definition

In the last few years, different researchers have studied sustainable entrepreneurship, which has been regarded as a subsection of a subarea of the main field of entrepreneurship (Kuckertz & Wagner, 2010). In this regard, three research approaches can be differentiated that involve the positive impact of entrepreneurship activities on sustainable development. It can also be stated that the term ‘entrepreneurship for sustainable development’ can be shortened to ‘sustainable entrepreneurship’ (Katsikis & Kyrgidou, 2007; Wagner, 2012). One of the three research areas regarding sustainable development is the environment.

Sustainable entrepreneurship can also be referred to as environmental entrepreneurship, environmental entrepreneurship, eco-preneurship, green entrepreneurship and green–green businesses (Gibbs, 2009; Isaak, 1997; Menon & Menon, 1997; Ndubisi & Nair, 2009; O'Neill & Gibbs, 2016). Most of the authors who have worked on environmentally sustainable entrepreneurship consider it at the individual level, as their emphasis is not on entrepreneurship organizations but environmental entrepreneurs. Environmental or green entrepreneurs can be defined as entrepreneurs who carry out their business in such a way that their business goals and environmental goals can be achieved simultaneously (O'Neill & Gibbs, 2016). In addition to environmental entrepreneurship, there is another line of research; this other line of research is based on social entrepreneurship, which focuses on the social side of sustainability and not on the economic side. Social entrepreneurship involves processes and activities that are aimed at the identification and exploration of opportunities through which social wealth can be improved due to the creation of social capital that can meet social needs (Zahra et al., 2009).

The aforementioned two approaches have been taken as one single aspect of sustainable entrepreneurship, in other words, it can be stated that if either economic and social or economic and environmental aspects are connected with entrepreneurship, it can be considered sustainable entrepreneurship (Gerlach, 2003; Schaltegger & Wagner, 2011). On the other hand, other researchers consider that both environmental and social aspects must be connected with the economic concept to make entrepreneurship sustainable (Levinsohn & Brundin, 2011; Parrish, 2010; Shepherd & Patzelt, 2011). These researchers prefer a holistic view of sustainable entrepreneurship that consider all three aspects of sustainability. Based on this idea, only those entrepreneurs who make contributions to all three areas of wealth generation can be considered sustainable entrepreneurs (Tilley & Young, 2009).

Several terms that constitute aspects of sustainable entrepreneurship have been recognized in the literature, for example, innovative behavior, examination, ability, continuing commitment, process, the form of creation, focus, discovery and exploitation, sorts of entrepreneurship (Cohen & Winn, 2007; Crals & Vereeck, 2005; Gerlach, 2003; Kuckertz & Wagner, 2010; Shepherd & Patzelt, 2011; Spence et al., 2011). All the aforementioned terms make up various definitions of sustainable entrepreneurship. However, a common aspect that has been found in almost all definitions of sustainable entrepreneurship is the aspect of opportunities, their examination, discovery and evaluation and all the dimensions related to the triple bottom line of sustainability, although some only consider two dimensions of the triple bottom line. Some researchers insist that the three dimensions of sustainable performance are prerequisites for entrepreneurship to be sustainable (Crals & Vereeck, 2005; O'Neill Jr et al., 2009; Schlange, 2009; Spence et al., 2011). The definitions of sustainable entrepreneurship also show that the process of entrepreneurship and opportunity recognition is very much connected. These opportunities can either be sustainable development discovery opportunities or create opportunities that either require the existing economic structures or new economic structures, respectively (Pacheco et al., 2010).

2.3.2. Theoretical Perspective of Sustainable Entrepreneurship

Researchers have explored sustainable development through entrepreneurship using various theoretical perspectives and approaches. One such study employed stakeholder theory to give rise to strategic entrepreneurship so that other natural, as well as social benefits, can be

achieved (Hitt et al., 2011). In the same way, another theory, named ecological modernization theory, was associated with sustainable entrepreneurship due to the reason that this theory provides a structure for different environmental issues and problems (Tilley & Young, 2009). Due to these environmental issues, industrial activity and economic growth might increase and thus sustainability can be enhanced through entrepreneurship. Another study with a similar context indicated that sustainability can be considered a 'green prison' for entrepreneurs. The concept of green prison is based on game theory: entrepreneurs in a green prison contribute to actions that damage the environment because of the divergence between individual rewards and collective goals for sustainable development. Entrepreneurs can escape the green prison by influencing the design of incentives so that the adoption of sustainability behaviors will be worthy not only at an organizational level but also at an individual level (Pacheco et al., 2010). In the context of incentives, the impact of centralized and decentralized institutions on the implementation process of incentives has been studied by Meek et al. (2010). Following an integrated approach, a study by Spence et al. (2011) suggested that theories based on entrepreneurship, neo-institutions and management can be integrated to form sustainable development theory. They elaborated that sustainable entrepreneurship involves the collaborative impact of different factors at an individual, organizational and contextual level. On the other hand, the organizational strategic view indicates that the DCV and RBV provide researchers with explanations regarding the strategic integration of sustainability (Aragón-Correa & Sharma, 2003; Schrettle et al., 2014).

It has been discussed in the literature that the development of organizational capabilities is the consequence of certain biophysical environmental restrictions. In this context, Hart (1995) related the competitive advantage of an organization with the natural environment based on the RBV. In addition, there is an underlying integration of pollution prevention, sustainable development and product stewardship as well. In the context of DCV, researchers have considered environmental proactivity as a dynamic capability because, from their point of view, it is a specific and socially complex strategy that is non-replicable and dependent and it also goes far beyond environmental regulations (Aragón-Correa & Sharma, 2003). Based on this perspective, various other researchers have also taken environmental proactivity as an important dynamic capability possessed by an organization through which the internal, as well as external environment, can be improved (Andrés et al., 2013; Menguc et al., 2010).

On the other hand, other researchers think that the dynamic capability of sustainable and strategic change in such a construct has various dimensions, such as exploration, reconfiguration and identification capabilities of the firm, and issues related to the environment are interpreted as potential opportunities for the firm (Aragón-Correa & Sharma, 2003). This is the reason why dynamic capabilities make it possible for firms to implement a sustainable development strategy and evaluate the competitive advantages and long-term growth of the firm. In this way, organizations can pay attention to complex and dynamic environmental issues and convert the possible threats faced by the firm into opportunities (Bowen & Sharma, 2005; Sharma et al., 2007). In a nutshell, it can be stated that the concept of SEO is composed of entrepreneurial orientation and sustainable orientation.

Entrepreneurial orientation is considered to be a strategic orientation that requires heavy investment; entrepreneurial orientation is also considered to be an important dynamic capability of an organization for the success and growth of the organization (Lee et al., 2001; Menguc & Auh, 2008; Webb et al., 2010). It has also been suggested that entrepreneurship is crucial for the creation and maintenance of the internal generative capability of an organization and results in various novel capabilities in the firm; this indicates that entrepreneurial orientation is a dynamic capability of a firm which is developed as a result of different capabilities and resources. There are two major perspectives on the dimensionality of entrepreneurial orientation. One perspective indicates that the dimensions of innovativeness, proactiveness and risk-taking represent the entrepreneurial behavior of an organization (Miller, 1983). This perspective puts more emphasis on the process of entrepreneurship as compared to emphasizing the top management of the firm.

The aforementioned three dimensions of entrepreneurial orientation (innovativeness, risk-taking and proactiveness) when the integrated result in the renewing of the firm, demolition of the market orders and provision of a value proposition by the firm that is considered competitively superior by the customer (Deshpandé et al., 1993; Matsuno et al., 2002; Slater & Narver, 1995). The first dimension, innovativeness, involves the usage and scanning of market information to acquire knowledge. The second dimension, risk-taking, involves the trial and error aspect of creating a knowledge base. The third dimension, proactiveness, involves the pursuit of market opportunities as part of a future-looking perspective (Zhou, 2007).

Entrepreneurial orientation can also be seen from the perspective of a competitive culture (Noble et al., 2002). In this perspective, the strategic orientation of entrepreneurship is considered the business philosophy in which the values of the organizational culture of that organization are reflected (Gray & Wert-Gray, 2012). Therefore, entrepreneurial orientation promotes decision making and other specific behaviours and practices that organizations use to create value as they explore and exploit opportunities found in the market. These opportunities might result in the development of new and innovative products, new and improved production processes or the identification of new markets (Lumpkin & Dess, 1996; Matsuno et al., 2002). When sustainability is incorporated into a business strategy, it provides a competitive advantage through intangible resources, such as the culture of an organization and the other dynamic capabilities possessed by the organization related to sustainability (Crittenden et al., 2011). One of these capabilities is sustainability orientation, which is also a strategic orientation just like entrepreneurial orientation, and it can also be viewed from a competitive culture perspective. Sustainability orientation also showcases the culture of an organization and the business philosophy, indicating the values related to sustainable development (Efrat & Shoham, 2013; Gray & Wert-Gray, 2012).

In contrast to entrepreneurial orientation, sustainability orientation is a relatively newer concept in research and thus little literature on sustainability orientation can be found. Sustainability orientation can either be considered at an individual level or at an organizational level where it is embedded in the business philosophy. Sustainability orientation can be described as a strategic orientation through which sustainable interests and practices can be integrated with the operational, strategic and tactical activities of the organization; companies that show sustainability orientation integrate their interest in sustainability with their culture and business operations (Reuter et al., 2012). This shows that SEO not only involves the fulfilment of customer needs and requirements but an organization should also be committed to sustainable development (Uriely et al., 2007).

2.4. Sustainable Entrepreneurial Performance

2.4.1. Definitions of Sustainable Entrepreneurial Performance

Sustainability has always been associated with certain activities that revolve around environmental protection and social welfare, the ultimate result of which is sustainable performance (Gong et al., 2018). Sustainable performance has been defined as the integration of three aspects of performance – economic performance, environmental performance and social performance – which leads to economic growth and development as well as the growth of the organization. In addition, sustainability performance also leads to a positive influence on the environment and society (Carter & Rogers, 2008). According to another perspective, sustainability performance refers to those activities performed by an organization that focuses on the objectives of that organization and these objectives revolve around economic, social and environmental performance (Adebambo et al., 2015).

A researcher classified sustainable performance into two classes or categories: the first category is related to the financial performance or financial profit of the organization; and the second is related to the non-financial performance or non-financial profit of the organization (Ahmad et al., 2018). Non-financial performance covers the satisfaction of the employees, customers and the suppliers of an organization and the image of the organization. Another definition of sustainable performance involves the overall performance of an organization in which all the activities, decisions and strategies of that organization are included and these result in the outcomes or results related to economic, environmental and social aspects. Some researchers considered SEP as a whole, in which all the three aspects of economic, environmental and social performances were included, other researchers considered the three aspects separately. Economic sustainable performance is the most significant and crucial aspect of sustainable performance. Economic performance is observed when a particular organization enhances its profitability, sales and overall productivity and gains success in reducing costs (Eltayeb et al., 2011). The major positive outcomes related to economic sustainable performance include the development of the green image of the organization, increased market share, better position in the market and increased revenues and profits (Abdul-Rashid et al., 2017). However, an important point in this regard discussed by past researchers is that when an organization implements certain initiatives related to sustainability, it might not result in

positive economic outcomes in the short run, but it might result in positive economic outcomes in the long run due to investment in sustainability initiatives (Zhu & Sarkis, 2004).

After economic performance, the next important aspect of sustainability performance is environmental sustainability performance, which refers to all the positive outcomes of certain sustainability activities that are related to both the internal as well as external natural environment of the organization (Rao & Holt, 2005). To be more specific and precise, this involves compliance with environmental standards, decreased emissions of air pollutants, decreased consumption of resources and decreased consumption of other material that is hazardous (Eltayeb et al., 2011; Rao & Holt, 2005; Zhu & Sarkis, 2004). Another study described environmental sustainability performance as reductions in air pollutants, material utilization and consumption of energy, and abiding by environmental rules and regulations (Laosirihongthong et al., 2013). In the same way, reductions in carbon dioxide emissions, waste water and solid wastes are also related to environmental sustainability performance (Laosirihongthong et al., 2013).

Lastly, social sustainability performance refers to the ability of an organization to increase the social well-being along with the safety and health of its employees and the public associated with it (Paulraj, 2011). In other words, in addition to focusing on profitmaking, organizations must also consider the aspect of social welfare and the preservation of ecosystems for the upcoming generations (Carter & Rogers, 2008). It has been argued by a past study that social sustainability performance involves an increased relationship between the stakeholders of an organization and the community, increased workplace safety and care for the environment, and better standards of living for the community at large (Abdul-Rashid et al., 2017).

2.4.2. Triple Bottom Line Perspective

Research regarding the sustainability aspect in various fields has increased significantly in the past few years. In the case of sustainability performance, economic sustainability performance (the most important perspective) is the most documented metric. Most of these research studies considered conventional accounting measurements for organizations, such as revenue, cost and profitability, concerning economic-related decisions of the organizations (Taticchi et al., 2015). The research suggests that in the future, the economic perspective of sustainability performance

should also consider the importance of a cooperative relationship, rather than a relationship based on competition using conventional accounting methods, to give an edge to the information-sharing process between value chain partners so that the overall sustainability performance can be enhanced (Taticchi et al., 2015). Various measurements are associated with environmental sustainability performance, such as carbon emissions, usage of natural and material resources, and waste from products and materials (Koh et al., 2013; Lake et al., 2015; Nagurney et al., 2015; Pimentel et al., 2016).

Although there are various metrics to measure the environmental perspective of sustainability performance, it is sometimes quite a difficult task to find out which metric should be used and when (Hassini et al., 2012). This enhances the need for the development of an improved metric. The measurement of the social perspective of sustainability (after economic and environmental perspectives) has been performed by various indicators, but the issue is that there is a clear gap between the theoretical and practical implementation of those indicators. Some researchers have also incorporated the concept of corporate social responsibility into social sustainability performance to guide the business-related decisions of organizations (Hutchins & Sutherland, 2008; Li et al., 2014; Morali & Searcy, 2013). One such study included different measures of social sustainability in the business decision making of organizations through various measures, such as healthcare, equity, safety and philanthropy of the workforce, which are directly linked with the social Life Cycle Assessment model. This not only provides information regarding an organization's inputs and outputs for the measurement of the social performance of the organization, but it also shows that actions and activities of the organization increase social change (Hutchins & Sutherland, 2008).

2.4.3. Integration of Economic, Environmental and Social Sustainability Performance

The concept of sustainability involves the interrelationships between three aspects of sustainability objectives: social, economic and environmental. The number of research studies based on the integration of these three objectives has increased considerably in the past few years. However, an important point that must be emphasized here is that the interrelationship and the integration of the three aforementioned perspectives of sustainability are very different concepts. The difference between the two concepts is that interrelationship refers to the complicated interactions between the three perspectives, whereas integration refers to the

combined effect of the three perspectives. The latter has been explored and investigated in Koh et al. (2016) study.

However, the interrelation of the three perspectives has been rarely studied and understood in the literature. The majority of such research indicated that as all three perspectives of sustainability (i.e., economic, social and environmental) can be achieved at the same time, it can be considered a win-win situation. In other words, it can be stated that an improvement in social and environmental performance ultimately results in an improvement in the overall economic performance of sustainability. However, another view in this regard states that due to the trade-off between economic, social and environmental perspectives, a negative influence might be observed, but the aforementioned win-win scenario is based on positive relationships in the long run.

There are two strands of research that support this win-win paradigm. The first strand of research states that the management skills possessed by an organization along with the environmental and social performance of the organization can affect its economic performance (Frooman, 1997; Schuler & Cording, 2006; Waddock & Graves, 1997). These good managerial skills lead to rewards from the stakeholders to the organization, such as an increase in investment by the investors, an increase in consumption by the consumers and an increase in productivity by the employees. Based on these rewards, the economic performance of the company is enhanced. The other strand of research supporting the win-win situation has its basis in stakeholder theory, which states that the costs related to negotiation and contracting are reduced due to the explicit and implicit mutual collaboration and trust among the stakeholders and this also results in the development of control mechanisms through which the opportunistic behavior of the managers of the organization is reduced and the managers adopt a long-term orientation (Choi & Wang, 2009; Eccles et al., 2014; Jones, 1995). Therefore, stakeholder theory suggests that the enhanced environmental and social performance of an organization should reduce the costs regarding the management of the relationships among the stakeholders; thus, economic performance is enhanced as compared to organizations with less environmental and social performance and badly managed relationships among stakeholders (Jones, 1995). In addition to this, by addressing the claims of the stakeholders, the efficiency

of the organization's capability to adapt to external demands can be increased by the managers, which ultimately increases economic performance.

On the other hand, there are two strands of research that have demonstrated negative relationships between environmental and social performance and the economic performance of sustainability. One strand of this research believes that when the managers of an organization focus on environmental and social activities, there is a possibility that they will overlook the opportunity costs associated with these activities, which may lead to the economically profitable activities of the organization also being overlooked (Schuler & Cording, 2006); this failure to note opportunity costs and economically profitable activities while conducting social and environmental activities ultimately leads to decreased economic performance. The other strand of research supporting a negative relationship has its basis in agency cost theory; it suggests that the managers of an organization perform certain social and environmental activities to support their interests by taking advantage of the inability of the owners of that organization to have checks and balances on the managers (Schuler & Cording, 2006). This indicates that when the managers of an organization use their resources in different environmental and social activities, they are unable to use these resources to increase their productivity; therefore, in the long run, economic performance is affected negatively.

A third perspective on the interrelation of the three sustainability performance perspectives is based on affordability theory. According to this perspective, only those firms that can afford to invest in certain social and environmental activities will have good or sufficient economic performance. In other words, it can be stated that better economic performance leads to activities that have a social and environmental aspects. For example, it has been argued that the management of the economic, legal and ethical domains of an organization provides enough resources for the organization for it to pursue philanthropic activities (Carroll, 1979). There are examples of companies, such as Coca-Cola, Philip Morris, Anheuser-Busch, Eli Lilly and Target, that have assigned a specific portion of their income to philanthropic activities (Schuler & Cording, 2006). The literature has indicated that SEP has been directly associated with economic, environmental and social perspectives, but research on the association of these perspectives with big data-related capabilities is scarce; the current study investigates the effects of BDM capabilities on the SEP of an organization.

2.5. Exploitative and Exploratory Innovation

2.5.1. Concept and Definitions

Innovation has been broadly classified into two categories: innovation of technology and innovation of the market (Abernathy & Clark, 1985; Jansen et al., 2006). In innovation of technology, explorative or radical innovation leads to changes in the overall technological path, whereas exploitative or incremental innovation leads to little changes in the technology-related capabilities of an organization (Benner & Tushman, 2003). In innovation of the market, exploratory or radical innovation leads to the exploration of new and emerging customers and markets, whereas exploitative or incremental innovation leads to a focus on existing customers and markets (Benner & Tushman, 2003; Jansen et al., 2009). The literature considers that exploration and exploitation distinguish innovation strategies (Enkel & Heil, 2014). Explorative innovation involves breaking with the current dominant research logic; firms that carry out exploratory innovation see far beyond domestic current research so that the limitations or gaps related to internal search can be bridged (Enkel & Gassmann, 2010). Several terms can be used to capture elements of exploration, such as variation, search, experimentation, risk-taking and discovery. More importantly, in exploratory innovation, new and modern knowledge is required so that a shift can be made from current knowledge to new knowledge (Barirani et al., 2015; Datta & Jessup, 2013). In a nutshell, exploratory innovation refers to new and innovative products and services, and improved technology; the use of exploratory innovation can make current products, services and technology non-competitive (Hernandez-Espallardo et al., 2011).

On the other hand, exploitative innovation involves routine learning (Nooteboom et al., 2007). Organizations that pursue exploitative innovation search for opportunities in their primary landscape and they rely on their primary search activities (Barirani et al., 2015). The elements associated with exploitative innovation include choice, efficiency, refinement, production, execution and implementation. Exploitative innovation involves the knowledge and skills, structures and processes that currently exist in an organization. In other words, this type of innovation involves the improvement and innovation of existing products and services (Jansen et al., 2006). The balancing of these two sorts of innovation by an organization is referred to as ambidexterity; various researchers have focused on the concept of ambidexterity in the past

(Chen & Kannan-Narasimhan, 2015; Enkel & Heil, 2014; Wei et al., 2014). Ambidextrous organizations are able to create synchronization between exploration and exploitation and are thus involved in the pursuit of both types of innovation at the same time. The benefit to organizations of ambidexterity is that it assists organizations to overcome all the challenges that might result from exploitative innovation and getting full benefits from exploratory innovation (Jansen et al., 2008).

2.5.2. Organizational Ambidexterity

In line with the previous discussion, strategic ambidexterity has been classified into two dimensions that are complementary as well as orthogonal and these two dimensions have been named exploratory and exploitative behaviors. Both exploration and exploitation have been defined by March (1991) through various terms as discussed earlier. Based on these terms, it has been stated that successful organizations are those that pursue discontinuous and incremental innovation and change at the same time. In the same way, successful organizations are known to follow change and preservation, alignment and adaptability, and exploratory and exploitative innovation at the same time (Gibson & Birkinshaw, 2004; Jansen et al., 2006).

In exploitative innovation, the focus of organizations is on the existing environmental conditions and the adaptation of current technologies and various processes, products and services. This type of innovation is designed by organizations to fulfil the needs and requirements of their existing customers and markets instead of moving to new markets and customers. In this type of innovation, existing designs are made better, and existing products and services are improved and expanded. To pursue this type of innovation, an organization needs to internalize and compile explicit knowledge bases (Chen & Kannan-Narasimhan, 2015; March, 1991).

On the other hand, the focus of organizations pursuing exploratory innovation is on responding to the changing needs and demands of the markets and customers through developing innovative products and services and by entering new markets to fulfil the needs of their customers. In this type of innovation, new and creative designs are developed, and new and innovative products and services are added to the offerings of an organization. To pursue this type of innovation, organizations need to externalize and compile tacit knowledge bases.

Organizations involved in adequate exploitative innovation activities to serve their current markets and at the same time are involved in exploratory innovation activities to serve new markets and customers are considered successful in the long run. Organizations mostly involved in exploitative innovation activities to refine their current business model without focusing on moving to new market opportunities might gain short-term benefits, such as decreased costs of production. However, changes in the organization or organizational inertia might increase due to a focus on incremental innovation. The drawback of this scenario is that when shifts take place in the business environment and markets, these organizations are unable to survive (Tushman & Smith, 2004). On the other hand, businesses or organizations only involved in exploratory innovation activities might face losses related to sustained paybacks. In addition, their experimentations costs might also increase without providing many benefits. In a nutshell, focusing on only one of the two types of innovation or one of the two sides of ambidexterity can result in the suffocation of the organization due to conservatism or downing of the organization due to the introduction of extensive changes (Kollmann et al., 2007). Therefore, it has been argued by researchers that organizations must focus on the two types of ambidexterity simultaneously to expand and be successful in the long term.

Simultaneous carrying out the two types of innovative activities (i.e., exploratory and exploitative) has been referred to as ambidexterity. If the employee level or individual level is considered, exploratory activities refer to the development and implementation of innovative ideas to get a competitive advantage, whereas exploitative activities refer to the utilization of existing knowledge to increase efficiency and efficacy in an incremental way (Gibson & Birkinshaw, 2004). Most of the research studies that are based on ambidexterity have taken the context of organizational ambidexterity (Junni et al., 2013). Two different conceptualizations of ambidexterity have been classified in the literature: contextual and structural (Caniëls & Veld, 2019). Structural solutions refer to the establishment of a dual structure in the organization through which the two activities (i.e., exploitative and explorative) can be carried out at the same time in the organization in different strategic business units (Adler et al., 2013). Researchers have suggested that it is quite a challenge for organizations to carry out the two activities at the same time. The reason behind this difficulty is the opposite goals of the two activities, which require the same resources but different sets of skills and capabilities in the organization (Caniëls et al., 2017). Contextual ambidexterity refers to the idea that an

organization must be set up in such a way that the employees can perform the two types of activities (i.e. exploitative and explorative) at the same time (Caniëls & Veld, 2019). The contextual aspect involves more utilization of behavioral and social factors in the integration of exploratory and exploitative activities. In this approach, systems, beliefs and processes are used through which individual-level behaviors can be identified in the organization. This is one reason for the focus on the employee level in investigations of the performance of exploratory and exploitative activities (Prieto & Pilar Pérez Santana, 2012). In other words, the contextual aspect of ambidexterity refers to the idea that the more ambidextrous the organization is, the better the performance of exploitative and exploratory activities at the individual or employee level (Cao et al., 2009). Research studies regarding exploitative and exploratory innovation in the context of an overall organization are scarce, which makes it necessary to conduct research into exploitative and exploratory activities at an organizational level.

2.5.3. Entrepreneurial Perspective

Entrepreneurs are considered to be the decision-makers and strategy developers who are involved in the recognition of opportunities; after recognizing opportunities they also function to collect the resources required to pursue those opportunities. As strategists, they also develop innovation strategies following the resources needed to pursue the recognized opportunities. Finally, they are also able to establish an organization that can implement and execute the designed innovative strategies (Hitt et al., 2011). This view of strategic entrepreneurship indicates that entrepreneurs must be able to manage resources strategically and influence others in this regard as well. The purpose of this resource management is bi-fold: to seek advantages and benefits and to seek further opportunities (Harms et al., 2012). The seeking of advantages is mostly a strategic activity and it requires adapting to environments that are uncertain and risky (Wang et al., 2012). This is achieved by finding new market opportunities and introducing products, services and processes according to the recognized opportunities (Wang et al., 2012). In this regard, the aspect of exploitative innovation revolves around the usage of existing knowledge to enhance the skills, structures and processes that currently exist (Jansen et al., 2006). Exploitative innovation can be associated with the advantage-seeking behavior of entrepreneurs. On the other hand, exploratory innovation involves the usage of new and innovative knowledge to introduce new processes, products, structures and services.

Exploratory innovation can be associated with the opportunity-seeking behavior of entrepreneurs through which organizations break new ground and gain competitive and first-mover advantage (Darling et al., 2007; Rauch et al., 2009; Wang et al., 2012). This indicates that entrepreneurs have an impact on the development of both types of innovation (i.e. exploitative and exploratory); it has been argued that both types of innovation are critical for the growth and development of organizations (Ireland & Webb, 2007).

Both types of innovation are very much associated with the performance of organizations, both existing and new ventures. In other words, the performance of a business is dependent on the strategy selected by the entrepreneurs and managers that are based on either of the two types of innovation. As discussed earlier, exploratory innovation involves the development of new and innovative products and services for new markets and customers by identifying gaps and opportunities in the market through the usage of new knowledge; in this way, competitive advantage is gained by organizations, especially new ventures, thus increasing their sale returns and market share (Benner & Tushman, 2003; West & Noel, 2009). However, it is generally a major risk for new ventures that do not have enough products or services and the resources to develop them, which makes exploratory innovation harmful and unprofitable if it is not accompanied by exploitative innovation. In these circumstances, it becomes difficult for firms to maintain their competitive advantage and obtain value (Auh & Menguc, 2005). Therefore, it is necessary to also increase existing knowledge and improve and expand existing products and services so that mature existing markets can be exploited. This is because the returns resulting from exploitative innovation are predictable and usually positive (Zhou & Wu, 2010).

2.6. Theoretical Framework

2.6.1. Dynamic Capabilities View

Today's business environment is dynamic, and to cope with such dynamism, it has become necessary for organizations to possess dynamic capabilities that enable them to explore and exploit changes occurring in the environment (Zheng et al., 2011). Dynamic capabilities are those that enable an organization to develop, integrate and reconfigure its various competencies so that changes in the business environment can be addressed (Teece et al., 1997). DCV is considered to be an extension of RBV which revolves around the idea that an organization must

utilize its strategic resources to gain a competitive advantage in the market (Barney et al., 2011; Zheng et al., 2011). There is another similar view in this regard which is named the knowledge-based view (KBV), which revolves around the idea that knowledge is an important and major asset possessed by an organization whether the knowledge is at an individual level or an organizational level. KBV also indicates that the major objective of an organization is to create value through its knowledge base (Grant, 1996). RBV has seen criticism because it cannot be applied effectively in a rapidly changing business environment and in such a scenario an organization requires dynamic capabilities to cope with the changing business environment (Gutierrez-Gutierrez et al., 2018; Teece et al., 1997).

The DCV shifted the focus of researchers, especially those in the field of strategic management, from RBV to DCV, which involves the ability to adapt to the changing environment and to acquire the capabilities required for that purpose. These dynamic capabilities form a stable and learned pattern of certain activities that shift the processes and activities of an organization intending to improve effectiveness. This pattern also modifies the learning mechanisms of the organization, such as knowledge-related activities, which are the basis of dynamic capabilities (Zollo & Winter, 2002). If the KBV is connected with DCV, it gives rise to knowledge-based DCV or KBDCV, which revolves around the concept of getting, developing or integrating the various resources of knowledge in an organization so that changes in the dynamic environment of the business world can be sensed, explored and addressed effectively (Zheng et al., 2011). In the current study, the association between BDM, SEO and exploitative and exploratory innovation activities and, finally, SEP can be explained based on KBDCV.

In the current economic situation, the creation of value and the entrepreneurial perspective of organizations has changed and the situation certainly requires some unique and innovative capabilities (Akter et al., 2016; Braganza et al., 2017). Big data has become an important aspect of the innovation-related and entrepreneurship-related activities of organizations in the current scenario of a dynamic and digital economy and business world (Janssen et al., 2017). Therefore, it has become extremely important for firms to possess dynamic capabilities for innovation and entrepreneurship purposes. Changes in decision making are an important aspect in this regard; these changes have resulted from the increased availability, affordability and vitality of the data acquired by organizations. Some researchers believe that only the firms or

organizations that possess big data and are data-driven organizations are successful in a dynamic business environment (McAfee et al., 2012). In this regard, the current study investigates the effect of the four dimensions of BDM capabilities (i.e., democratization, contextualization, experimentation and execution) on SEO, exploitative and exploratory innovation and, ultimately, SEP. The role of knowledge-based activities is quite important in this regard.

Knowledge-related activities in the context of democratization refer to the management of big data; knowledge-related activities in the context of contextualization refer to the gaining of useful insights from the big data. Both these aspects of BDM lead to the creation of knowledge in the organization. In the same way, experimentation performed on the execution of big data also provides insights and can also develop the information and data patterns that ultimately lead to the creation of knowledge in the organization (Uriarte, 2008). However, this overall process of management of big data developed by customers worldwide to understand it and extract information from it requires dynamic capabilities and, to be very precise, BDM capabilities.

The value of the big data possessed by an organization increases the more the organization uses it. Big data is considered to be self-regenerative and a unique asset that is quite different from the traditional physical assets and it is also considered to be a limited and non-renewable resource possessed by an organization. In addition to big data, ambidexterity or the carrying out exploitative and exploratory activities at the same time by the firm is also considered to be a dynamic capability of a firm (Vahlne & Jonsson, 2017). It has been argued in the literature that resources alone are not enough for an organization to create value and get involved in innovation activities, instead the proper management of these resources is also required (Sirmon et al., 2007). If an organization is capable to deal with the technical side of big data, it might not be sufficient. If an organization wants to make certain decisions based on the information obtained from big data, mere big data is not enough because the management of big data is also required. BDM capabilities, such as democratization, contextualization, experimentation and execution of big data, have been studied on an individual level in the past but the association of these capabilities with entrepreneurship at an organizational level needs more attention.

2.6.2. Dimensions of Dynamic Capabilities

In the management literature, there has been a great focus on the operationalization of dynamic capabilities. According to Teece (2014), the conceptualization of dynamic capabilities has three dimensions. The first one is a ‘sensing’ capability, which refers to the ability of an organization to recognize, generate and assess technological opportunities to meet customers’ wants and needs and pursue business opportunities. The second dimension recognized is a ‘seizing’ capability, which refers to the ability of an organization to activate the resources that are required to fulfil the identified needs of customers, pursue identified business opportunities and obtain value. The third dimension recognized is a ‘reconfiguring’ or ‘transforming’ capability, which refers to the recombination of various resources and capabilities intending to innovate and respond to the dynamic changes in the business environment or the market (Fainshmidt et al., 2016; Teece, 2014). Similarly, three dimensions of dynamic capabilities were pointed out by another researcher and these are learning, sensing and reconfiguring (Wilhelm et al., 2015). Of these capabilities, the ‘learning’ capability differs from the dimensions introduced by Teece (2014). The ‘learning’ capability refers to the ability of a firm to generate the tools and methods to face changes in the environment and to recognize business opportunities efficiently. The learning capability, in this case, is quite similar to the seizing capability discussed earlier.

All these dynamic capabilities enable organizations to recognize the needs and demands of customers and to recognize business opportunities. In addition, they also allow organizations to grow and develop by enabling them to respond to the dynamic business environment (Mikalef & Pateli, 2017). In the process of developing dynamic capabilities, there is an adjustment of an organization’s processes for the reduction of its costs; profitable innovations; availability of new decision choices; the generation of new knowledge, products and processes; and, finally, the proper allocation of all the internal and external resources of an organization following the selected strategy (Pezeshkan et al., 2016; Teece, 2012; Wilden et al., 2013). Based on this discussion, it can be stated that the KBDCV can be used effectively in the current study to explain the relationships between different constructs of the study.

2.6.3. Entrepreneurship Theory

Entrepreneurship theory consists of various paradigms. Verstraete and Fayolle (2005) identified four paradigms in this regard: innovation, opportunity recognition, business creation and value creation. Researchers' studies on entrepreneurship theory share a common description of entrepreneurship: 'newness'. Innovation means the destructive discovery of some new process, product, service or resources required (Schumpeter, 2013). Other terms used by researchers to describe innovation include extension, invention, synthesis and duplication (Kuratko & Hodgetts, 2001). The next paradigm is opportunity recognition and development. This paradigm refers to the recognition and exploitation of an opportunity which might provide more profit as compared to the competitors' profit. It has been argued that entrepreneurs are in a continual state of alertness or are receptive to all the available opportunities (Kirzner, 1997). An opportunity can be defined as a future situation that is not only attractive but also feasible to perform and provides profit. Here, the difference between entrepreneurs concerning innovation and opportunity recognition can be observed. This difference is based on the fact that entrepreneurs in the context of innovation are bolder and more visionary and have a long-term orientation. On the other hand, entrepreneurs in the context of opportunity recognition are more alert to the changes around them and thus recognize opportunities and might have a short-term orientation (Kirzner, 2009).

The difference between an entrepreneur and a manager has been explained by Shapero (1984). Shapero (1984) stated that entrepreneurs have to share the risks of failure and success and are also responsible for handling and managing the firm or company independently. This concept of entrepreneurship is quite broad as compared to the paradigm of business creation, according to which entrepreneurship theory stands firm only in the case of for-profit organizations. This does not include social and environmental entrepreneurs and entrepreneurs in other fields of life (Filion, 2001). The last or fourth paradigm is value creation and according to this paradigm, entrepreneurs are the source of profit and wealth for an organization as well as for society. Therefore, organizations that are involved in sustainable development can be considered to be involved in an entrepreneurial act. All the aforementioned paradigms of entrepreneurship are found in the entrepreneurs who have a clear image of their objectives, extraordinary tolerance for ambiguity, high achievement needs and self-efficacy (Shane & Venkataraman, 2000).

However, it has also been argued that the individuals involved in entrepreneurial activities are not enough to explain the concept of entrepreneurship. The activities related to entrepreneurship are very much associated with social relationships as well. Social networks are considered unique competencies for an organization while working for sustainable development. This is due to the reason that social networks are a source of other organizations' experience, field experts and different government institutions from which a motivating push is also obtained along with practical advice and, in this way, costs are reduced due to the sharing of technology (Friedman & Miles, 2002). In the current research, a major focus has been set on the SEO and SEP aspects of entrepreneurship and sustainability and thus entrepreneurship theory can be used to explain associations among various constructs of the research.

2.7.Relational Literature Review

2.7.1. Big Data Management and Sustainable Entrepreneurial Orientation

Due to the dynamic condition of the market, researchers have focused on big data in recent years and some researchers have found that big data influence the SEO of organizations. It has been argued that the current market environment and business conditions are dynamic and, in this situation, the role of big data is quite important for organizations to gain a competitive advantage by understanding customer behavior and intentions (Duan et al., 2019). It has also been discussed that the performance of style, decision and action during the process of the business strategy of an organization can be summarized for entrepreneurial orientation. The entrepreneurial behaviour of an organization is clearly shown in its philosophy and its way of doing business also reflects the entrepreneurial orientation of that organization (George & Marino, 2011). As per past research, the entrepreneurial resources of an organization are considered to be its major or key resources to cope with the changing and dynamic business environment. In the same way, dynamic capabilities that are specifically associated with BDA are necessary for organizations to gain a competitive advantage over their rivals (Demirkan & Delen, 2013).

Activities such as innovation, exploration of new opportunities and usage of resources in an efficient way are in the domain of entrepreneurial orientation; therefore, it can be derived that big data-related analytical capabilities are necessary for organizations to achieve

entrepreneurial orientation through various activities, such as the production of new and innovative products and services, improvement in existing products and services, reduction in market risks and reduction in the costs of the company (Wiklund & Shepherd, 2011). This argument can be explained in this way: innovation is an extremely risky as well as costly process, it can be made less risky and less costly by taking advantage of big data analytical capabilities, such as infrastructure flexibility, management capabilities and personnel expertise (Arunachalam et al., 2018).

It is a well-known concept in the literature that the entrepreneurial orientation of organizations has three characteristics through which they can bring innovations, new and unique technologies and new customer trends; these characteristics are innovativeness, risk taking and proactiveness (Miller, 1983). Big data and its related analytical capabilities, especially BDM capabilities, can be leveraged to achieve the aforementioned three characteristics of organizations. An important gap that has been found in the literature in the context of the effect of BDM on the SEO of organizations -is the insufficient acknowledgement of the role of sustainability, because the main focus has been on entrepreneurial orientation. In the current research, this gap is being bridged by taking the factor sustainability in the form of SEO.

BDA has been found to improve the information processing capabilities of organizations and it also assists them in the interpretation and combination of complex information that has been obtained from different sources (Srinivasan & Swink, 2018). This processed information is used by entrepreneurs and managers of organizations to reduce ambiguities regarding the demand and supply and capacities of organizations (Dubey, Gunasekaran, Childe, Blome, et al., 2019). In the absence of such big data-related capabilities, it becomes difficult for organizations to achieve an entrepreneurial orientation as they have to invest heavily in the maintenance of high inventory and in developing a responsive supply chain. By contrast, if organizations possess BDM capabilities, then it provides them with opportunities to reconfigure their available resources so that they can cope with the dynamic nature of the business environment (Duan et al., 2019).

In the literature, it has been clearly and repeatedly argued that big-data-driven decision support systems increase access to, and the sharing of, knowledge; they also enhance the analytical skills of organizations, which leads to an improved entrepreneurial orientation of organizations

(Watson IV et al., 2018). Moreover, when updated data and information regarding the behaviours and needs of customers, and the actions and strategies of competitors, is collected in real-time, it provides organizations with the capability to cope with the dynamic business environment and to capture innovative opportunities found in the market (Corte-Real et al., 2017).

Especially in the case of big companies or multinational corporations, the availability of real-time big data and information about competitors and customers improves entrepreneurial orientation. It has been made quite clear that through IT-related capabilities, such as BDM, the risk-taking, proactiveness and innovativeness of organizations are increased, ultimately resulting in the gaining of competitive advantage. There are several other orientations of an organization, such as learning orientation and marketing orientation, on which big data can exert influence, but the most important orientation is entrepreneurial orientation because of its capturing of opportunities and gaining of competitive advantage (Gnizy, 2019; Zhang et al., 2016). Companies that have capabilities related to big data are more capable of collecting and analyzing data effectively taken from the external environment, whether it is about customers or competitors, and this data assists organizations to sense and shaping business and market opportunities (Garmaki et al., 2016). All the aforementioned research studies indicated the effect of BDA, especially the management of big data, on the entrepreneurial orientation of any organization.

2.7.2. Big Data Management and Exploitative Innovation

Organizational BDAC comprises a collection of various capabilities that provide the ability to mobilize and deploy BDA-related resources along with other resources and capabilities (Wamba et al., 2017). Three capabilities related to big data have been highlighted by authors: BDA infrastructure flexibility, BDA management capabilities and finally BDA personnel expertise. The first capability, infrastructure flexibility associated with BDA, includes the information systems through which the big data can be collected, analyzed, and stored and the flexibility of this infrastructure means that it can adapt itself following different needs and types of data. The benefit of this capability is that it becomes easier to process data in different formats and different situations (Rialti et al., 2018). BDA management capabilities involve the selection of the right infrastructure following the data to be processed and the accurate

identification of the information that needs to be derived from the big data. This capability also enables managers to find the best solution in a particular scenario for the organization and enables them to make the best decisions based on BDA skills (Ferraris et al., 2019). Finally, BDA personnel expertise involves the employees of an organization having skills that reduce the chances of the organization rejecting usage of BDA and implementing of required information systems for BDA. These employees must also have skills in the selection of the right datasets and identification of the right information to be extracted (Wamba et al., 2017). In the literature, researchers have focused on all these capabilities and have found that they provide a competitive advantage to organizations, but in the current study, the focus is only on BDA management capabilities and its four dimensions: big data democratization, big data contextualization, big data experimentation and big data execution (McAfee et al., 2012; Shamim et al., 2021).

It is an important point that for organizations to get benefits from big data and its related analytical capabilities, they need to make some investments and these investments are usually huge; this is the reason why SMEs find it difficult to use BDAC as they lack the required investments for acquiring the required infrastructure or hiring employees with the required skills (Raguseo & Vitari, 2018). Several researchers have argued that large organizations using BDAC can bring certain innovations to their existing products and services using technologies such as the internet of things, and through BDAC they can make their procedures more effective and efficient thus providing customers with a satisfactory experience. BDAC not only assists organizations in identifying opportunities but also helps them configure their resources and capabilities to exploit those opportunities (Braganza et al., 2017; Hofacker et al., 2016; Johnson et al., 2017). It has been argued in the literature that the performance of organizations is improved due to BDAC because of the factor of ambidexterity (i.e., carrying out both exploratory and exploitative innovation at the same time in an organization).

BDAC enables organizations to shuffle their resources and routines and recognize changes that keep on taking place in the business environments and marketplaces to find opportunities among them. BDAC helps organizations cope with such changes in the business environment and effectively exploit the opportunities, based on these capabilities, organizations bring certain innovations to their practices and products or services (Rialti et al., 2018). To be more

specific, existing products and services are improved based on information and insights obtained through BDAC; this is called exploitative innovation. Not only existing products and services can be innovated but the existing markets of an organization can also be innovated. An important concept called organizational agility has also been related to BDAC. Organizational agility refers to the idea that an agile business can renovate itself, it can respond rapidly whenever necessary and it can adapt its products and services (Teece et al., 2016). This can be related to the concept of exploitative innovation as businesses react to changing business environments by introducing innovations to existing products, services and processes. The role of BDAC has also been discussed in this context because BDAC, especially the management capabilities, provide organizations with information and insights that managers and other related personnel can use to make good, fast and effective decisions regarding the adaptation of products, services and processes (Rialti et al., 2019; Wamba et al., 2017).

An important gap that has been found in the literature in the current context is that researchers have not sufficiently explored the influence cast by BDAC on exploitative innovation activities, especially the various dimensions of BDA management capabilities (i.e., democratization, contextualization, experimentation and execution). In the current research, this gap has been bridged by the researcher by taking all the aforementioned dimensions concerning exploratory and exploitative innovation separately. This review of the literature has made it crystal clear that through BDAC, especially BDA management capabilities, organizations can bring certain innovations to their existing products, services and practices.

2.7.3. Big Data Management and Exploratory Innovation

On the one hand, dynamic capabilities are found to provide a competitive advantage to organizations and, on the other hand, it has also been argued that these capabilities are also involved in enhancing and strengthening the innovation-related capabilities of these organizations (Drnevich & Kriauciunas, 2011; Ghasemaghaei & Calic, 2019). Dynamic capabilities are not only sufficient but are also necessary capabilities for organizations to gain a competitive advantage. It can be stated based on this argument that it is not the dynamic capabilities that provide a competitive advantage to firms, but the resource configurations based on dynamic capabilities. Therefore, big data-related capabilities and innovation activities are the strategic options of firms through which their current capabilities can be renewed, and

new and innovative capabilities can also be developed based on need or demand (Pavlou & El Sawy, 2006).

In the context of BDA, the information and insights that are obtained from the careful analysis of big data enable organizations to identify gaps and limitations in the market and, based on these gaps, they can take appropriate strategic actions that are innovative (Erevelles et al., 2016). The innovative practices of organizations can be improved through BDA due to the betterment of their dynamic capabilities; this is because when organizations improve their big data-related capabilities, such as BDM, they can derive various results and information from their detailed analysis of a huge volume of data.

The analysis and detailed interpretation of huge data are possible only when firms possess big data-related capabilities (Sagiroglu & Sinanc, 2013). Various sorts of information are obtained through the analysis of big data, such as identification of customer or non-customer needs, identification of inefficiencies in organizational operations, identification of the strategic steps and actions taken by rivals, the development of strategic actions and modelling for future opportunities for the organization (Chen et al., 2012). The identification of customer and non-customer needs includes customer behaviors, attitudes and interactions; trends and patterns exhibited by customers toward products and services; the attachment or affection of the customers toward the firm or its products and services; and accurate identification of the self and needs of the customers and the creation and production of products and services in accordance with those needs (Jang et al., 2013; Kwon et al., 2014; Mikalef et al., 2019b).

All these aspects enable firms to carry out innovation activities through which competitive advantage is gained. In the same way, in terms of operational insights, information can be obtained from BDA, such as identification of bottlenecks in supply chains, accurate equipment maintenance frequency prediction and accurate forecast of sales and demands so that inventory management and production-related planning can be improved (Lim et al., 2014; Wang et al., 2016).

Furthermore, it has been argued that through BDAC, such as BDM, human-based decision making can be supported and an organization's response action can be automated. Various firms are currently relying on big data to orchestrate real-time processes for activities related

to their supply chain and logistics (Schoenherr & Speier-Pero, 2015). In the same way, there are various organizations considering smart manufacturing, following the paradigm of Industry 4.0, using cyber-physical systems that result in faster and more efficient processes and operations and high-quality products.

Similarly, in the case of customer management and service activities, the market approaches of organizations can be personalized and priority can be given to the more profitable segments, and customized products and services can be provided as well, due to firms' proper management and analysis of big data (Akter & Wamba, 2016). Therefore, it can be argued that in addition to the recognition and identification of opportunities and threats, big data-related capabilities can also assist firms or organizations to be responsive to opportunities and threats and change their actions and way of doing things in accordance with them to get a competitive advantage.

Exploratory or radical innovation involves the development of products and the provision of services that are innovative and novel. An example of an innovative product is customized medicine in which genomics is integrated with the electronic health record of a patient for better and more effective treatment (Alyass et al., 2015).

In the same way, innovative service might be exemplified through adaptive learning systems that are developed through big data regarding the interaction of learners and their environment (Maselena et al., 2018). There have also been several case studies in which the effect of BDA, such as BDM, on innovation activities has been explored. For instance, Intel, a company that manufactures semiconductor chips, applied BDA to improve the efficiency of their production process by reducing the number of tests required for their products. Similarly, Delta Airlines utilized BDA to improve its strategic actions (Ransbotham & Kiron, 2017).

These instances make it quite clear that BDA and, more importantly, BDM can improve the innovative practices of organizations leading to the gaining of competitive advantage. In the literature, researchers have mostly considered exploratory and exploitative innovation practices collectively, whereas in the current study they are studied separately.

2.7.4. Mediating Role of Sustainable Entrepreneurial Orientation, Big Data Management and Exploitative Innovation

Manufacturing, as well as service companies, leverage innovative technologies, such as BDA, to renew their business models and innovate (Arias-Pérez et al., 2021; Porter & Heppelmann, 2015). The introduced innovation includes the development of innovative products and services, segmenting the markets in a better way, improving pricing strategies, developing new and improved distribution channels, and improving revenue models and cost structures (Paiola & Gebauer, 2020). Following the DCV, it can be stated that if organizations do not possess dynamic capabilities, they will not be able to get maximum benefits from BDA to exploit the opportunities of renovating their business models and getting a competitive advantage within the dynamic nature of the business environment. A business structure or model can be considered successful only when it can adapt itself over time (Gambardella & McGahan, 2010). Therefore, certain capabilities, such as infrastructural capabilities, managerial capabilities, and technical and organizational capabilities, are required to effectively exploit BDA to innovate the business model. More specifically, the capabilities associated with BDA have the potential to provide valuable and beneficial information to organizations obtained from the huge volumes of updated data regarding markets, competitors and, more importantly, customers (Ghasemaghaei & Calic, 2019).

It has been argued in the literature that decision support systems created based on big data increase access to, and the sharing of, knowledge in an organization and support the analytical skills of the organization, thus enhancing its entrepreneurial orientation. If organizations can effectively collect updated and real-time data about customers, markets and competitors, they can gain insights into the present and future changes in the business environment and thus can take steps under these changes (Côte-Real et al., 2017). Although both radical and incremental innovations are closely associated with entrepreneurial innovation, radical innovation requires a much higher level of entrepreneurial orientation (Schneider & Spieth, 2013).

The mentality or orientation of a business toward entrepreneurship plays an important role in bringing innovation to different contexts in the organization because through enhanced entrepreneurial orientation the collaborative network of the organization, which includes different stakeholders, resources, capabilities and knowledge, is improved thus giving rise to

innovative practices (Genc et al., 2019). In addition to innovation in products and services, it has been argued in the literature that organizations with an entrepreneurial orientation also innovate their business models, so that they can deal with a shortage of resources and continuous changes in the business environment; the role of BDAC is significant in the innovation of business models (Amit & Zott, 2012). There are several studies in the literature that have found that BDAC enhances the entrepreneurial orientation of organizations, which leads to innovative practices. Entrepreneurial-oriented organizations utilize big data to support the three major dimensions of entrepreneurship (i.e. proactiveness, risk-taking and innovativeness) not only in existing products, services and practices but also in new ones, resulting in an ambidextrous nature (Chehbi-Gamoura et al., 2020; Ghasemaghaei & Calic, 2019; Kollmann & Stockmann, 2010; Merendino et al., 2018; Shamim et al., 2021).

Based on the DCV, both entrepreneurial orientation and BDA can be considered dynamic capabilities of an organization leading to value creation and proposition and thus having an impact on innovation (Bouncken et al., 2016). This shows the mediating impact of entrepreneurial orientation on the relation between BDAC and innovation. Entrepreneurial orientation is not the only orientation which has been associated with BDAC in the literature. There are other orientations such as learning orientation and market orientation that also have an impact on BDAC (Gnizy, 2019). However, entrepreneurial orientation is considered to be an ideal mediator in this regard as it involves the aspect of innovation more than other orientations and it also enables organizations to identify and exploit opportunities and gain a competitive advantage over their rivals (Zhang et al., 2016). This is based on the reasoning that the information and insights about markets, competitors and customers obtained from the analysis of big data possessed by organizations provide them with opportunities to exploit, thus, linking with the aspect of entrepreneurial orientation. This information and the insights are used by organizations to innovate their existing or new products, services, practices and overall business models but with a high level of risk (Marzi et al., 2020; Usai et al., 2018).

The premise that entrepreneurial orientation has a mediating role between BDA and innovation can be supported by the behavioral components of entrepreneurial orientation. In this regard, the first assumption is that companies or organizations that can have effective BDA are naturally led toward innovation and creativity and toward the implementation of data-driven

strategies in their organizations (Lumpkin & Dess, 1996; Wang & Hajli, 2017). The second assumption in this regard is that the organizations that possess effective BDAC have higher receptiveness to market opportunities that are related not only to new customers but also to old customers; this enables the organizations not only to identify changes in the business environment but also to cause changes in the business environment by bringing innovations to their products, services, practices and overall business models. The current review of the literature shows that although BDAC aspects have been well covered in the literature, the mediating impact of entrepreneurial orientation has not been investigated with a specific focus on BDM and its different dimensions. In addition, the aspect of sustainability with entrepreneurial orientation has not been sufficiently studied in the literature.

2.7.5. Mediating Role of Sustainable Entrepreneurial Orientation, Big Data Management and Exploratory Innovation

It is one of the major characteristics of entrepreneurial-oriented organizations that they are biased toward innovativeness and risk-taking and are proactive in their products-related and market-based strategies (Renko et al., 2009). Such organizations are involved in continuous experimentation and technological leadership, and have a creative and innovative mindset; in other words, they are far away from traditional and conventional ways of doing business (Li et al., 2010). The forward-thinking and mindset of these organizations indicate that they believe that it is better to lead the market instead of getting led by the market. Such a mindset encourages these organizations to venture into unknown situations by carrying out ambiguous and uncertain activities. Some of the major practices of entrepreneurial-oriented organizations include heavy investment in R&D, usage of new and novel technologies, innovative managerial and strategic practices, and development of new technological solutions; thus, gaining competitive advantage (Ahuja & Morris Lampert, 2001; Arias-Pérez et al., 2021; Mikalef et al., 2019b). All these activities and strategies of these firms can be supported by BDAC, especially through BDM.

The entrepreneurial orientation of an organization is reflected in its decisions, style and actions and the different practices and processes of its business strategy. In the literature, the discussion on entrepreneurial orientation has evolved from a single dimension to multi-dimensional. A very famous argument and discussion regarding this concept revolve around the three

dimensions of entrepreneurial orientation, which are innovativeness, risk-taking and proactiveness (Dubey et al., 2020; Miller, 1987). Innovativeness refers to the adoption and support of new, innovative and creative processes through which new products and services, new technologies and new markets can be obtained. Innovativeness encourages organizations to increase their level of investments with the motive to carry out certain technological innovations, such as the acquisition of new technology and development of new products and services, to enhance the innovation ability of the firm (Lumpkin & Dess, 1996). Innovativeness also involves the promotion of enterprise reforms and innovations through which the transformation of new knowledge can be accelerated leading to the creation of new knowledge as well as technology to enhance the innovation performance of the organization (Cenamor et al., 2019; Ciampi et al., 2021; Menon & Varadarajan, 1992; Wiklund, 1999). The role of BDAC is important in the process of innovation as it can provide the knowledge and information required by firms to innovate either existing processes and products or new ones. The information obtained from BDAC, such as customer behavior and intentions and needs, assists organizations to innovate. Another dimension of entrepreneurial innovation is proactiveness. Proactiveness refers to organizations carrying out actions and strategies through which innovation is brought to products, services and practices by foreseeing the market situation and opportunities, which can lead to a major competitive advantage (Jia et al., 2013). Proactiveness is assisted by BDAC because BDAC provides information and insights regarding the market situation and opportunities before competitors get the information; thus, the organization innovates before its competitors do (Wiklund & Shepherd, 2005). The third dimension of an entrepreneurial organization as mentioned earlier is risk-taking in which organizations show a tendency to take actions that are bold so that higher rewards can be achieved (Miller, 1987). Risk-taking can be taken in two contexts: market and technology. In the case of the technological aspect, risk-taking involves the tendency of organizations to invest in technological innovation, products and services that have a high risk of failure and uncertainty. This aspect is very closely related to entrepreneurial risk and attitude to new technologies. As the ultimate product of risk-taking is also innovation, assistance can be acquired from BDAC in different perspectives, to know about the market condition and the opportunities that are available to pursue (Wiklund & Shepherd, 2003; Zeng & Khan, 2018). The market aspect of risk taking involves the risk of entering new markets; the role of BDAC in this aspect is also important. For example, BDAC can support the entrepreneurial orientation of organizations

which leads to innovation in products, services, processes and strategies. In other words, risk taking, proactiveness and innovativeness can be increased in this way.

The concept of absorptive capacity has also been connected with innovation and entrepreneurial orientation in the literature. Absorptive capacity refers to the ability of an organization to realize the importance of new information, assimilate that information and apply it to business strategies. In other words, absorptive capacity can be explained by three dimensions of knowledge: acquisition, assimilation and application (Cohen & Levinthal, 1990). This information can be obtained from different resources and an important source in the context of the current study is BDA. In knowledge acquisition, an organization obtains information and knowledge from BDA to apply them in their business activities and processes. BDA also plays an important role in knowledge assimilation because it involves the analysis and understanding of the information obtained from big data. Knowledge application refers to an organization's application of analyzed information from BDA to achieve certain goals of the organization (Hofacker et al., 2016; Johnson et al., 2017; McAfee et al., 2012). This discussion shows how BDAC, especially BDM, leads to exploratory innovation along with the mediating role of SEO between BDM and innovation. In the literature, an important gap has been recognized: sustainability factors have not been sufficiently considered by researchers and research has focused on simple entrepreneurial innovation. This gap has been bridged in the current study because the three dimensions of sustainability (i.e., economic, social and environmental) are considered while discussing the innovative practices of organizations.

2.7.6. Sustainable Entrepreneurial Orientation and Sustainable Entrepreneurial Performance

In the literature regarding sustainable entrepreneurship, it has been argued that the aspect of sustainability in entrepreneurship refers to practices through which opportunities associated with sustainable development and value creation for the community as well as the environment are identified and transformed; in this regard, the role of costs, uncertainty and risks is also important (Cohen & Winn, 2007). The tendency of some organizations to work for sustainable development can be referred to as SEO. This concept is not limited only to the starting of new businesses but it can also be found in existing businesses in the form of transformation and renewal of products and services (Gast et al., 2017). SEO involves the strategic actions of

organizations regarding the exploitation of opportunities for the creation of products, services and practices that can bring both economic and non-economic benefits and have implications for society and the economy as well (Jiang et al., 2018; Shepherd & Patzelt, 2011). SEO is considered a crucial aspect of any business, the business philosophy of that organization, and it shows the willingness and readiness of the organization to take actions that are innovative, risky and proactive for the core purpose of the improvement of the environment, and society and economy. In other words, the business opportunities, in this case, are related to society, profits and the overall planet (Hernández-Perlines & Ibarra Cisneros, 2018; Thananusak, 2019). Organizations that have SEO focus on the triple bottom line (i.e., society, environment, and economy) and consider that investment and opportunity will bring sustainability to their organization in the long run. Such organizations are involved in the development of organizational practices that do not produce waste or harmful emissions and use renewable energy.

In the literature, various researchers have explored the effect of SEO on a firm's performance, which can be referred to as SEP, with the sustainability of the firm as the major outcome. SEO can be considered multiple strategic orientations as it contains two orientations: entrepreneurial and sustainability; based on DCV and entrepreneurship theory, SEO has been associated with SEP of organizations (Criado-Gomis et al., 2018b; Criado-Gomis et al., 2020). SEO increases organizations' implementation of sustainable practices and it results in a decrease in the consumption of resources, ultimately leading to cost efficiency (Jiang et al., 2018). As discussed earlier, the concept of sustainability is associated with the triple bottom line, in which economic, social and environmental aspects are included; the effects of SEO in association with SEP for these three aspects are reviewed in this section.

Firstly, economic performance is directly associated with the factor of financial returns and profitability of firms, reducing the costs of operations through efficiency and effectiveness and, ultimately, getting better financial outcomes (Hussain et al., 2018). However, some researchers have also argued that even if the costs are reduced, some additional costs are linked with sustainability that might affect the financial outcomes of an organization, and through this argument, a negative association between SEO and economic SEP can be sensed (Shrivastava & Tamvada, 2019). By contrast, another argument is that when firms with SEO are innovative,

proactive and risk-taking, their production practices and methods become efficient and there is minimum wastage of resources, thus leading to better economic performance (Masocha & Fatoki, 2018).

Secondly, social SEP involves the attitude and behavior of an organization toward society and the community. It involves social development and responsible dealing with customers, investors and government and involves motivation of the employees for value creation in the business (do Prado et al., 2020). In social SEP, not only the shareholders are taken care of, but also all the stakeholders of the organization, including employees and customers. Organizations with SEO tend to make good relationships with their stakeholders, care about the satisfaction of their customers and employees, and act in a socially responsible way. Proactive organizations carefully plan and anticipate the needs of their employees and thus improve their image in front of their stakeholders. The innovativeness dimension of entrepreneurship involves the development of sustainable products and services for the better health of customers. Finally, in the case of risk-taking, organizations avoid activities that might have negative consequences for society (Martinez-Conesa et al., 2017; Mullens, 2018). All these factors lead to the improved social SEP of organizations.

Lastly, environmental SEP involves those activities that have an impact on the natural environment. As resources such as land, water and air are already very scarce, they should be saved from human activities. The major activities that are related to environmental performance include careful use of resources, preventing pollution and a decrease in waste (Masocha & Fatoki, 2018). The effect of SEO on environmental SEP is not quite clear in the literature, but it can be understood through an example of an actual company named Interface Corporation (Fatoki, 2019). Interface Corporation adopted a strategy of leasing their carpets instead of selling them; when their customers need to change their carpets, the company takes the carpets back and recycles them to make new floor coverings. In this way, no waste is generated and no harmful emissions are released (Miles et al., 2009). These instances show that SEO has a significant effect on the economic, social and environmental performance of organizations.

2.7.7.Sustainable Entrepreneurial Orientation and Exploitative Innovation

Entrepreneurial orientation is a kind of strategic orientation through which the intention of an organization to compete is captured. All the methods, processes and decision-making styles of an organization through firm-related activities are guided and are included in this orientation. To be very accurate, a definition of an entrepreneurial firm has been provided in the literature: an entrepreneurial firm is involved in the product market innovation, developed risky ventures and businesses and is the first one to introduce proactive innovations (Miller, 1983). Based on this definition, three characteristics of entrepreneurial orientation can be extracted: innovativeness, proactiveness and risk-taking. In entrepreneurial-oriented organizations, there is new product and service development, new market-related activities, improvement to current products and services, and improvement to current market-related activities. To be very specific, innovativeness involves the extent to which an organization supports novelty and creativity and invests in R&D for the production of new products, services and processes (Hughes & Morgan, 2007). This tendency of organizations also leads to improvements in currently existing products and services, which are referred to as incremental or exploitative innovation activities. Proactiveness is associated with the anticipation of market opportunities and actions taken by an organization under those opportunities. Today's customers expect innovative and improved products and services as well as a better understanding of their needs and requirements (Cenamor et al., 2019; Criado-Gomis et al., 2018a; Yli-Renko & Janakiraman, 2008). Lastly, risk-taking involves the willingness of organizations to pursue those opportunities in which the failure cost is comparatively high or the results and consequences are unknown. However, despite all the aforementioned factors regarding risk-taking, such as high failure costs and ambiguous outcomes, the incremental innovation or improvement of current products and services reflects the entrepreneurial orientation of organizations.

The literature has argued that organizations that have a high level of innovativeness are inclined to use experimentation, technological capabilities, creativity and R&D to bring novelty to products, services and processes (Miller et al., 1984). These organizations have an innovative mindset that is far away from the existing technologies and capabilities and is varied from the existing state of the art. These aspects of an organization are crucial from an innovation

perspective. An important argument made in the previous literature is that through innovation, not only products and services are renewed and new markets are explored, but existing products and services can also be improved and current markets can be explored in a new way (Cho & Pucik, 2005). As part of the innovativeness of an organization, creativity and commitment to new and innovative ideas enable organizations to enter either new markets or existing markets with either new products or services or existing products or services. This shows that innovativeness is an important component of entrepreneurial orientation that leads to innovation in an organization (Hughes & Morgan, 2007).

Proactiveness ensures that an organization gets the short-run first-mover advantage and long-run competitive advantage. It is clear that the market situation and business environment are changing continuously; therefore, organizations need to anticipate these changes and identify opportunities so that these can be exploited, and the organizations can act under the changes in the business environment. It can also be stated that merely anticipating change is not enough, organizations need to take those changes as opportunities and must make changes themselves as well (Bateman & Crant, 1993). Through proactiveness, the receptiveness of a company is increased regarding the market situation as well as the needs and demands of the consumers (Hughes & Morgan, 2007).

Gradually, with time, organizations keep on learning from these changes and finally become very proactive and able to adapt themselves according to those changes whenever needed so that they can stay ahead of competitors. Structural capital also has great importance concerning proactiveness. The structures and processes of an organization are included in its structural capital and they enable the organization to develop new resources fast and at lower rates as compared to its competitors (Lumpkin & Dess, 2001). The high responsiveness of these organizations keeps them one step ahead of their competitors because they can develop new products and services and improve current products and services by utilizing the available opportunities.

Lastly, risk-taking organizations take action and make decisions by pursuing identified opportunities. They have a high tolerance for faults and errors and usually consider the risk associated with a return on investment (G. G. Dess & G. T. Lumpkin, 2005). In addition, the scarcity of resources is an important issue here; therefore, businesses make sure that they have

an eye on imminent financial and business risks. Furthermore, it has been argued that organizations that are low-level risk-taking are reluctant to introduce new and innovative products and services and to react following changes in the business environment (G. Dess & G. Lumpkin, 2005). In short, concerning all the three dimensions (i.e., proactiveness, innovativeness and risk-taking), entrepreneurial orientation has been found to impact the innovative practices of an organization significantly.

2.7.8.Sustainable Entrepreneurial Orientation and Exploratory Innovation

Entrepreneurial orientation refers to the way an entrepreneur acts or behaves while: starting a new business; developing a new product, service or practice; and entering new markets. This orientation involves all the structures, behaviors and processes of the organization, which are based on the three key aspects or dimensions of entrepreneurial orientation: innovativeness, risk-taking and proactiveness (Miller, 1983). In other words, when organizations see opportunities in the market or business environment, they act on the principles of innovativeness, proactiveness and risk-taking (Lumpkin & Dess, 1996). The methods, processes and decision-making styles of managers and entrepreneurs are also included in entrepreneurial orientation, which means that this orientation is a firm-level concept that is associated with the organization at a strategic and decision-making level. In the literature, various researchers focused on the antecedents of entrepreneurial orientation; some researchers proposed that the psychology of the managers and founders of an organization is behind the entrepreneurial orientation of an organization, whereas other researchers suggested that environmental and organizational influences are the antecedents of entrepreneurial orientation. Other researchers focused on the strategic aspect of entrepreneurial orientation by associating it with the resources and capabilities of an organization (Covin et al., 2006; Poon et al., 2006).

In the literature, it has been argued that entrepreneurial orientation has a significant positive impact on the innovativeness of an organization, but there are other sorts of orientation as well, such as market orientation, which might also impact the innovativeness of an organization (Cenamor et al., 2019; Grinstein, 2008). Researchers suggested that if organizations put more focus on their customers' needs and demands and the situation of the overall market as part of their market orientation, then they will have a higher tendency to develop and produce new and innovative products and services. In the same way, intelligence on customers has also been

found to have a positive influence on innovation in products and services (Verhees & Meulenbergh, 2004). Specifically, the entrepreneurial orientation of organizations has been found to influence innovation capabilities as compared to organizations that are conservative and traditional; entrepreneurial organizations create innovation by being proactive and by boldly taking the risks innovation. The literature supports the argument that innovative firms have a higher tendency to take great risks and have proactive market leadership as compared to non-innovative organizations (Khan & Manopichetwattana, 1989). Proactive organizations have insights into the future dynamics of markets and business environments, which helps them take innovative steps to introduce new and innovative products and services by taking risks at the same time (Avlonitis & Salavou, 2007; Cenamor et al., 2019).

The role of technological capability in organizations is also important to the innovative and entrepreneurial mindset of organizations because technological capability is considered to be an important source of knowledge and a long-term competitive advantage for organizations (Lee et al., 2001). The most important aspects related to the technological capabilities of an organization that assist organizations to take innovative actions include major technology-related knowledge of the organization, trade secrets, copyrights and patents, technical insights obtained through R&D and other technological intellectual property (Hsieh & Tsai, 2007). The patents and copyrights of an organization as well as its investment in R&D reflect the entrepreneurial orientation of the organization and increase its ability to innovate its products and services and attract more investment from investors. In other words, it can be stated that organizations that have strong technological capabilities have higher entrepreneurial orientation and thus have high innovativeness (G. Williams, 2007).

Exploratory and exploitative innovative activities are also enhanced by the entrepreneurial orientation of an organization. Continuously changing business environments, technological opportunities and customer needs provide developmental opportunities for organizations, which encourages them to increase their innovative capabilities by using market information and to develop prospects for the organization (Lichtenthaler & Lichtenthaler, 2009). This innovative capability is reflected by explorative and exploitative innovation activities. When organizations exploit new opportunities in the business environment to create and develop new products and services, they are following exploratory innovation; on the other hand, when

organizations use existing information to make certain improvements and innovations to existing products and services, they are following exploitative innovation (Limaj & Bernroider, 2019). So, it can be stated that the innovative capability of an organization is not confined to the ability of the firm to use internal learning mechanisms to increase its knowledge base and to increase investment in R&D and market-related capabilities, it also involves the integration of internal as well as external resources to develop new and innovative products and services and to promote product development activities. Through these internal and external information and knowledge resources, organizations can see available opportunities and the ways and practices to exploit them; this enhances and highlights the entrepreneurial orientation of the organization leading ultimately to the innovation of products and services (Zhang & Ziegler, 2015). This innovation is usually exploratory and it provides organizations with a long-term competitive advantage. The characteristics of the resources that provide a competitive advantage to organizations include valuable, scarce, difficult to copy and difficult to substitute.

2.7.9. Mediating Role of Exploitative Innovation between Sustainable Entrepreneurial Orientation and Sustainable Entrepreneurial Performance

The two most important aspects while studying the effect of innovation on SEP in sustainable entrepreneurial-oriented organizations are innovation and sustainability (Maletič et al., 2014). In the case of innovation, a new management knowledge system and new markets are created through the use of already available resources and capabilities under DCV and RBV. Through this, new eco-friendly products and services and environment-friendly technology are developed by the organization that ultimately have a positive influence on the environment (Maletič, Maletič, & Gomišček, 2016). In the same way, existing knowledge and capabilities can also be used to improve current products and services with a major focus on sustainability and social and environmental betterment along with economic performance (Maletič, Maletič, Dahlgaard, et al., 2016). In this way, innovation activities by SEO organizations improve their SEP from the perspective of innovation. On the other hand, if the perspective of sustainability is considered, the major aspects include pollution prevention; green innovation of products, services and processes; and the overall development of the economy, society and environment in a harmonious way (Tomšič et al., 2015).

All these aspects are achieved by entrepreneurial-oriented organizations through innovation. The major behaviors that are associated with sustainability include reduced impact of the product cycle and other activities of the organization on the natural environment by innovating the technology and processes used for production, reduction in the consumption of resources or materials, increase in waste recycling activity through the use of environment-friendly technology and, finally, the development of the sustainability-related knowledge of the employees and managers of the organization (Maletič, Maletič, Dahlgard, et al., 2016). It has been argued in the literature that the green identity of organizations increases the understanding of the organizations' employees of innovation and environmental management. These employees not only adhere to the social corporate goals but also take certain initiatives from the organization to resolve major environmental issues and problems (Song & Yu, 2018). This means that the green identity of organizations plays an important role in their sustainable entrepreneurial mindset to undertake green innovative activities to increase their SEP.

A gap has been found in the literature regarding the mediating effect of exploitative innovation on the relation between SEO and SEP and although the economic and environmental aspects have been thoroughly covered in the literature, the aspect of social performance has not received sufficient attention from researchers. In the current study, this gap has been bridged by taking all the three aspects (i.e., environmental, social and economic perspectives of sustainability) together to explore the mediating effect of exploitative innovation on the relation between SEO and SEP. Moreover, the reviewed literature has made it very evident that exploitative innovation has a certain mediating effect on the relation between SEO and SEP.

2.7.10. Mediating Role of Exploratory Innovation between Sustainable Entrepreneurial Orientation and Sustainable Entrepreneurial Performance

It has been made quite clear that innovation can be subdivided into two types (i.e., exploratory and exploitative innovation) and when an organization is involved in both of these types of innovation activities, the firm is said to be ambidextrous (i.e., it is engaged in both radical and incremental innovation at the same time). When an organization brings certain improvements to its products and services, it assists in sustaining its market share as well as the profitability of the organization at the same time (Davila et al., 2012). In the same way, when improvements are made in the processes of an organization, it results in efficiency and reduction in the costs

of production (Grant, 2010). Similarly, innovation in products, services and processes also results in the exploitation of new and existing markets. Exploratory and exploitative innovation are non-substitutable elements and therefore the aspect of ambidexterity involves much higher levels of these two types of innovative practices or activities. In the literature, some studies explored the impact of carrying out both types of innovation on the performance of organizations. These studies indicated that when the two innovation activities take place at the same time, it increases the sales growth of the organization, profitability of the firm and return on equity (He & Wong, 2004; Jansen, 2005). However, other researchers argued that conducting the two types of innovation activities sequentially rather than simultaneously has a higher positive impact on the performance of an organization (Venkatraman et al., 2007). Moreover, the results of another study indicated the negative impact of innovation on the performance of an organization (Bierly III & Daly, 2007). These instances make it clear that organizations that have an entrepreneurial orientation are engaged in innovation activities that ultimately impact the performance of these organizations, either economically, socially or environmentally. An important aspect in this regard is that to achieve improved sustainable organizational performance it is not enough that exploratory and exploitative activities are taking place at the same time, there should also be integration between these two types of activities, and the flow of information and knowledge should be smooth enough to increase the performance of the organization (O'Reilly III & Tushman, 2008; Teece, 2007).

As regards the concept of sustainability along with entrepreneurial performance, the literature has argued that organizations must focus on environmental and social issues as part of their corporate social responsibility (Song et al., 2019). The image or identity of the organization is crucial in this regard because if the identity of the organization is green, it encourages people or members of the organization to bring green innovations that not only conserve the environment but also have positive outcomes for society along with the economic performance of the firm. Environmental laws have been improved and the concerns of customers and other stakeholders for environmental protection have also increased; therefore, the organizational management must innovate their products and services in such a way that it benefits economic, social and environmental performance (Carmeli et al., 2017). Corporate development and environmental conservation must be balanced and the role of exploratory and exploitative innovation is crucial in this regard, because they not only act as a source of competitive

advantage for the organization but also play a role in the prevention of pollution, reduction in the environmental costs and sustainable development (Hart & Dowell, 2011). When organizations have a green identity, their members are wholeheartedly involved in innovating either new products and services or existing products and services (Chang & Chen, 2013). Along with being involved in innovative activities, these members are also willing to focus on the prevention of pollution and emissions in the environment, green product management and sustainable development of the organization.

2.8. Research Framework

The above discussion is represented through the following research framework and hypotheses based on the framework and variables associations are developed:

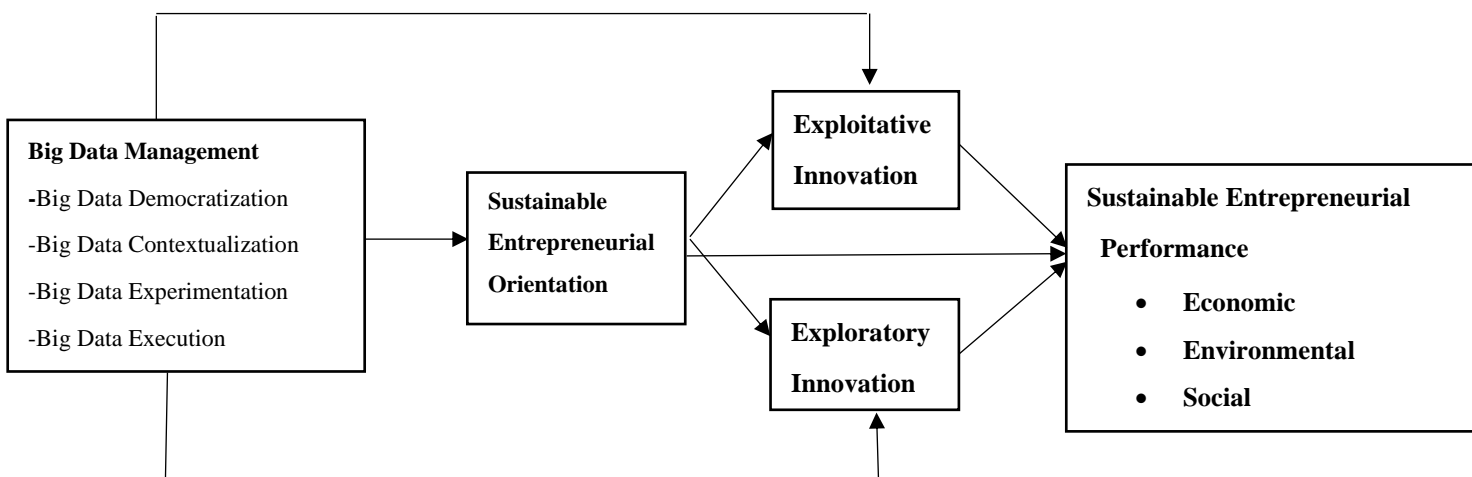


Figure 1: Research Framework

As per the above-specified research model (Figure 1) and the literature review, the following hypotheses are proposed:

H1: Big data democratization has a positive impact on SEO

H2: Big data contextualization has a positive impact on SEO

H3: Big data experimentation has a positive impact on SEO

H4: Big data execution has a positive impact on SEO

H5: Big data democratization has a positive effect on exploitative innovation

H6: Big data contextualization has a positive effect on exploitative innovation

H7: Big data experimentation has a positive effect on exploitative innovation

H8: Big data execution has a positive effect on exploitative innovation

H9: Big data democratization has a positive effect on exploratory innovation

H10: Big data contextualization has a positive effect on exploratory innovation

H11: Big data experimentation has a positive effect on exploratory innovation

H12: Big data execution has a positive effect on exploratory innovation

H13: SEO positively and significantly mediates the relationship between big data democratization and exploitative innovation

H14: SEO significantly mediates the relationship between big data contextualization and exploitative innovation

H15: SEO significantly mediates the relationship between big data experimentation and exploitative innovation

H16: SEO significantly mediates the relationship between big data execution and exploitative innovation

H17: SEO significantly mediates the relationship between big data democratization and exploratory innovation

H18: SEO significantly mediates the relationship between big data contextualization and exploratory innovation

H19: SEO significantly mediates the relationship between big data experimentation and exploratory innovation

H20: SEO significantly mediates the relationship between big data execution and exploratory innovation

H21: SEO has a positive effect on economic performance

H22: SEO has a positive effect on environmental performance

H23: SEO has a positive effect on social performance

H24: SEO has a positive effect on exploitative innovation

H25: SEO has a positive effect on exploratory innovation

H26: Exploitative innovation significantly mediates the relationship between SEO and economic performance

H27: Exploitative innovation significantly mediates the relationship between SEO and environmental performance

H28: Exploitative innovation significantly mediates the relationship between SEO and social performance

H29: Exploratory innovation significantly mediates the relationship between SEO and economic performance

H30: Exploratory innovation significantly mediates the relationship between SEO and environmental performance

H31: Exploratory innovation significantly mediates the relationship between SEO and social performance

2.9. Summary of chapter

This chapter presented the theoretical foundation and associations among the variables proposed in the study through previous research. The research gaps were discussed and the association between the big data management capabilities, innovation, and entrepreneurial orientation of firms was discussed in detail. This chapter presented the variable associations based on the dynamic capabilities and entrepreneurship theories. The association between big data capabilities and innovation was discussed as a unique asset and innovation tendencies of the firms were posited as dynamic capabilities of the firm. The role of internal and external resources for mobilizing the SEO and SEP of the firm were discussed. In the end, a research framework was presented and the research hypotheses were developed based on theory and discussion.

Chapter 3: Methodology

3.1 Introduction

The previous chapters presented a review of the literature and background information relating to the industry of choice; this chapter discusses and describes the methodology used to address the study's research questions. These research questions were presented in the first chapter. The philosophical paradigms and perspectives that support the methodology being applied in the study are presented in this chapter, followed by a justification for using a quantitative approach (i.e., the administration of questionnaires for data collection and documentation). The subsequent sections of this chapter describe the specifics of the present study, such as the background and selection of the participants, the methods used for data collection, and the analytical processes used to evaluate the data. Moreover, the validity and reliability of the study and analytic technique are discussed.

3.2 Research Design

According to the concepts proposed by Bell et al. (2018), the research design provides the guidelines and a framework for the analysis and data collection phases of a study. It is significant to link theory and data collection to answer the research questions and satisfy the research objectives (Frankfort-Nachmias & Nachmias, 2008). The research method or strategy influences the selection of the research instrument and sampling techniques (Joseph F Hair et al., 2011). During the design configuration process, the researcher can make rational decisions relating to the purpose, location, instrument selection, type of study, time horizon, and unit of analysis (Sekaran & Bougie, 2016). Based on the guidelines presented by Sekaran and Bougie (2016) relating to research design, the primary purpose of the present study included detailing an investigation into the role played by BDM in sustainable entrepreneurship and innovation; thus, the purpose of the study was to test the relationships generated and proposed through the conceptual model. These relationships and associations will be analyzed through the testing of the hypotheses. The present study is being carried out in a natural or non-contrived environment (i.e., the researcher will not be creating an artificial environment for the sake of the research). The respondents or participants will be approached in natural settings and the interference of the researcher will be kept to a minimum. The unit of analysis is organizations from the software industry that are working on big data projects. Moreover, the choice of time horizon

will be specified in subsequent sections (Sarantakos, 1993). The literature review, and Chapter 3, were fundamental to the development of understanding of the research problem.

3.3 Research Philosophy

The term research philosophy represents a method of assumptions and beliefs regarding the advancement of knowledge about a concept. A research philosophy represents a system of beliefs and mechanisms that guides the overall process of the research process. The research philosophy represents the very essence of the research process (i.e., it directs the methods adopted for developing knowledge in some aspect). A series of assumptions guide the research process; these assumptions relate to the criteria regarding human knowledge (epistemology), the depth of the inclusion of realities (ontology), and the degree to which the values of the researcher influence the research (axiology) (Crotty, 1998). Different assumptions or beliefs direct the type of philosophy adopted for the research process – ontological, axiological, and epistemological assumptions – and represent different levels and characteristics of the research philosophy.

A research philosophy includes the methods and assumptions that have been used for the construction of knowledge relating to the phenomenon under study. The research philosophy represents a belief system and concepts that relate to the design, which is one of the main drivers of the overall research process. Several processes are used to construct these processes; the main ideas behind these different world views or the academic design are known as philosophy. There are several assumptions relating to the choice of the philosophy to be implemented in the study. These are defined as ontological, epistemological, axiological, and methodological assumptions, representing different facets of the research philosophy.

Four research philosophies are guided by these assumptions: positivism, critical realism, interpretivism, and pragmatism (Crossan, 2003). The first and the most widely used philosophy is the positivist philosophy. Under the guidelines of this approach, the quantitative method is considered suitable for the application, and various rules and assumptions regarding reality, knowledge, and existence are formulated. According to the ontological perspective, the subject under evaluation is independent and objective. Concerning the knowledge collection processes or the epistemological considerations, causal fact-based explanations and law-like

generalizations are used to construct information. In such a design, the researcher's input or beliefs do not influence the study's outcomes. The study results are based on rules and processes that are the basis for the interpretations and explanations being drawn for the phenomenon under study. The typical methods adopted for the research process in a positivistic study include quantitative methods of analysis that use large samples and a structured process for evaluation (Saunders et al., 2009; Saunders & Lewis, 2012).

The second paradigm is realism. Realism is not defined by the use of either qualitative or quantitative methods. The philosophy of critical realism was initially developed as an argument in opposition to the positivist phenomenon. The supporters of critical realism think that there are two aspects to reality: the visible portion and the fundamental part. The real part is unobservable and independent of the researchers' perception. Knowledge is gathered through the facts of history.

Moreover, social actors play a considerable role in the construction and evaluation of knowledge. This paradigm transits from the pure objectivism standpoint to partial subjectivism. Therefore, the methodology for critical realism is not limited to just quantitative methods, and a range of processes is generally adopted.

The third paradigm in the research literature is known as interpretivism and is guided entirely by qualitative research and inquiry methods. The philosophical beliefs supporting this paradigm are that reality is understandable or conceivable and can only be understood through the subjective intervention of social actors. Reality is based on the subjects' beliefs or entities that are part of the research framework. From an epistemological viewpoint, unlike positivistic studies that are limited and do not include explanations, the world is not defined by a single reality. Thus, knowledge evaluation is based on interactions with the study subjects and should be explored through the narratives of the study subjects. This process is value-laden, and the researchers' perceptions are of prime importance as they are the main objects that transition the knowledge onward. No basis or foundation can evaluate and govern the statements observed and presented by the researcher, as the method is based on instruments that use the interpretation and observation of the researcher to a great extent. The methodology for the paradigm supports the use of inductive qualitative modes of study that involve small samples,

which are best suited for gathering the data in such studies (Creswell & Creswell, 2017; McCusker & Gunaydin, 2015).

The fourth research philosophy is known as pragmatism. Pragmatists believe that the application of knowledge is relevant and required when it is linked with conceiving the solution to some problem. The methods applied in this paradigm are a mixture of the subjectivist and objectivist approaches. Both methods are applied so that an in-depth evaluation of reality can be performed. The ontological standpoint for this paradigm is that reality is a culmination of ideas, processes, and experiences. The epistemological framework supports the focus on problem areas, and contributions are made through developing an actionable solution to varying problems. The axiological perspective for this paradigm supports the implementation of fact-based knowledge through objectivism and understands the importance of the value input of the researcher. The methodology supports the use of practical methods for gaining solutions and outcomes, mixed methods, and qualitative and quantitative evaluation.

The primary purpose of this research study is to evaluate the dynamics present between BDM, innovation, SEO, and performance. The study's primary purpose is to quantitatively evaluate the effect of the factors affecting the SEP of the software companies of Pakistan working on BDM projects. The positivist philosophy supports quantitative and empirical methods; therefore, it is applied in the present study. For justification of the choice of research philosophy, the core ontological assumptions by Morgan and Smircich (1980) have been used. The continuum of the core ontological assumptions is representative of two extremes: objectivist interpretations and subjectivism. In the present study, the preference is to implement a quantitative design. The paradigm supporting that notion has been chosen as the positivist approach, which supports the notion of using objectivism to guide the research process results. Therefore, the study is utterly dependent on the data collected from the respondents through a research instrument and not based on the observations and opinions of the researcher. Also, the present study posits several hypothesized associations among the variables that require testing and measuring through quantitative methods within the context of the DCV.

The positivist approach has fundamentally been linked with the application and selection of quantitative methods and therefore has been chosen for this study. Thus, the choice of the philosophy is supported and justified from the methodological point of view. The current study

uses numerical methods approach to satisfy the study's objectives. The study will be using primary data analysis and evidence collected from the respondents on the adoption and application of sustainable entrepreneurship in the technology sector. Therefore, the positivist philosophical point of view is applied as it supports the notion of a quantitative approach to evaluation (Tharenou et al., 2007; Veal, 2005; C. Williams, 2007). Also, the purpose of the present study requires a well-defined conceptual framework, where all the relationships among the constructs are well-defined and can be evaluated through precise measurements.

In the present study, all the constructs relating to BDM, innovation capabilities, SEO, and performance have been validated and developed from existing theories and models presented in Chapter 2. The present study also uses structural equation modeling (SEM) for hypothesis testing. Thus, the statistical packages to be employed in the present study also describe the positivist philosophy and follow the requirements and processes defined by the approach.

3.4 Research Method

The aims and objectives of a study are used to guide and direct the research processes and procedures to be selected for application in the study. Research methods have been repeatedly defined in past literature as the mechanisms used by a researcher to conduct a study (Creswell & Creswell, 2017). The research objectives and research questions are the sources for choosing the appropriate method of data collection. Moreover, the philosophical direction chosen by the researcher is also used to guide the selection of an appropriate method and instrument. Three kinds of research methods have been used by researchers: qualitative, quantitative, and mixed methods. The quantitative method is associated with collecting and analyzing data that can be represented numerically and quantified.

In contrast, qualitative studies are concerned with using data that is non-numeric (McCusker & Gunaydin, 2015). Quantitative studies call for the usage of statistical and mathematical tools to collect, compile, and analyze data. In contrast, qualitative studies require systematic tools to assort and analyze non-numeric data.

The literature has associated qualitative methodologies with interpretivism and quantitative methodologies with positivism (Terrell, 2012), as the qualitative research process often

involves developing new theories. In contrast, the quantitative method of study is used to test and analyze pre-existing theories and inspect research constructs (Morse, 2016). The third type of method is known as a mixed-methods approach. A mixed-methods methodology uses quantitative and qualitative methods to explore the research problem. Research shows that mixed methods provide the basis for a more comprehensive understanding of the research problem (Almalki, 2016).

A quantitative research design has been selected for implementation in the present study as it has various advantages over the mixed methods and qualitative study designs. By applying an empirical research design, the interference of the researcher and subjects will be limited. Thus the bias from the researcher will be non-existent; due to this factor and some other reasons, quantitative design is considered robust and effective. The method adopts an objective point of view for data collection and evaluation; that is, the data is collected according to the defined objectives of the study, and then, after analysis, it is interpreted based on some existing rules and procedures that limit the inclusion of the researcher's personal beliefs and inferences. The quantitative methods approach is applied when research aims to evaluate a phenomenon or theory of interest and then evaluate it statistically (McCusker & Gunaydin, 2015; Molina-Azorin, 2016; Molina-Azorín et al., 2018). There are various advantages observed due to applying a quantitative methods methodology. A quantitative method provides a conclusive and definite answer to research questions.

The overall analytical portion of the research process (i.e., the data collection, analysis, interpretation, and reporting based on some standardized method, the evidence for which can be found in the literature) and therefore, the method itself is considered to be more credible in contrast to qualitative methods. The results from quantitative studies can be generalized to populations or target groups. Thus, based on these advantages and rationale, along with the objectives of the study, which include an empirical verification of variables' relationships with one another, the quantitative research method has been chosen, as it is also supported by the approach and philosophy chosen for implementation. The study will collect primary data through a research instrument and assess the variable relationships through a verifiable quantitative and statistical method.

3.5 Research Approach

The research approach has been identified as the guiding method or plan of action for the study. The research approach is related to the aims and objectives of the study and is also related to the direction of the study. The past literature explained the research approach as a procedure or plan comprising various steps of research that are used for the collection, analysis, and interpretation of the research data (Maxwell, 2012). Thus, it can be stated that the research approach is guided by the nature and type of research questions being addressed in a study. The research literature acknowledges two types of approaches that can be used to design and conduct research: the inductive approach and the deductive approach.

Deductive approaches are typically applied in studies where the researcher aims to take a specific problem and generalize it. The inductive approach is applied in studies where the inquiry begins from a general area and leads to a specific solution or answer. Generally stated, in a deductive approach-based study, the researcher moves the context of the study from a general discussion toward a specific one (i.e., a researcher explores the literature, formulates hypotheses based on the literature, and then reaches the outcomes of research by obtaining data from specific respondents targeted in the study). The deductive research approach is usually connected with developing hypotheses based on existing literature and theories. The researcher then designs a strategy to test and analyze these hypotheses (Gliner et al., 2011). The deductive research approach, in short, is characterized as the reasoning process that moves discussions in research from the specific to the broad (Jackson, 2015).

In contrast, in inductive approach-based research, the discussion is moved from a specific topic toward general implications (i.e., the researcher obtains data from a specific set of respondents intending to form a new theory that can be applied to the whole population). The researcher aims to develop and propose theories or new facts as a conclusion or consequence of the research through an inductive study. These studies are based on the elicitation of patterns derived from the opinions obtained from research participants. The studies develop justifications and theories based on these opinions generalizable to a larger group (Rahi, 2017). Inductive reasoning, therefore, can be used for the formulation of a new theory, while deductive reasoning concentrates on testing existing theories.

In the current study, the researcher decided to use a deductive approach to research as the study's objectives do not indicate the need to explore any new theoretical framework. Still, the existing relationships between various constructs relating to innovation, sustainable entrepreneurship, and BDM are to be tested. Therefore, the researcher aims to move the thesis context from a general to a specific pattern rather than from the specific to the general. In the present study, the researcher explicitly used a deductive approach because the researcher wants to know how BDM activities and processes influence sustainability orientation and the SEP of employees. These associations have been discussed in the literature, and the relationship between these variables can be predicted using hypotheses. In summary, the deductive approach is selected as the most appropriate approach for the current study by the researcher as it enables quantitative investigation and tests the significance of relationships proposed in previous chapters.

3.6 Nature of Research and Time Horizon

The nature of a research study can be explanatory, where there is some ambiguity relating to the associations proposed in the statement of purpose, and further evaluation is required for essential associations; exploratory studies involve constructs and variables about which the literature is in the development phase and requires further evaluation for the formulation of distinct features; or descriptive studies, where the researcher discusses the findings of the studies. Exploratory research involves research processes that are based on the formation and testing of totally new hypotheses. In explanatory research, new hypotheses are generated to support some previously existing theories or hypotheses. In descriptive research, some previous phenomenon is targeted and presented in a new context instead of working with a hypothesis. In other words, if the study aims to propose a new theory or concept, it is said to have a descriptive nature, exploratory research is based on providing some new evidence regarding already existing concepts, and descriptive studies are carried out to solve some specific problems. In the present research, the researcher has opted to use a descriptive study to examine the effect of the influence of innovation activities and BDM on the SEO and performance of the software firms in Pakistan.

The social research literature acknowledges two kinds of research designs in this dimension: longitudinal and cross-sectional studies. In longitudinal studies, a researcher aims to collect

data over a long time as the impacts of variables are explored before and after aspects of some phenomenon. In contrast, data is collected once in a single time frame in a cross-sectional design. In the present study, the researcher has used questionnaires to collect data, and all of the data was collected in a single time. Thus, it can be specified that the researcher used a cross-sectional approach to collect data.

3.7 Population and Sampling

3.7.1 Population

The population is identified as the group of entities or subjects evaluated by the researcher to investigate and fulfill the research objectives (Sekaran & Bougie, 2016). The sample in a study is a small set derived from the population used in a research study; a sample is a representative group chosen from the population because collecting data from the entire population is not possible. For the present study, the population was the software companies registered with the PSEB. Software houses that are working on or have worked on BDM or capabilities will be considered the target audience for the study.

3.7.2 Unit of Analysis

One of the most fundamental decisions of the research process for the researcher is to decide on a sampling unit for the study. The unit of analysis needs to be clearly and accurately defined as it is the indivisible unit of a sample that cannot be further disintegrated for research. Thus, the defined unit or level of the subject has a central position in the research design. As Zikmund et al. (2003) discussed, a clearly defined sampling unit indicates the depth and level of investigation intended in a study, which allows the research methodology and processes to be mapped out accordingly.

Moreover, the description and decision for selecting a sampling unit allow the researcher to determine data collection and analysis techniques and the research instrument, which is designed based on the sampling unit being targeted through the study (J. Hair et al., 1998). In short, the overall research methodology in a study can be accurately determined after the researcher has finalized the unit of analysis. In the present study, the sampling unit or the unit

of analysis was the employees working in software firms practicing BDM. As specified before, the study population is the employees from software firms registered with the PSEB; the researcher filtered the organizations engaged in BDM capabilities and recruited employees from these organizations for the analysis. The employees from these organizations were targeted as they had the best knowledge to provide insights for this study.

3.7.3 Sampling Technique

Sampling is the process that a researcher uses to select a subset of individuals who belong to a larger target population of the study to deduce the major descriptive characteristics of the entire population. There are multiple kinds of sampling techniques available to a researcher that is applied to obtain a suitable sample of an appropriate size and represents the entire population from a large population to collect data from that sample.

The sampling process decided upon in the study needs to ensure an accurate sample concerning the analytic technique and the objectives and scope of the study, one that comprises participants who can easily represent the entire population's points of view and perceptions. Sampling techniques are divided into two major types: probability and non-probability sampling. In probability sampling, every sampling unit in the population has an equal and same opportunity or chance of inclusion in a sample, which is possible only if the researcher has complete information about the population of the study; in cases where there is insufficient information about the population, probability sampling methods cannot be used, but non-probability techniques can be used. In non-probability sampling, the participants do not have an equal participation opportunity (Acharya et al., 2013). The sampling techniques present their distinctive advantages and application techniques.

The researcher used the non-probability sampling method in this study. Even though the researcher has a list of all registered companies or organizations, it is impossible to enable equal participation of all the organizations listed in the PSEB portal. Therefore, to avoid any ethical violation, the researcher selected the non-probability-based sampling techniques of purposive and convenience sampling. The study aimed to evaluate the effect and role of BDM capabilities on the SEP of firms; thus, a large dataset is being targeted by the researcher. The purposive or judgmental sampling technique refers to the inclusion of a specified group of

subjects central to the study's focus (i.e., only those entities capable of answering the research questions are selected). Therefore, the purposive sampling technique was used to select only those firms belonging to the technology development sector and practicing BDM activities. In convenience sampling, sampling items are selected based on the convenience of the researcher, availability of the sampling unit, and some factors like experience. The researcher initially selected 100 firms listed on the PSEB portal and established contact with them. When a researcher makes such a decision based on the sampling item being nearby, available, or easy to study, it is known as convenience sampling (Etikan et al., 2016). There are several advantages associated with convenience sampling, including a faster or speedy process, low costs incurred to recruit the sample units, and no need for a sampling frame (Baltes & Ralph, 2020). After establishing contact with around 100 firms, the researcher contacted the employees working in these organizations. The managers were requested to introduce the researcher to any organization that the researcher had missed. From these 100 firms, the researcher contacted about 1100 employees working in the BDA field.

3.7.4 Sample Size

The research process needs to specify the sample size following the population of the study. Following Bell et al. (2018), using a large sample does not ensure precision and accurate results; thus, it can be associated with wastage of time and economic resources. However, a small sample size, mainly when statistical data analysis techniques like SEM are applied in the study, has been associated with lower precision and validity (Hair et al., 2011). The population being targeted in this study (i.e., Pakistan) is vast, as the research was not limited to a region or a city. Thus, the sample size was determined based on the requirements of the SEM techniques as specified by the software AMOS. Roscoe (1975) stated that the following rules should be considered while finalizing the sample size for SEM-based studies:

- Sample sizes greater than 30 and less than 500 are considered appropriate for several studies.
- In the process of categorizing the sample into groups, at least three measures should be used to evaluate the constructs.

- In multivariate analysis studies, the sample size should exceed the number of variables within the study's conceptual framework by 10 or 20 times.

Therefore, in line with the above-specified regulations and suggestions relating to the assumptions of the SEM technique (Joseph F Hair et al., 2011) and also catering to the complexity of the conceptual model in terms of both variables and the parameters or items relating to the variables, the sample size needs to be at least 20 times the number of parameters. There are 54 items in the study, and thus the sample size has been set at 1100.

3.7.5 Non-response Bias

There are primarily two reasons identified for the non-response of participants: refusal to respond to individual questions and refusal to respond to any of the questions specified in a study (Saunders & Lewis, 2012; Sekaran & Bougie, 2016). If there is a relatively high rate of non-response, then the instrument's validity is at risk. The non-response bias occurs when those who respond differ in the outcome variable from those who do not respond. The selection of the research instrument and the method adopted for recruiting the research participants affects the response or non-response bias. In the present study, to decrease the bias of respondents to a minimum, a combination of techniques for data collection were used (i.e., paper-based or self-administered and online survey) (Council, 2013). Also, the pre-testing and a pilot study indicated a high response rate with high satisfaction with the length, clarity of wording, and layout of the questionnaire. Thus, it is assumed that the researcher will not face this issue, and the response rate of the participants will be in line with this assumption.

3.8 Research Instrument

Various techniques and methods have been developed for the conduction of research, including field studies, ethnography, field experiments, grounded theory, surveys, and laboratory experiments (Creswell & Creswell, 2017; Frankfort-Nachmias & Nachmias, 2008; Gliner et al., 2011; Jackson, 2015; Sekaran & Bougie, 2016; C. Williams, 2007). A research instrument is defined as a tool used to collect data. For the present study, the researcher developed a survey-based approach to collect data from software organizations in Pakistan. The survey research approach has been credited as one of the tools or techniques most often applied in

quantitative methodologies; more than 50% of the articles in management and information systems journals are based upon this technique (Gliner et al., 2011). The present study aims to evaluate the factors influencing the SEP of the software houses of Pakistan, which involves the collection of data from a significant number of organizations within Pakistan, especially if SEM is to be applied; the usage of a technique or method other than a survey-based approach for data collection would be excessively time-consuming and expensive as well (Asparouhov & Muthén, 2016; Joseph F Hair et al., 2011). Also, the conceptual framework established in the third chapter needs to be tested, and the usage of the survey research technique is considered appropriate.

Furthermore, the application and usage of the survey method are aligned with the application of quantitative methods and positivistic research philosophies (Saunders et al., 2009; Saunders & Lewis, 2012). The collection of a large amount of data, standard in survey research studies, allows the findings to be applied to the entire research population. Another major factor that supports the application of this research approach is the relatively less controlled bias and interference of the researcher in the responses of the research participants. The researcher is isolated from the aim of the study and does not offer any personal opinions to the research participants that may or may not influence their responses.

Once a questionnaire has been designed, it is disseminated among the research participants with just a brief introduction and explanation of the objective and scope of the research; beyond this point, the researcher does not interfere with the research process. Therefore, the accuracy and reliability of these studies are considered to be more than the accuracy and reliability of studies involving observations and case studies (Saunders & Lewis, 2012). By applying this technique for data collection, a large number of participants can be approached in a relatively easy, efficient, quick and economical way compared to other research methods (Saunders et al., 2009). A questionnaire as a data collection method has been widely used in studies in a context similar to this study. For example, see (Albergaria & Jabbour, 2020; Aydiner et al., 2019; Frank et al., 2019).

In the present study, the researcher used a self-administered questionnaire and online questionnaires to increase the research instrument's reach and collect data without the issue of geographical boundaries. The questionnaire was designed in English, and the pilot testing

showed that the pilot group could understand all the statements without any serious difficulty. Moreover, a cover letter specified all the necessary information relating to the questionnaire in online and self-administration formats. For self-administration, the researcher personally went to the organizations specified in the sample in Lahore and other areas of Punjab. The names of the firms and areas are not disclosed to maintain the anonymity and confidentiality of the respondents. The remaining proportion of the questionnaires was emailed to the companies' official email addresses, and the researcher also personally called representatives of the organization. It took the researcher 4 months to get 961 forms filled by respondents. After carefully analyzing the responses, 958 respondents were included in the final analysis. The others were removed because they were incorrect, incomplete, or irrelevant to the survey.

3.9 Research Data and Questionnaire Design

The research data is defined as the facts and the material that is recorded, collected, and assembled by the researcher for the application of analytic techniques and methods to evaluate the truth of the hypothesis and generate authentic results. The literature acknowledges different kinds of data: primary and secondary. There are different categories of numerical data: nominal data, ratio level, ordinal data, and interval data. Data categorized and classified into discrete and non-overlapping classes, like gender-based divisions, is nominal data (Perreault Jr & Leigh, 1989). Categorical data has variables arranged in a natural order; categories that have unknown distances are called ordinal (Christensen, 2015), such as Likert scale-based data. Interval level data is defined as data that is numeric. However, the differences between the data points are meaningful compared to ordinal level data (Miller & Yang, 1997). Ratio level data is similar to interval data in that it is also numeric, but it has a valid zero point (i.e., there can be no negative values in ratio data) (Emrouznejad & Amin, 2009). An example of ratio level data is height and weight, which cannot be negative. In contrast, the temperature is an example of interval-level data with standardized division points and a negative value. Thus, in the present study, the researcher has chosen to include categorical data in the study, as a Likert scale is used for response recording of the respondents.

The design and material included in the questionnaire are based upon the aims and objectives of the study. They are also dependent on the nature of the study (i.e., descriptive, exploratory, or explanatory). The design of a research questionnaire is dependent on whether the researcher

is aiming to collect exploratory-based or quantitative-based information. The present study involves the usage of a structured questionnaire, and the questionnaire is based on multiple options-based and close-ended questions. The main goal of the development of the questionnaire was to collect the data required to substantiate the study's objectives. The items required for measuring and evaluating the variables included in the study were all obtained from the literature review relating to BDM, innovative activities of employees, and sustainable entrepreneurship. These topics were covered in chapters 1 and 2. The present study aligns with the recommended processes and procedures for questionnaire development proposed by Sekaran and Bougie (2016).

In the current study, the questionnaire is initiated or begins with a short introduction to the researcher, the affiliated institution, and the study's objectives. Then five questions are specified in the first section relating to the demographical characteristics of the respondents: information relating to their gender, age, experience, education, and marital status. These questions help build a reference for the population characteristics and aid in the generalizability of the results. Following the demographical profile, the researcher created separate sections for the dependent variable, which is the SEP of the firms, and the independent and mediating variables, which are BDM capabilities, exploitative and exploratory innovation, and the SEO of the employees.

The researcher also opted to conduct a pilot test to ensure the reliability of results and to increase the overall research productivity and effectiveness. Pilot studies have been described as necessary in the past literature as they can increase the likelihood of success of the research (Van Teijlingen & Hundley, 2002). A pilot study is a short form of an actual survey, which can indicate the type of results obtained from the survey and allow a researcher to move ahead with their work confidently. Pilot studies have been proven helpful in indicating any lags in the study and have also been used to indicate factors or statements that are difficult to understand. Thus, conducting a pilot study helps a researcher test the understandability of the instrument.

In the present study, the researcher selected a group of 10 respondents to conduct this pilot study: 5 employees of software firms handling big data projects, 3 academics, and 2 practicing experts in the field. The pilot study results showed that the respondents were capable of understanding the language of the questionnaire with ease and comfort and did not get confused

by any of the statements included in the questionnaire. Moreover, the academics approved the accuracy of the selected items, their sequencing, and the overall context setting of the survey instrument. The field experts indicated that a research assistant should be present when the employees fill in the questionnaires. The researcher or assistant should explain the context of the study so that participants could be guided in the meaning of the questions if needed. Overall, the pilot study confirmed the instrument's effectiveness, and no changes were made.

3.10 Measures

As specified before, the measures or items required for the study were based on the previous literature and have proven records of reliability and validity in the extant literature. All the variables have been measured based on a five-point Likert scale ranging from 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree in the present study. The details of the scales and items used to evaluate the constructs are as follows.

3.10.1 Big Data Management

The seminal study by Zeng and Glaister (2018) was used to develop the measures related to BDM capabilities. The study included four sub-constructs of BDM capabilities based on 23 items. There were seven items for big data democratization capabilities included in the study. A sample item is “I can access big data when needed at any given time.” The big data contextualization factor was evaluated based on five items, and a sample item is “I can identify contextual clues in big data.” The experimentation capabilities were measured based on six items, and a sample item is “I can come up with new methods to test big data.” And the execution capabilities were measured through five items, including, “When I observe any abnormality emerging from the data, I react to the situation in real-time.” Similar to the study of Zeng and Glaister (2018), the BDM capabilities were evaluated at the firm level.

3.10.2 Innovation

The firm's innovation capabilities were measured based on two types of innovation capabilities: exploratory and exploitative innovation. The scales required to measure both of these innovative activities were adapted from the study of Mom et al. (2007). The scale has been

used by Shamim et al. (2020). A total of 10 items for measuring the innovative activities of the firm were included in the study: 5 items related to exploratory innovation, for example, “Focusing on the strong renewal of products/services or processes” and 5 items related to exploitative innovation, for example, “Activities which I can properly conduct by using my present knowledge”.

3.10.3 Sustainable Entrepreneurial Orientation

The entrepreneurial orientation of the organizations was evaluated based on seven items based on the studies of Miller (1983), Covin and Miller (2014), and Covin and Slevin (1989). The construct is inclusive of three dimensions: innovativeness (2 items), proactiveness (2 items), and risk-taking (3 items).

3.10.4 Sustainable Entrepreneurial Performance

The SEP involves the three aspects of sustainability, i.e., social, economic, and environmental. The triple bottom line is considered a key to sustainability. The idea of the TBL approach is that the business activity can simultaneously deliver financial, social, and environmental benefits, and many corporates are treating it as their corporate social responsibility. SEP is based on the triple bottom line proposed by Henriques and Richardson (2013) and Chang et al. (2009). The SEP of the firms is reflective of its economic (4 items), social (5 items), and environmental performance (5 items).

3.11 Data Analysis

For the present study, the data were evaluated in two different stages, and two different statistical packages were also used. In the preliminary testing stage, SPSS version 23 was used for demographical analysis, missing value detection, coding, and outlier detection, and normality testing of the study was performed. Whereas in the second part of the analysis, the SEM technique was used to test the truth of the hypotheses and examine the relationships among the variables proposed through the conceptual model. Advanced statistical processes and procedures have been increasing because as research models grow more complex,

simplistic techniques and processes are not compatible with the evaluation of multiple dependencies (Hair et al., 2011).

SEM, also known as a path analysis technique, covariance structure analysis, or simultaneous equation model, examines the hypothesized relationships among the variables presented through a conceptual model. The SEM technique replicates the structure of a covariance matrix of the conceptual model. The process is used to evaluate the structural relationships between the measurable variables and the latent constructs (Biddle & Marlin, 1987). SEM is performed because the analytic design of the estimation process allows for testing the multiple interrelated dependencies in a single procedure. The SEM framework uses two types of variables: exogenous or the independent variables and endogenous or the dependent variables. SEM is one of the most widely applied and popular statistical methodologies in quantitative research and thus has been chosen for this study. However, before applying the SEM technique, supporting processes have to be performed on the data. For example, the Kaiser–Meyer–Olkin (KMO) test and Bartlett test for ensuring the adequacy of the sample, CFA confirms the inclusion of only relevant and significant measures, and to ensure the fitness of the model, the validity and reliability of the model are measured through construct validity and Cronbach’s alpha.

3.12 Ethical Considerations

It is essential to follow the ethical requirements and processes of a research study to promote participant confidence and maintain research principles. Demonstration of ethical behavior during the research process allows researchers to maintain the values of the overall process and allows uniformity in the research process. Furthermore, demonstrating and following ethical considerations is one way to attain decency in the overall data collection, analysis, interpretation, and reporting of the results.

The maintenance of regulations and the following principles mandated by literature and institutions are ways of ensuring and increasing the merit of the researcher and the credibility of the study. Therefore, it is stated that the selected and chosen research paradigms, methods, approach and design, questions included in the questionnaire, method, and source of secondary data collection and analysis, methods of primary data collection, and reporting of the results all

present their implications in terms of ethics. For this primary purpose alone, ethicality and a coercion-free and manipulation-free safe process for the participants are maintained to grow their confidence in research activities and processes. The implications of ethicality need to be addressed by the researcher at an early stage during the research process to be catered for and dealt with to keep an eye on the outcomes or emergence of possible ethical issues that could arise during the study (Creswell & Creswell, 2017).

This study's ethical norms contemplated and considered are numerous (Cortina, 2019). One of the central ethical norms required to abide by is the obsolescence of coercion and manipulation for recruiting research participants. Coercion distorts the accuracy and effectiveness of the data collected and the overall research. Thus, it was essential that the researcher ensured that no coercion was used in sampling and data collection (i.e., the researcher ensured that anyone forced no participant to participate in the research study). Moreover, participants unwilling to respond to statements or questions were neither compelled nor manipulated to answer them.

The next main issue that compromises the accuracy, reliability, and confidence of research participants is the anonymity of the participants and confidentiality of their data; it was ensured that the respondents knew that their responses would remain confidential and would not be used beyond the scope of the present study. The participants were informed that no other person other than the researcher and their supervisor would be allowed to browse through, see or use the data collected for the present study. Furthermore, the results presented in the published research will be summarized and aggregated. The original raw data would only be accessible to the researchers involved in this particular study. Moreover, the researcher ensured that the authenticity of the data was not compromised: data was included in an original form, there was no tampering with the participants' responses, and no fake or fraudulent information was included in the thesis. The researcher, complying with the plagiarism policy of the institute and research ethicalities, correctly cited the work of other authors and ensured that plagiarism-free work was completed.

The research instrument was implemented in English to increase the generalizability of the study and because the research sample had characteristics such that the instrument's language would not affect the accuracy and understanding of the respondents. Colleagues of the

researcher and peers will review the present study to ensure reliability. Finally, no discrimination was intended in this study in terms of gender, race, religion, etc.

3.13 Summary

The present chapter of the study has presented the research design, philosophy, method, approach, sampling technique, sample size determination, and the research instrument. The time horizon, study setting, population of the study, data collection method and procedure, determination of effective response rate, measures of the study, and last but not least, the statistical measurement of the model using SEM have all been explained through this chapter. The rationale behind the adoption and choice of each method has been specified in the study. The study implements the positivist philosophy to evaluate the dependencies and associations among the variables. The survey was selected as the data collection tool, and the data was collected from the software firms of Pakistan listed on the PSEB portal practicing BDM and SEO in their organizations. Also, the sample size and research instrument design were discussed; the ideal sample size was set at 1100. The research instrument was designed sequentially to increase the respondents' comprehension. A pilot study indicated some of the minor flaws prevalent in the instrument's design, which were corrected. This chapter also stated the ethical considerations and norms followed to increase the validity and precision of the study's findings.

Chapter 4: Analysis and Results

4.1 Introduction

This chapter presents the empirical research findings for the research questions, objectives, and hypotheses established in the previous sections. The main focus of the present study is to investigate the associations between BDM, SEO, exploitive and exploratory innovation, and SEP. The methodology described in the previous section is used to analyze the conceptual framework's context to answer the research questions established in the first chapter of the study. Various techniques for verifying the model, sampling adequacy, descriptive analysis, demographical profile, and validity of the constructs were applied. The SEM technique was then applied to test the hypothesized relationships. This chapter provided information on data characteristics, theorized model, and the truth of the hypothesized relationships.

4.2 Procedures for Analysis

The analysis for the present study has been executed using the latest versions of AMOS and SPSS software. The analysis has been performed in two steps. The first step is associated with the preliminary analysis, where the adequacy of the data and sample, and the general summaries of the data, are computed. Measures like demographical analysis and descriptive tests are used to compute the sample characteristics, and data summaries are computed to evaluate the normality of the data along with missing values and outlier assessment.

The second phase of the study is related to computing the validity and reliability of the constructs involved in the hypothesized model and, in a continuation of the second step, the relationships among the variables are computed through the application of regression analysis to justify and find the significant relationships hypothesized among the variables considered for the study. For this purpose, the researcher performed various tests and techniques to ensure construct validity, which is comprised of convergent and divergent validity, as recommended in Joe F Hair et al. (2011). Additionally, descriptive analysis and a demographical profile have been constructed as well. To check for factor loadings, CFA has been conducted. Finally, the researcher used the path estimation procedure to show the variables' direct, indirect, and total effects on each other.

4.3 Demographical Profile

Demographical information collection is one of the essential stages of data collection. It is defined as the statistical data collected about the population's characteristics, like age, gender, and income. The demographical information is crucial for data reporting and results from generalizations. It is commonly used to explain how well the respondents adhere to and respond to the phenomenon under evaluation based on their profile and characteristics. Demographic information informs the researcher of the research participants' characteristics, which is necessary to determine whether the individuals in a study are representatives of the population under consideration for generalization purposes.

Connelly (2013) stated that it is essential to evaluate and describe the participants of a research study (i.e., demographical profiling is an essential component of reporting). Demographics have been realized as components or variables, such as age, qualification, experience, gender, and ethnicity, which researchers collect to explain the nature of the sample using inferential statistics. The demographic data is used to describe the sample that has been taken from the population. The data is used to differentiate between the participants included in surveys. When designing a survey or a research study, one of the critical responsibilities of the researcher is to decide from whom to collect the data and how the overall survey response data needs to be broken down so that an influential group of respondents can be selected.

A demographic profile is a reflection of the characteristics of the respondent sample. The information collected from the participants under the characterization of demographics is essential for generalizing the study results. Moreover, these are independent variables because any other variable cannot manipulate. In this research, data has been collected from the software houses of Pakistan that deal in BDM. The frequency distribution method has been used to evaluate the demographical profiling of the respondents.

4.3.1 Coding

The data collected from the respondents was finalized and entered into an Excel sheet. Once the data was coded and entered into an Excel file, it was transferred to SPSS for further analysis and testing. The data was collected against five variables in this study: gender, age, experience,

marital status, and education/qualification. The first variable analyzed was gender, and the variable was coded as 1 = male and 2 = female. The second demographic entity or characteristic recorded was age, which measured the age of the respondents in four age groups; the variable was coded as 1 = less than 25, 2 = 26–30 years, 3 = 31–35 years, and 4 = above 35. The sample's third demographic characteristic measured and recorded was their work experience (i.e., the amount of time they have spent working in the technological industry). Four options were developed for this variable coded as 1 = less than two years, 2 = 3–5 years, 3 = 6–8 years, and 4 = more than 8 years. The next characteristic recorded for the analysis was the participants' marital status, which was coded as 1 = married and 2 = single. The fifth and last characteristic inquired from the respondents was their educational background or qualification. There were four categories or options for this variable that were coded as 1 = intermediate, 2 = bachelors, 3 = masters and 4 = others.

4.3.2 Gender

The first demographic or characteristic documented of the participants was their gender. Table 1 presented the gender profile of the research participants and finalized sample size. The table shows that 958 respondents have been included in the study. 525 (54.8%) were men, and 433 (45.2%) of the sample were women. This disparity is proof that more men are working in Pakistani software houses than women.

Table 1: Gender profile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	525	54.8	54.8	54.8
	Female	433	45.2	45.2	100.0
	Total	958	100.0	100.0	

The gender distribution graph in Figure 2 reflects the same information as the table above; the proportion of male participants is greater than that of female participants. It can be seen that the height of the bar for male respondents is slightly higher than that of the female respondents, as evidenced by the gender profile in Table 1 as well.

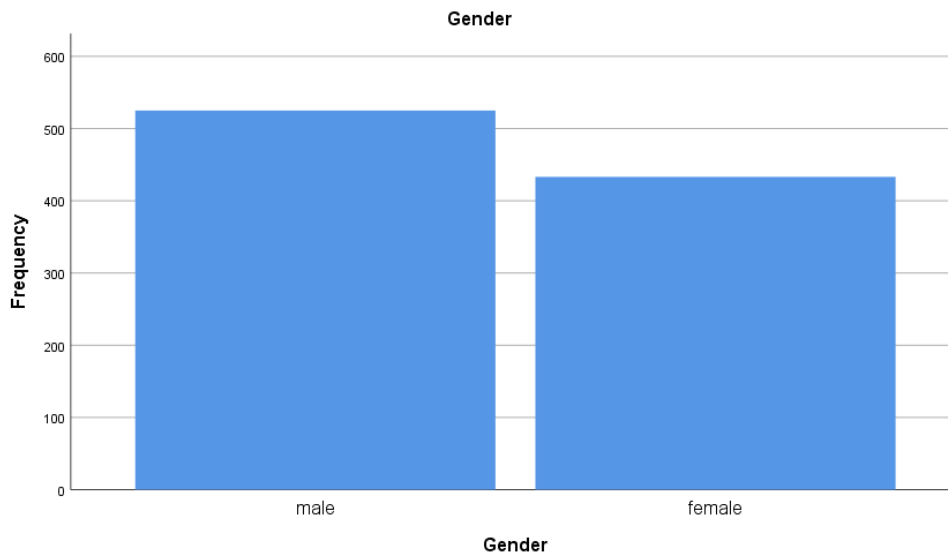


Figure 2: Gender distribution

4.3.3 Age

The age variable has been divided into intervals of 5 years. The first interval comprised all respondents under 25 and the last one comprised all those above 35. Of all the respondents, 313 respondents fall in the first range (i.e., below the age of 25 years), representing 32.7% of the sample, the second interval is from 26 to 30 years and includes 383 respondents representing 40% of the sample, 221 in the third range (i.e., 31 to 35 years) and is representative of 23.1% of the sample and 41 are in the last interval of more than 35 years.

Table 2: Age profile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less Than 25 Year	313	32.7	32.7	32.7
	26 to 30 Years	383	40.0	40.0	72.7
	31 to 35 Years	221	23.1	23.1	95.7
	More Than 35 Years	41	4.3	4.3	100.0
	Total	958	100.0	100.0	

These four intervals and the distribution of the respondents are represented through the age distribution graph figure3. The graph shows that the second interval has the most significant number of respondents as the second interval bar is the highest bar; it is followed by the first interval (i.e., less than 25 years), then by interval 3, and the least number of respondents is in the last interval which includes people above the age of 35 years, this is primarily because BDM technology is relatively new in Pakistan. Therefore, the people working in its domain are mainly fresh computer sciences and engineering graduates.

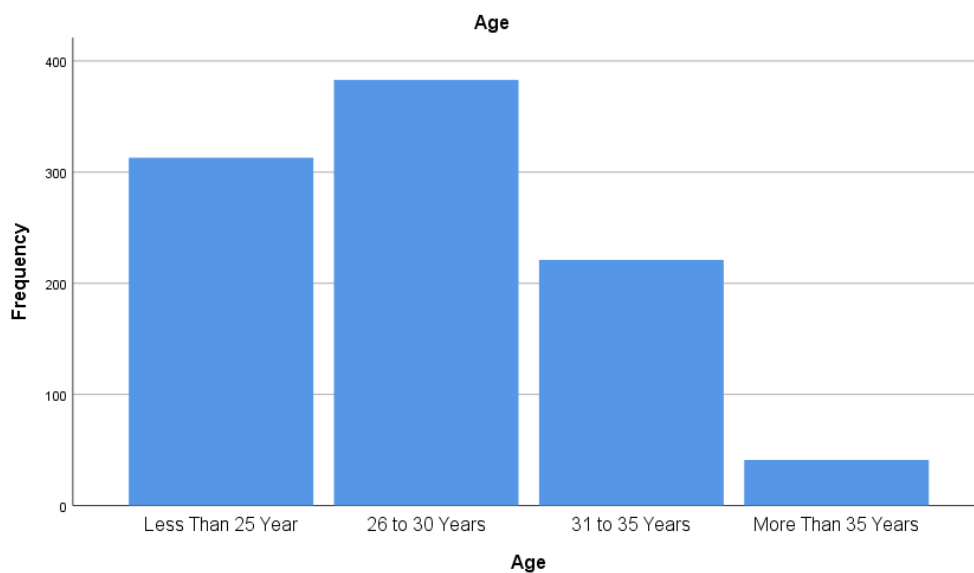


Figure 3: Age distribution

4.3.4 Experience

The information relates to the experience of people working in software development organizations. The researcher inquired about project developers' level of experience regarding the number of years they had worked in software houses. A total of 136 respondents, 14.2%, had below two years of experience, 420 respondents, 43.8%, had between 3 and 5 years of experience, 311 respondents, 32.5%, had between 6 and 8 years of experience, and 91, 9.5%, had over 8 years of work experience.

Table 3: Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 2 Year	136	14.2	14.2	14.2
	3 to 5 Year	420	43.8	43.8	58.0
	6 to 8 Year	311	32.5	32.5	90.5
	More than 8 Year	91	9.5	9.5	100.0
	Total	958	100.0	100.0	

The experience distribution graph in figure 4 shows that the most significant number of respondents have experience of between 3 and 5 years, as the peak of the bar graph is highest for this group and reflective of the most of the participants falling in this category; this supports the findings of the age group of the respondents and shows that young people are a more comprehensive component of the technology management and implementation services and sector.

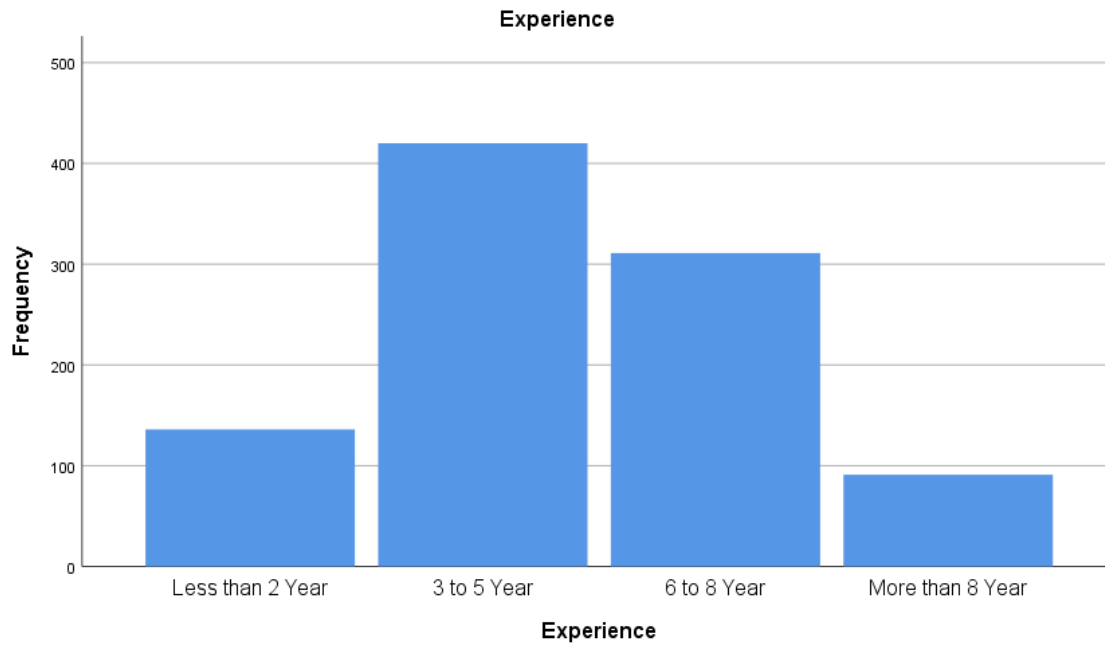


Figure 4: Experience distribution

4.3.5 Marital Status

The following demographical information the respondents were asked to give was their marital status. Table 4 shows that more than half of the sample is single (i.e., 504 respondents, representing 52.6% of the overall sample), whereas the remaining 454 reported themselves to be married.

Table 4: Marital Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	504	52.6	52.6	52.6
	Married	454	47.4	47.4	100.0
	Total	958	100.0	100.0	

The marital status distribution in Figure 5 displays the information shown in Table 4. It can be seen that the graph is divided into two categories: married and single. The graph below indicates that a greater proportion of the sample was single.

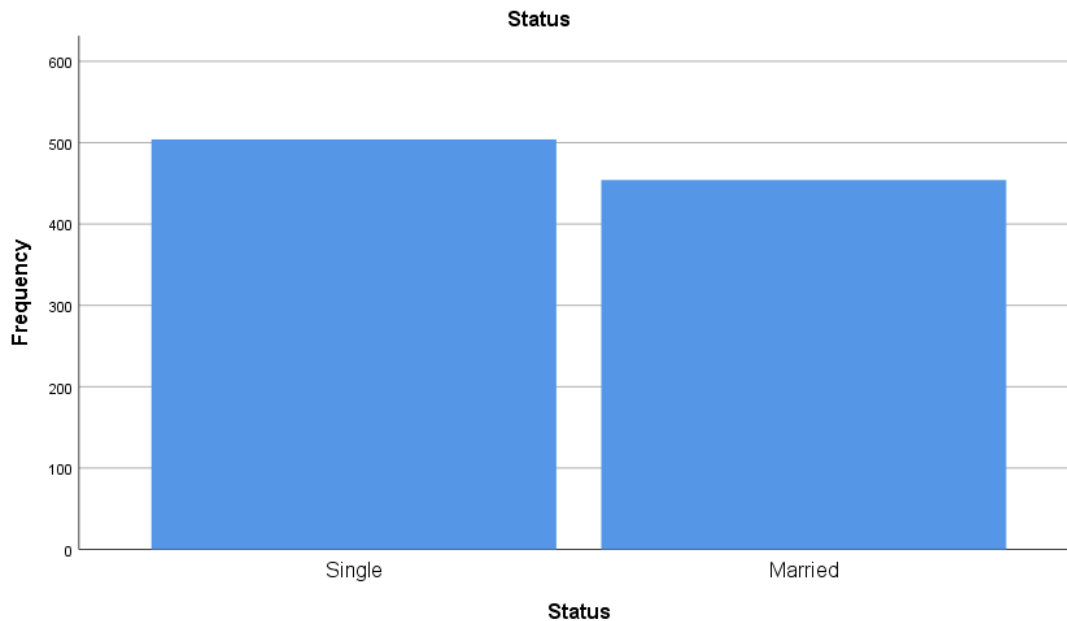


Figure 5: Marital status distribution

4.3.6 Qualification/Education

The following demographic characteristic evaluated was qualification (i.e., the educational status of the respondents). The qualification variable was divided into four levels: intermediate, bachelor's, master's, and others. Out of 958, 120 (12.5%) of the respondents have an education level of intermediate, 473 out of 958 (49.4%) have an education level of graduation, 308 out of 958 (32.2%) have masters level education, and 57 respondents (5.9%) have either lower or higher degrees, as they selected “others.”

Table 5: Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Intermediate	120	12.5	12.5	12.5
	Bachelor	473	49.4	49.4	61.9
	Master	308	32.2	32.2	94.1
	Other	57	5.9	5.9	100.0
	Total	958	100.0	100.0	

The qualification distribution graph presented in figure 6 is representative of the participants' qualifications. The height of the bars represents the number of participants falling in each category. It can be seen that the height of the second category (i.e., bachelor) is the highest and represents the most respondents, followed by participants acknowledging their educational level as masters, intermediate, and then 'others.'

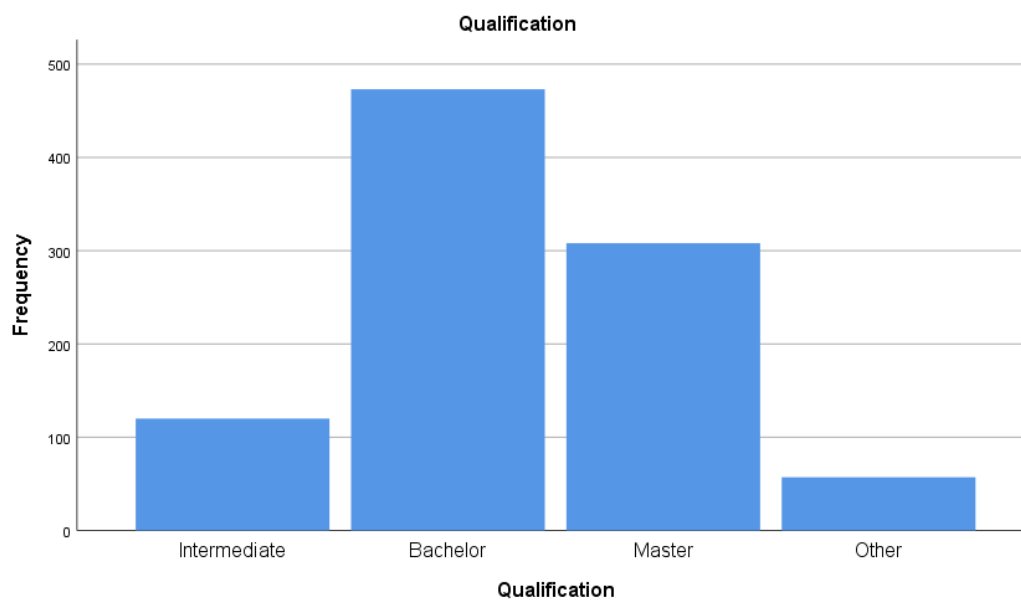


Figure 6: Qualification distribution

4.4 Evaluation of Missing Values

The questionnaires used in the study were screened thoroughly for the presence of missing values before the data was formally entered into an Excel file. The process was simplistic but critical to facilitating error-free data entry. Furthermore, the descriptive analysis was also evaluated to ensure the reliability of the data. According to Joseph F Hair et al. (2011), missing data is considered a significant problem as the results and analysis can be affected by its presence. The impact of missing values or data is more severe when SEM is applied (Arbuckle, 2009), which is true in the present case. Chi-squared values and other measures of a model's fitness, like the goodness of fit (GFI) and other modification indices, are affected (i.e., in the case of missing values, these indices cannot be computed). Also, it is essential to evaluate the missing values and the extent of these values present in the sample, as this discovery helps eliminate or resolve the issues (Pallant, 2020). According to Tabachnick et al. (2007), if the missing values are distributed randomly within the questionnaire, the data can be ignored. However, suppose the values are distributed non-randomly (e.g., missed responses for a particular construct are present). In that case, the results' generalizability is affected and the problem needs to be dealt with. According to Schumacker and Lomax (2004), the presence of 5% of missing values or data is deemed acceptable.

After the initial demographical evaluation, the data analysis proceeded with handling data and examining missing values. Evaluation of the data's characteristics and precision is necessary to evaluate the data entry process (J. F. Hair et al., 1998). For this purpose, all the cases or entries were verified case by case, and then the frequency distribution and missing data test from SPSS was performed to verify the presence or absence of missed values. Missing values are defined as questions unattended to by the participants and any missed case by the researcher (Coakes & Steed, 2001). A double-check on all the cases was carried out to maintain a high degree of precision in the data. At first, all of the entries were verified by case, and then the missing data test was performed on the variable entries. The missing data test showed two mistakes in the data entry process and thus the accuracy of the data was found to be 99.25%.

In the next step, the responses from the participants were evaluated for missing values. Several researchers agree that the data needs to be verified against missing values as it dampens the accuracy of the data and produces biased estimates (Acock, 2005). Moreover, the presence of

missing values in the data results in lower reliability levels and affects the results of an SEM (Tabachnick et al., 2007). Thus, the data were scrutinized for the presence of any missing values or values missed by the participants. The findings indicated that three questionnaires had over 40% of missing values. According to Sekaran and Bougie (2016), if the missing values are less than 5%, the measure is considered appropriate and can be included in the data. Missing values are viewed as a lack of knowledge of the respondent or a consequence of stress and lack of attention. A total of 1100 questionnaires were distributed, out of which 961 were returned, and 3 were found to have over 40% of missing values; therefore, they were excluded from the data file.

4.5 Descriptive Statistics

A descriptive analysis is used to formulate a descriptive evaluation of the general features of the data, like the summary statistics for the variables used in the study (Fisher & Marshall, 2009). In studies involving large datasets, descriptive analysis helps the researcher manage the data, and features like normality, outliers, and response orientation can be assessed. In summary, descriptive statistics are used to numerically describe and summarize features and the data of a research study (Oja, 1983). The statistics computed through descriptive statistics are used to inform the researcher of the basic features of the data and are also used to compute simple summaries relating to the sample and measures. In descriptive statistics, you simply describe what is or what the data shows. Since a descriptive analysis is used for summarizing and presenting the data's characteristics, the kind of data needs to be analyzed for an accurate summary. The evaluative techniques for data differ; for example, if the data is categorical, then frequency distributions and cross-tabulations are used to generate descriptive analysis results. If the data is scale level, then the summaries or descriptive is used. If the data is based on multiple response options, percentages are used to present a data summary. In the present study, a Likert scale was used to record responses. Therefore, the data was identified as scale level; therefore, the descriptive method was used to summarize the data's characteristics. When summarizing quantitative data, the typical types of information of interest are: to find the central point of the data (i.e., averages, accomplished through the mean, median, or mode of the data); the standard deviation values to show how the data is spread out; the extremes of data shown through minimum, maximum and outliers; and the shape of data distribution, which confirms if the data is normally distributed or not, through tests like skewness and kurtosis.

Descriptive analysis can be generated through SPSS; the software computes a set of basic descriptive statistics inclusive of valid responses, mean, sum, standard deviation, variance, minimum and maximum range, standard error of the mean, and skewness kurtosis. As shown in Table 6, the researcher computed the valid responses (i.e., the responses exclusive of missing values), mean, minimum, and maximum ranges, standard error, and skewness of the data. The descriptive analysis in the present study was used to test three main features of the data: the presence of outliers, normality, and response orientation. Outliers are extreme values, higher or lower, present in the data. Under the concepts of Hodge and Austin (2004), outliers are the values distant from the other observations of the study. The presence of outliers affects the model's fitness and increases the incidence of error values. This study detected potential outliers by evaluating the minimum and maximum values displayed in the data summary. The descriptive analysis was also used for testing data normality. Normality tests are used to ensure that the dataset is well-modelled and has a normal distribution; these tests also measure the underlying random variable in the dataset (Park, 2015). To obtain conclusive outcomes via SEM, it is essential to support a normal dataset. Before any analysis, it is essential to determine the normality of the data as it is one of the most fundamental requirements of SEM and regression analysis. The primary purpose of evaluating the normality of the data is to find out whether the data lies within structured ranges or not.

Furthermore, the evaluation of the response orientation of the participants aids the researcher in evaluating the response pattern shown by the respondents. The mean values are used to evaluate the average values, and the response orientation of the participants, which is an indication of the general perception of the research participants relating to the statements and items inquired into through the study. The minimum and maximum displayed in Table 6 indicate the measurement scale ranges, 1–5, for the 5-point Likert scale used in the present study. The mean values are the average of responses for each item. Skewness values refer to distortion or asymmetry in a symmetrical bell curve or normal distribution in a data set (Groeneveld & Meeden, 1984; Mardia, 1970), which means skewness is a measure of distortion in the normal distribution of a dataset (Ho & Yu, 2015). A customarily distributed dataset has a zero skew.

Table 6: Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Democratization	958	1.00	5.00	3.2545	1.14442	-.203	.079
Contextualization	958	1.00	5.00	3.1933	1.16964	-.129	.079
Experimentation	958	1.00	5.00	3.3250	1.18702	-.332	.079
Execution	958	1.00	5.00	3.3430	1.12621	-.286	.079
Orientation	958	1.00	5.00	3.3756	1.14392	-.280	.079
Exploitative	958	1.00	5.00	3.2864	1.19534	-.240	.079
Exploratory	958	1.00	5.00	3.3271	1.20476	-.164	.079
Economic	958	1.00	5.00	3.2409	1.14355	-.134	.079
Environment	958	1.00	5.00	3.1541	1.15877	-.124	.079
Social	958	1.00	5.00	2.9894	1.15427	.023	.079
Valid N (listwise)	958						

The values in Table 6 represent the descriptive analysis of the study and show a detailed explanation of the study's variables and their descriptive coefficients that give a complete summary of the data. The table indicates that 958 valid responses have been calculated against each variable. The table confirms the absence of outliers as the maximum and minimum values are in the threshold range of 1 to 5, which is in line with the ranges of the 5-point Likert scale; this is shown by the minimum and maximum column, which have values above or equal to 1 for minimum and 5 or below for maximum. The mean values for almost all the variables approach 3.3; this shows that the participants showed an inclination or assertion with all the questionnaire statements. Moreover, the skewness values are within the range of -1 to 1; this shows that the given data is normally distributed and valid. The results in Table 6 prove that

the data is valid (i.e., it is normally distributed and free from outliers) and therefore eligible to be used for further testing.

4.6 Sample Adequacy

Sampling adequacy is evaluated through the KMO test and Bartlett’s test. The KMO test is a measure used to indicate the suitability of the data for factor analysis. The test is used to evaluate the sampling adequacy of each of the variables included in the study and the whole research model. The statistics gauge the proportion of variance present among the variables that might be occurring as a common variance. The lower the proportion of variance, the more the data is suitable for factor analysis. The presence of underlying factors indicates this proportion of variance. High values (i.e., values closer to 1) generally indicate that conducting a factor analysis will provide relevant results. However, if the value is less than 0.5 or inclined toward the lower end, it is an indication that factor analysis will not provide favourable results (Vogt & Johnson, 2011). Bartlett’s sphericity test compares the correlation matrix formulated by the variables with the identity matrix. Simply stated, the test is used to evaluate whether there is redundancy between the variables that can be summarized with the help of some factors. The Bartlett test thus tests whether the correlation matrix formulated by the variables is an identity matrix and tests for the presence of relevance among the variables because unrelated variables are not suitable for factor analysis and structure detection. The significance of the test is used to indicate the absence of redundancy in the data and indicates that factor analysis of the data will be useful (Snedecor & Cochran, 1989).

Table 7: KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.950
Bartlett's Test of Sphericity	Approx. Chi-Square	44209.390
	Df	1431
	Sig.	.000

Table 7 presents the results of the KMO test and Bartlett test. It can be seen that the KMO value is close to 1; thus, the value is significant and indicative of the suitability of the data for factor analysis. Moreover, Bartlett’s test is also significant, as indicated by the *p*-value of the test. Both tests are significant and show no redundancy, and the data is suitable for factor analysis.

4.7 Confirmatory Factor Analysis

This study uses CFA to examine the relationships between the constructs used in the study (i.e., the factors or variables present in the conceptual model) (Arbuckle, 2009). To evaluate the measurement model through CFA, the researcher first estimates the model's fitness and then evaluates the measurement or conceptual model's validity (construct validity). The CFA technique is a method that does not require exogenous and endogenous variables to be distinguished from one another; however, differentiation is essential during the testing stage of the model. As presented in Figure 10, all constructs are linked together, and rectangular shapes represent Two-headed arrows indicating the covariance present between the construct items. At the same time, causal associations or relationships are represented by a single-headed arrow between an indicator and a construct. In the present study, the sample data was subjected to a series of preliminary tests (e.g., missing values analysis, outliers, KMO, and Bartlett's test) to specify the best models for the study. 54 items are present in the study, primarily derived from exploratory factor analysis and used for the CFA.

The CFA is a test used to evaluate whether the understanding of the constructs included in the research model is comparable with the researcher's understanding of these constructs (Harrington, 2009). Suppose there is existing information about a substantive theory, some previous results or a similar research design. The researcher can opt to use CFA in which particular parameters are set to previously recommended values, typically zero. CFA can be performed in cases where restrictions are put on specific parameters, error terms, or correlations. Going one step ahead of exploratory factor analysis, CFA permits the testing of the viability of the research model as a whole, not simply the number of factors, and this test is mainly driven by theory (Thompson, 2004).

In the present study, the CFA step was carried out individually to evaluate the fitness of all the constructs being considered in the study (i.e., the CFA was performed individually on BDM, SEO, exploitative innovation, exploratory innovation, and SEP). Once the fitness of the overall constructs was established, the nested model's fitness and the loadings of all contributory items were computed.

The model was first evaluated through factor analysis before subjecting it to structural analysis; once the model's fitness and validity have been confirmed, then the next phase of the analysis can be performed. One of the primary rationales behind the assessment of the constructs through CFA is to evaluate the validity of the model, individual factors, the nested model, and the loadings of the items involved in the construct. In the case of any weakened validity (i.e., debilitated validity or low validity of the model), further steps of the structural analysis do not proceed. Evaluating the model's validity is a multifold valuation that elaborates discriminant and convergent validity. To evaluate and confirm the model's validity fully, the CFA step was repeated once for each of the variables and then for all of the variables included in the hypothesized model. Hu and Bentler (1999) formal and recommended techniques for assessing factor loading values and the fitness of a model were adopted in the present study. The technique suggests that the fitness of a model can be observed through a combination of the root mean square error of approximation (RMSEA) of the default model along with the GFI, comparative fit index (CFI), minimum discrepancy function (CMIN), incremental fit index (IFI) and Chi-squared values. The RMSEA is defined as an absolute fit index, and it assesses how far the hypothesized model is from a perfect model (Xia & Yang, 2019). The value of the RMSEA criterion is supposed to be within the benchmark of 0.08 (i.e., a value of less than 0.08 is considered appropriate and acceptable) (Jackson et al., 2009).

Chi-squared is a statistical term applied to models that might not have an adequate sample size. RMSEA has been suggested to support a confidence interval, which is perceived as an added benefit and a more suitable measure than the Chi-squared (Hooper et al., 2008). The CFI, on the other hand, is dissimilar to the absolute fit index, RMSEA, and is considered to be a trusted auxiliary score (Hooper et al., 2008). In the present study, for the sake of building a reference, the values of the CFI, adjusted GFI (AGFI), and GFI were required to be higher than 0.9, which is an acceptable value following Xia and Yang (2019) and Asparouhov and Muthén (2016), as these measures indicate the reliability of the hypothesized model (Joseph F Hair et al., 2011; J. F. Hair et al., 1998). To evaluate the constructs' precise values and fitness indices, the required parameters were estimated and reported. However, if any nominal or unacceptable values were present, the indicator was removed from the projected model. Thus, following the recommendations of Hu and Bentler (1999) and Joseph F Hair et al. (2011), the measures of GFI, CFI, Tucker–Lewis index (TLI), RMSEA, IFI, and the CMIN/DF (minimum

discrepancy/degree of freedom) were estimated for the constructs and then for the complete model.

Thus, the subsequent sections of the analysis presented the initial measurement of the model's fitness along with the results of the CFA. CFA is used to incorporate the testing of dimensionality and evaluate the model's underlying structure based on theoretical grounds. This method further allows the researcher to simplify, modify, and proceed with any refinement to the measurement model to examine the model's fitness and test the theories presented through the conceptual model. Though the identification of the model is one of the basic requirements of CFA, assessment of the standardized loadings (i.e., the regression weights and the modification indices displayed in the output of AMOS) presents options to verify the fitness and dimensionality of the measurement model.

The modification indices consist of the covariances, variances, and regression weights. These indices are examined while evaluating a model's fitness to get the direction or the extent of modification required for the model's constructs. They indicate, for example, whether incorporation of or deletion of parameters among or between the unobserved variables is required to achieve a greater fitness of the model. According to Anderson and Gerbing (1988), under acceptable but proper and converged solutions, deleting or relating indicators from the model is one of the preferred ways to respecify the model; this indicates that either the addition or the deletion of a new indicator is one of the best ways to improve the model's fitness. Any change in the model or deletion of items is an iterative process that changes parameters and either improves or deteriorates model fitness statistics. Thus, keeping these dilemmas under consideration, the measurement models for each of the constructs and its measures will be modified only if evidence of high covariances in items and errors are found in the case of low loading values. The decision for re-specification of the model was taken based on the findings of each construct and is discussed below.

4.7.1 Big data Management Model Fitness

BDM consisted of four sub-constructs: big data democratization, big data contextualization, big data experimentation, and big data execution. The construct was measured based on these sub-constructs, and the model's fitness was tested, encompassing all the items represented by

this multiple construct variable. The factors were evaluated independently as the four sub-constructs represent the variable ‘BDM’ and suggest different characteristics and facets of the BDM concept and process. The BDM scale consisted of 23 items: 7 items for big data democratization, 5 items for big data contextualization, 6 items for big data experimentation, and 5 items for big data execution. All of the items were included in the study, as Figure 7 demonstrates. The model was run and evaluated through the latest version of the AMOS software. The fitness of the model and the factor loadings have been evaluated. The results are shown in Table 8, and Figure 7 indicate that the model was per the standardized ranges of fitness and demonstrates appropriate factor loadings. The results indicate the presence of high covariances in the items of the variable and its error terms. Therefore, the modification indices were explored for this construct, and thus, some of the error terms in the construct were aligned to covary. This is illustrated by the double-headed arrow joining the errors of the variable. After a slight modification, it was found that the factor loadings were well above the lower limit (i.e., 0.5), and thus, no items were deleted from the projected model (Joseph F Hair et al., 2011). The factor loadings of the items were within the range of 0.68 to 0.9, as shown in Figure 7. Moreover, Table 8 shows that the values were within the threshold ranges: CMIN/DF was less than 3; GFI was greater than 0.8; IFI, TLI, and CFI were greater than 0.9; and RMSEA was less than the threshold value of 0.08. These values indicated an exceptional model fit.

Table 8: Big data management model fitness

Indicators	Threshold Range	Observed Values
CMIN/DF	Less or equal 3 or 5	2.932
GFI	Equal or greater .80	.948
TLI	Equal or greater .90	.974
IFI	Equal or greater .90	.978
CFI	Equal or greater .90	.978
RMSEA	Less or equal .08	.045

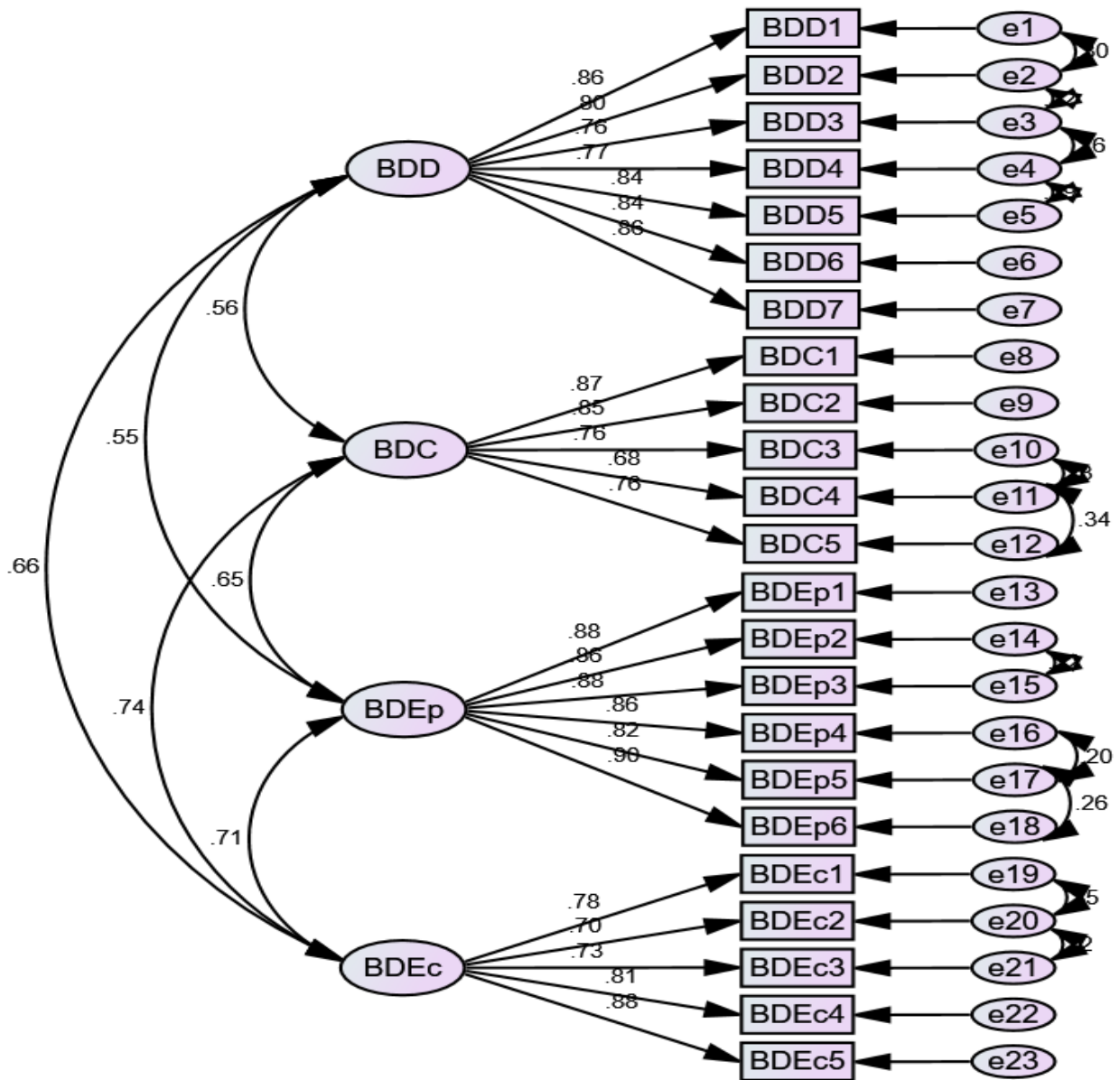


Figure 7: Big data management confirmatory factor analysis path

4.7.2 Sustainable Entrepreneurial Orientation Model Fitness

SEO has been evaluated based on seven items. All of the items were included in the study, as Figure 8 demonstrates. The model was run and evaluated through the latest version of the AMOS software. The fitness of the model and the factor loadings have been evaluated. It can be seen through the results indicated in Table 9 and Figure 8 that the model was per the

standardized ranges of fitness and demonstrated appropriate factor loadings as well. The results indicate the presence of high covariances in the items of the variable and its error terms. Therefore, the modification indices were explored for this construct, and thus, some of the error terms in the construct were aligned to covary. This is illustrated by the double-headed arrow joining the errors of the variable. After a slight modification, it was found that the factor loadings were well above the lower limit (i.e., 0.5), and thus, no items were deleted from the projected model (Joseph F Hair et al., 2011).

The factor loadings of the items were within the range of 0.78 to 0.86, as demonstrated in Figure 8. Moreover, Table 9 shows that the values were within the threshold ranges as well: CMIN/DF was less than 3 and supported a value of 5; GFI was greater than 0.8, and the observed value was 0.986; IFI was greater than 0.9, and the observed value was 0.992; TLI was greater than 0.9, and the observed value was 0.981, and CFI was also greater than 0.9, and the observed value was 0.992. Last, the RMSEA was less than the threshold value of 0.08, and the observed value was 0.069. These values have indicated an exceptional model fit.

Table 9: Sustainable entrepreneurial orientation model fitness

Indicators	Threshold Range	Observed Values
CMIN/DF	Less or equal 3 or 5	5.00
GFI	Equal or greater .80	.986
TLI	Equal or greater .90	.981
IFI	Equal or greater .90	.992
CFI	Equal or greater .90	.992
RMSEA	Less or equal .08	.069

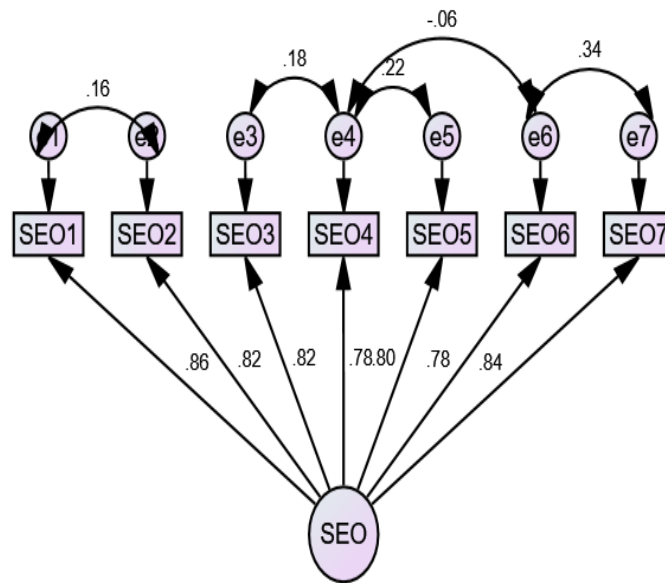


Figure 8: Sustainable entrepreneurial orientation confirmatory factor analysis path

4.7.3 Innovation Model Fitness

Innovation has been evaluated based on two sub-constructs: exploitative innovation and exploratory innovation. Both exploitative and exploratory innovation consists of 5 items each, and thus, the innovation factor was evaluated based on 10 items. All of the items were included in the study, as Figure 9 demonstrates. The model was run and evaluated through the latest version of the AMOS software. The fitness of the model and the factor loadings have been evaluated. It can be seen from the results indicated in Table 10 and Figure 9 that the model was per the standardized ranges of fitness and demonstrated appropriate factor loadings as well.

The results do indicate the presence of high covariances in the items of the variable and its error terms. Therefore, the modification indices were explored for this construct, and thus, some of the error terms in the construct were aligned to covary. This is illustrated by the double-headed arrow joining the errors of the variable. After a slight modification, it was found that the factor loadings were well above the lower limit (i.e., 0.5), and thus, no items were deleted from the projected model (Joseph F Hair et al., 2011). The factor loadings of the items were within the range of 0.82 to 0.90, as demonstrated in Figure 9.

Moreover, Table 10 shows that the values were within the threshold ranges as well: CMIN/DF was less than 3 and supported a value of 2.668; GFI was greater than 0.8, and the observed value was 0.984; IFI was greater than 0.9, and the observed value was 0.994; TLI was greater than 0.9, and the observed value was 0.991, and CFI was also greater than 0.9, and the observed value was 0.994. Last, the RMSEA was less than the threshold range of 0.08, and the observed value was 0.042. These values indicated an exceptional model fit.

Table 10: Innovation model fitness

Indicators	Threshold Range	Observed Values
CMIN/DF	Less or equal 3 or 5	2.668
GFI	Equal or greater .80	.984
TLI	Equal or greater .90	.991
IFI	Equal or greater .90	.994
CFI	Equal or greater .90	.994
RMSEA	Less or equal .08	.042

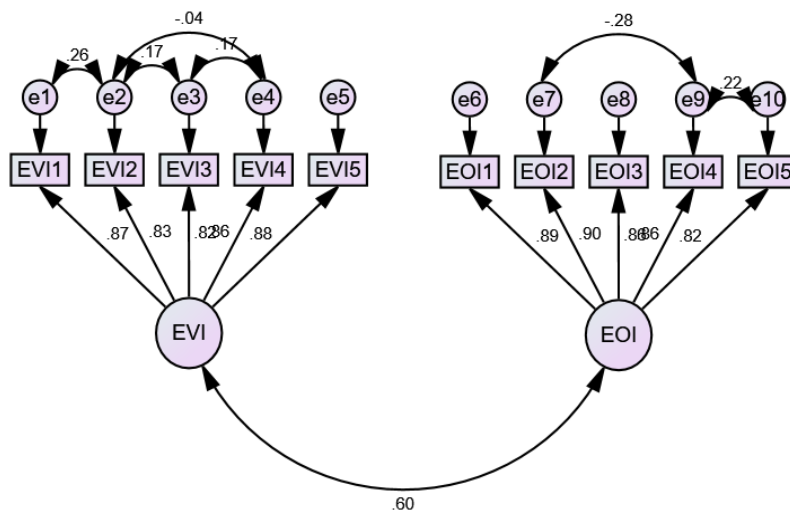


Figure9: Innovation confirmatory factor analysis path

4.7.4 Sustainable Entrepreneurial Performance

SEP has been evaluated based on three sub-constructs: economic performance, environmental performance, and social performance. The overall construct consists of 14 items: sustainable economic performance is evaluated based on 4 items, environmentally sustainable performance has been evaluated based on 5 items, and social entrepreneurial performance has also been measured based on 5 items. All of the items were included in the study, as Figure 10 demonstrates.

The model was run and evaluated through the latest version of the AMOS software. The fitness of the model and the factor loadings have been evaluated. It can be seen from the results indicated in Table 11 and Figure 10 that the model as per the standardized ranges of fitness and demonstrated appropriate factor loadings as well. The results indicate the presence of high covariances in the items of the variable and its error terms. Therefore, the modification indices were explored for this construct, and thus some of the error terms in the construct were aligned to covary.

This can be seen from the double-headed arrow joining the errors of the variable. After a slight modification, it was found that the factor loadings were well above the lower limit (i.e., 0.5), and thus, no items were deleted from the projected model (Joseph F Hair et al., 2011). The factor loadings of the items were within the range of 0.73 to 0.86, as demonstrated in Figure 10. Moreover, Table 11 shows that the values were within the threshold ranges as well: CMIN/DF was less than 3 and supported a value of 2.668; GFI was greater than 0.8, and the observed value was 0.984; IFI was greater than 0.9, and the observed value was 0.994; TLI was greater than 0.9, and the observed value was 0.991, and CFI was also greater than 0.9, and the observed value was 0.994. Last, the RMSEA was less than the threshold range of 0.08, and the observed value was 0.042. These values indicated an exceptional model fit.

Table 11: Sustainable entrepreneurial performance model fitness

Indicators	Threshold Range	Observed Values
CMIN/DF	Less or equal 3 or 5	2.995
GFI	Equal or greater .80	.970
TLI	Equal or greater .90	.982
IFI	Equal or greater .90	.986
CFI	Equal or greater .90	.986
RMSEA	Less or equal .08	.046

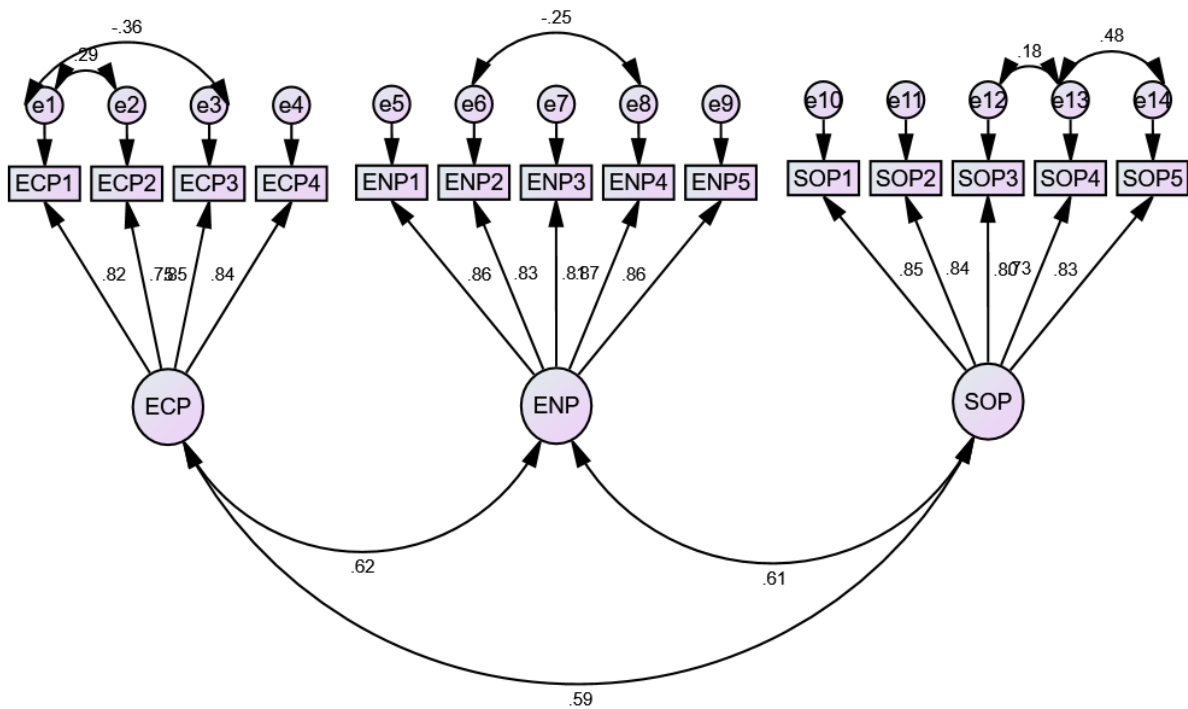


Figure 10: Sustainable entrepreneurial performance confirmatory factor analysis path

4.8 Factor Loadings

Once the individual constructs have been loaded and the factors and fitness of the model have been estimated, the analysis moves toward the next phase. As the significance and fitness of the individual constructs were evaluated in the previous section, the complete model will be evaluated in this part of the analysis. The standardized regression weights or the loading values of each of the constructs will be considered to evaluate the validity and fitness of the complete hypothesized model rather than the individual constructs.

Construct validity is one of the most efficient methods of defining the validity of the research model and evaluating the regression weights. The presence of construct validity is decided based on convergent and discriminant validity. The presence of convergent validity depends on high associations and junction among the measures of a similar variable compared to the other constructs or variables. The correlation coefficients mold the determination of convergent validity (Churchill Jr, 1979). However, in contrast, discriminant validity is based on the significant but slightly correlated measures of the different variables. Comparison of the coefficients of the variables is helpful in the determination of discriminant validity (Churchill Jr, 1979). The reliability and the validity of the measures, and their significant loading values, help in the testing of various criteria of the model. To test the reliability of the constructs, the reliability test is computed, which presents the Cronbach alpha value against each construct. Generally, a value higher than 0.7 indicates the reliability of constructs (Joseph F Hair et al., 2011). As specified before, discriminant validity and convergent validity are essential aspects of construct validity and validate the model. Convergent validity refers to the degree of closeness or the relativity of the new scale concerning the other variables of the construct. The construct should ideally correlate with related variables and not correlate or associate with dissimilar and unrelated variables.

The validation process of the model is essential before proceeding to the structural analysis. Thus it is essential to test the reliability and validity of the measures, as the study results can be affected by the presence of invalid and unreliable constructs. Therefore, to satisfy the study's objectives and test the truth of the hypotheses, it is essential to test the validity of the conceptual model (Joseph F Hair et al., 2011). The tests of reliability and validity differ from one another but are closely related to one another (Bollen, 1989). According to the concepts laid out by

Holmes-Smith (2011), a measure can be communicative or show results of high reliability (i.e., consistency). Still, it might not be valid (i.e., accurate), and a measure can support high validity or accuracy but may not be reliable or consistent.

Validity has been defined as the extent to which a set of measured variables represent the latent theoretical construct designed to measure by Joseph F Hair et al. (2011). Construct validity is evaluated through discriminant and convergent validity. As convergent validity evaluates the extent to which measures of a specific construct share a high proportion of variance or converge with one another, it is, in other words, indicative of the degree to which two constructs or measures should theoretically be related are in reality correlated. Discriminant validity or divergent validity is specified by how the concept or construct is insimilar and distinct from other constructs.

According to Hair et al. (2011), validity and reliability can be measured using composite reliability (CR), average variance extracted (AVE), maximum shared squared variance (MSV), and average shared squared variance (ASV). CR and Cronbach alpha values are used to establish the reliability of the constructs, where CR is an indicator of convergent validity. According to Joseph F Hair et al. (2011), the CR values of the measures should be greater than 0.6 and ideally greater than 0.7. To establish the presence of convergent validity, the AVE values need to be greater than 0.5. In the case that CR is greater than the AVE, convergent validity is deemed present; discriminant validity is supported when the MSV values are less than the AVE. Following Tabachnick et al. (2007), the factor loadings and the AVE values are used to indicate the convergent validity of the construct.

Table 12: Standardized items loading

Relationship			Estimated	S.E.	C.R.	P	Cronbach h Alpha	CR	AVE
BDD1	<---	BDD	.879	.028	33.542	***	.938	0.938	0.686
BDD2	<---	BDD	.835	.027	34.685	***			
BDD3	<---	BDD	.777	.029	30.516	***			
BDD4	<---	BDD	.782	.029	30.870	***			
BDD5	<---	BDD	.836	.027	34.766	***			
BDD6	<---	BDD	.827	.028	34.094	***			
BDD7	<---	BDD	.855	.026	36.342	***			
BDC1	<---	BDC	.819	.030	31.767	***	.897	0.890	0.617
BDC2	<---	BDC	.795	.031	32.752	***			
BDC3	<---	BDC	.787	.038	26.310	***			
BDC4	<---	BDC	.741	.039	24.043	***			
BDC5	<---	BDC	.785	.037	25.929	***			
BDEp1	<---	BDEp	.902	.023	26.456	***	.951	0.947	0.749
BDEp2	<---	BDEp	.855	.028	34.394	***			
BDEp3	<---	BDEp	.842	.029	31.788	***			
BDEp4	<---	BDEp	.871	.029	33.783	***			
BDEp5	<---	BDEp	.823	.028	32.551	***			
BDEp6	<---	BDEp	.896	.025	39.358	***			
BDEc1	<---	BDEc	.814	.021	37.886	***	.894	0.895	0.630
BDEc2	<---	BDEc	.759	.036	26.100	***			
BDEc3	<---	BDEc	.742	.037	<u>25.346</u>	***			
BDEc4	<---	BDEc	.792	.036	27.659	***			
BDEc5	<---	BDEc	.856	.033	30.796	***			
EOI1	<---	EOI	.894	.032	32.765	***	.937	0.937	0.748
EOI2	<---	EOI	.874	.025	39.151	***			
EOI3	<---	EOI	.862	.026	38.010	***			
EOI4	<---	EOI	.853	.026	37.212	***			
EOI5	<---	EOI	.840	.026	36.067	***			
EVI1	<---	EVI	.881	.021	33.456	***	.934	0.934	0.740
EVI2	<---	EVI	.860	.027	36.611	***			
EVI3	<---	EVI	.845	.028	35.394	***			
EVI4	<---	EVI	.853	.027	36.023	***			
EVI5	<---	EVI	.863	.027	36.888	***			
ENP1	<---	ENP	.866	.028	35.654	***	.923	0.923	0.706
ENP2	<---	ENP	.808	.030	31.515	***			
ENP3	<---	ENP	.811	.030	31.704	***			
ENP4	<---	ENP	.851	.029	34.429	***			
ENP5	<---	ENP	.863	.028	35.354	***			

Table 12 Continue

ECP1	<---	ECP	.820	.030	32.754	***	.887	0.887	0.663
ECP2	<---	ECP	.794	.036	27.285	***			
ECP3	<---	ECP	.801	.036	27.585	***			
ECP4	<---	ECP	.840	.035	29.324	***			
SEP1	<---	SEP	.853	.031	28.674	***	.914	0.669	0.910
SEP2	<---	SEP	.830	.032	31.065	***			
SEP3	<---	SEP	.809	.032	29.928	***			
SEP4	<---	SEP	.762	.035	25.948	***			
SEP5	<---	SEP	.832	.030	31.132	***			
SEO1	<---	SEO	.872	.032	30.463	***	.936	0.934	0.668
SEO2	<---	SEO	.832	.029	33.627	***			
SEO3	<---	SEO	.826	.030	33.153	***			
SEO4	<---	SEO	.788	.031	30.435	***			
SEO5	<---	SEO	.793	.031	30.799	***			
SEO6	<---	SEO	.771	.031	29.361	***			
SEO7	<---	SEO	.836	.029	33.851	***			

Table 12 shows that the loading values of all the items are greater than 0.7 and, therefore, highly significant. These values show that they contribute effectively to the variance of the measures. Moreover, the above table also specifies that the Cronbach alpha values of all the constructs are greater than 0.7: big data democratization has a value of 0.938, big data contextualization has a value of 0.897, big data experimentation has a value of 0.951, and big data execution has a value of 0.894. Exploitative innovation has a reliability score of 0.937, and exploratory innovation has a value of 0.934. SEP has a reliability value of 0.923, and the SEO's measures have reliability values of 0.887, 0.914, and 0.936 for the construct's environment, economy, and social dimensions. The subsequent columns of the table demonstrate the CR and the AVE values as well. For each of the constructs, the values of these indicators were above the required values of 0.7 and 0.5. Therefore, based on the values demonstrated in Table 12, the reliability and convergent validity of the conceptual model have been established.

4.8.1 Fitness of Nested Model

Table 13 demonstrates the fitness of the overall model. The complete model consists of 54 items in total. None of the items has been deleted due to their low loading scores. SEP has been evaluated based on three sub-constructs (i.e., economic performance, environmental performance, and social performance), representing 14 items in total; BDM was evaluated based on 23 items and included all the items of the sub-constructs of big data democratization, big data experimentation, big data contextualization, and the big data execution. The innovation construct had 10 items and included exploitative and exploratory innovation, and the SEO represents 7 items. Thus, the complete 54 items are included. All of the items were included in the study, as Figure 10 demonstrates. The model was run and evaluated through the latest version of the AMOS software. The fitness of the nested model and the factor loadings have been evaluated (reported in Table 12). It can be seen from the results indicated in Table 13 and Figure 11 that the model was under the standardized ranges of fitness and demonstrated appropriate factor loadings as well. The results indicate the presence of high covariances in the items of the variable and its error terms. Therefore, the modification indices were explored for this construct, and thus some of the error terms in the construct were aligned to covary. This is illustrated by the double-headed arrow joining the errors of the variable.

After a slight modification, it was found that the factor loadings were well above the lower limit (i.e., 0.5), and thus, no items were deleted from the projected model (Joseph F Hair et al., 2011). The factor loadings of the items were within the range of 0.74 to 0.89, as demonstrated in Figure 11. Moreover, Table 13 shows that the values were within the threshold ranges as well: CMIN/DF was less than 3 and supported a value of 2.474; GFI was greater than 0.8, and the observed value was 0.887; IFI was greater than 0.9, and the observed value was 0.956; TLI was greater than 0.9, and the observed value was 0.952, and CFI was also greater than 0.9, and the observed value was 0.956. Last, the RMSEA was less than the threshold range of 0.08, and the observed value was 0.039. These values indicated an exceptional model fit.

4.8.2 Discriminant Validity

As specified before, discriminant validity relates to evidence that the measures of the constructs that should be different according to theory and should not indicate high correlations are not related to each other; thus, the factors are discriminant (i.e., different from one another). Discriminant validity is evaluated through a correlation matrix. The discriminant validity of the model was assessed based on the criterion recommended by Ab Hamid et al. (2017) and Fornell and Larcker (1981). The discriminant validity is established when the square root of the AVE for each construct is significantly higher than the inter-construct correlation and also when the intra-construct correlation of the factors is higher compared to the inter-construct correlation.

Table 14: Discriminant validity

	SEP	BDD	BDC	BDEp	BDEc	EOI	EVI	ENP	ECP	SEO
SEP	0.818									
BDD	0.260	0.828								
BDC	0.314	0.575	0.786							
BDEp	0.306	0.541	0.659	0.865						
BDEc	0.322	0.657	0.749	0.701	0.794					
EOI	0.285	0.261	0.363	0.294	0.325	0.865				
EVI	0.290	0.308	0.282	0.292	0.309	0.597	0.860			
ENP	0.616	0.326	0.333	0.361	0.368	0.447	0.391	0.840		
ECP	0.594	0.313	0.306	0.273	0.332	0.402	0.307	0.631	0.814	
SEO	0.298	0.303	0.382	0.338	0.404	0.568	0.567	0.362	0.280	0.817

4.9. Hypothesis Testing

For hypothesis testing, the SEM technique has been used. SEM is a multivariate technique of statistical analysis which is used to test the validity of a research model. SEM is a combination of factor and multiple regression analysis (Kerlinger, 1966). The structure of SEM is such that it replicates the structure of a covariance matrix of the research model's measures. SEM is

preferred by the author of this research since this analysis procedure allows the estimation of the multiple interrelated dependencies in a single procedure. It is one of the most used and popular statistical methodologies in quantitative research. Its popularity has made way for the creation of a scholarly journal which is entirely dedicated and devoted to studies of SEM. Moreover, a large number of statistical software programs allow for this sophisticated and highly flexible modelling mechanism. Several benefits can be gained from using SEM rather than other multivariate techniques. The first benefit is that SEM allows for an explicit assessment of measurement errors in the research data and model. Second, it allows the researcher to estimate the latent (unobserved) variables of the research through the observed variables. Moreover, this technique also facilitates model testing in situations where a structure can be imposed and assessed as to the fit of the data.

Table 15: Hypothesis Testing

Hypothesis	Path	Estimate	S.E.	C.R.	P
H1	Sustainable Entrepreneurial Orientation <--- Big Data Democratization	.052	.038	1.354	.176
H2	Sustainable Entrepreneurial Orientation <--- Big Data Contextualization	.144	.041	3.426	***
H3	Sustainable Entrepreneurial Orientation <--- Big Data Experimentation	.092	.040	2.228	**
H4	Sustainable Entrepreneurial Orientation <--- Big Data Execution	<u>.186</u>	.047	4.053	***
H5	Exploitative Innovation <--- Big Data Democratization	.126	.037	3.599	***
H6	Exploitative Innovation <--- Big Data Contextualization	-.015	.040	-.395	.693
H7	Exploitative Innovation <--- Big Data Experimentation	.060	.038	1.564	.118
H8	Exploitative Innovation <--- Big Data Execution	.000	.045	.001	.999
H9	Exploratory Innovation <--- Big Data Democratization	.021	.037	.614	.539
H10	Exploratory Innovation <--- Big Data Contextualization	.131	.040	3.390	***
H11	Exploratory Innovation <--- Big Data Experimentation	.038	.039	.988	.323

H12	Exploratory Innovation	<---	Big Data Execution	-.001	.045	-.033	.974
H13	Exploitative Innovation	<---	Sustainable Entrepreneurial Orientation<--- Big Data Democratization	.025	.019	-	.179
H14	Exploitative Innovation	<---	Sustainable Entrepreneurial Orientation<--- Big Data Contextualization	.069	.021	-	**
H15	Exploitative Innovation	<---	Sustainable Entrepreneurial Orientation<--Big Data Experimentation	.044	.019	-	**
H16	Exploitative Innovation	<---	Sustainable Entrepreneurial Orientation<--- Big Data Execution	.089	.023	-	**
H17	Exploratory Innovation	<---	Sustainable Entrepreneurial Orientation<---Big Data Democratization	.024	.018	-	.179
H18	Exploratory Innovation	<---	Sustainable Entrepreneurial Orientation<--- Big Data Contextualization	.067	.020	-	**
H19	Exploratory Innovation	<---	Sustainable Entrepreneurial Orientation<--Big Data Experimentation	.053	.019	-	**
H20	Exploratory Innovation	<---	Sustainable Entrepreneurial Orientation<---Big Data Execution	.086	.023	-	**
H21	Economic Performance	<---	Sustainable Entrepreneurial Orientation	.054	.040	1.354	.176
H22	Environmental Performance	<---	Sustainable Entrepreneurial Orientation	.111	.039	2.876	**
H23	Social Performance	<---	Sustainable Entrepreneurial Orientation	.144	.041	3.542	***
H24	Exploitative Innovation	<---	Sustainable Entrepreneurial Orientation	.477	.031	16.108	***
H25	Exploratory Innovation	<---	Sustainable Entrepreneurial Orientation	.465	.031	15.769	***

H26	Economic Performance	<---	Exploitative Innovation <---Sustainable Entrepreneurial Orientation	.113	.021	—	**
H27	Environmental Performance	<---	Exploitative Innovation <---Sustainable Entrepreneurial Orientation	.203	.021	—	**
H28	Social Performance	<---	Exploitative Innovation <---Sustainable Entrepreneurial Orientation	.179	.022	—	**
H29	Economic Performance	<---	Exploratory Innovation <---Sustainable Entrepreneurial Orientation	.113	.021	—	**
H30	Environmental Performance	<---	Exploratory Innovation <---Sustainable Entrepreneurial Orientation	.203	.021	—	**
H31	Social Performance	<---	Exploratory Innovation <--- Sustainable Entrepreneurial Orientation	.179	.022	—	**

There are two kinds of effects that are studied in a path analysis that is shown by causal models. These include the direct, indirect effects and total effects (Alwin & Hauser, 1975). Direct effects can be explained as effects that are free from the presence of any mediation or moderation of impacts from other variables and are a clear distinguishable effect of one variable on another. An indirect effect, in contrast, is the impact of one variable on another, which takes into account the mediated or transmitted effects from other variables in the path. The total effect is another kind of effect which can be studied and it is the sum of both of these two impacts. The tables and figures that follow show these impacts for the current research. Figure 12 given below shows the path between the independent variables of BDM and its sub-constructs (i.e., democratization, contextualization, experimentation and execution), SEO, exploitative and exploratory innovation and the dependent variable SEP. This figure shows the direction of direct effect relationships: the relationship of effect of the BDM dimensions on SEO, BDM dimensions on innovation dimensions, SEO on SEP and innovation dimensions' direct effect on SEP.

Moreover, the estimates for the coefficient of effects are also shown in the figure, however, it cannot show the significance. Hypothesis testing Table 15 given above shows the significance of both paths, the coefficient of effects, the standard error in the effects and the CR values. The table shows, through *p*-values, the significance or insignificance of the associations. The results of the SEM and the path analysis are shown in Table 15.

The first hypothesis of the study was “*Big Data Management (democratization) affects Sustainable Entrepreneurial Orientation*”. The results show that there is a positive association between the two factors. The estimate of the association is 0.052 indicating that a unit increase in BDM (democratization) will influence an increase of 5.2% in SEO. However, the relationship is insignificant and the hypothesis is rejected. The second hypothesis of the study stated that “*Big Data Management (contextualization) affects Sustainable Entrepreneurial Orientation*”. The results show that there is a significant and positive association between the two variables. It can be seen that a unit increase in big data contextualization will influence an increase of 14.4% in SEO. As the relationship is significant, the hypothesis is accepted. The third hypothesis of the study was that “*Big Data Management (experimentation) affects Sustainable Entrepreneurial Orientation*”. The table indicates that there is a significant, direct and positive association among the variables. It can be seen that a unit increase in big data experimentation activities will lead to an increase of 9.2% in SEO. As the relationship is significant, the hypothesis is accepted. The fourth hypothesis is that “*Big Data Management (execution) affects Sustainable Entrepreneurial Orientation*”. The results indicate that there is a positive, direct and significant association among the constructs. It can be seen that a unit increase in big data execution will influence an increase of 18.6% in SEO. As the relationship is significant, the hypothesis will be accepted.

The fifth hypothesis is that “*BDM (democratization) affects exploitative innovation*”. The results indicate that there is the presence of positive, direct and significant associations among the constructs. It can be seen that a unit increase in big data democratization will influence an increase of 12.6% in exploitative innovation. Thus, the hypothesis will be accepted. The sixth hypothesis is that “*BDM (contextualization) affects exploitative innovation*”. The results indicate that there is a presence of negative, direct and insignificant associations among the

constructs. It can be seen that a unit increase in big data contextualization will influence a decrease of 1.5% in exploitative innovation. Thus, as the relationship is insignificant, the hypothesis is rejected. The seventh hypothesis is that “*BDM (experimentation) affects exploitative innovation*”. The results indicate that there is a presence of positive, direct and insignificant associations among the constructs. It can be seen that a unit increase in big data experimentation will influence an increase of 6% in exploitative innovation. As the relationship is insignificant, the hypothesis is rejected. The eighth hypothesis states that “*BDM (execution) affects exploitative innovation*”. The results indicate that there is a presence of positive, direct and insignificant associations among the constructs. It can be seen that a unit increase in big data execution will influence an increase of 0% in exploitative innovation (i.e., no change will be produced in exploitative innovation activities of the organization in response to the big data execution activities). As the relationship is insignificant, the hypothesis is rejected.

The ninth hypothesis is that “*BDM (democratization) affects exploratory innovation*”. The results indicate that there is a presence of positive, direct and insignificant associations among the constructs. It can be seen that a unit increase in big data democratization will influence an increase of 2.1% in exploratory innovation. As the relationship is insignificant, the hypothesis is rejected. The tenth hypothesis is also related to the direct effects and states that “*BDM (contextualization) affects exploratory innovation*”. The table values and results indicate that there is a presence of significant and positive associations between the two constructs. A unit increase in big data contextualization will influence an increase of 13.1% in exploratory innovation. As the relationship is significant, the hypothesis is accepted. Hypothesis 11 states that “*BDM (experimentation) affects exploratory innovation*”. The results indicate that there is a presence of positive, direct and insignificant associations among the constructs. It can be seen that a unit increase in big data experimentation will influence an increase of 3.8% in exploratory innovation. As the results show insignificance, Hypothesis 11 is rejected. Hypothesis 12 contends that there is a direct association between big data execution and exploratory innovation. Table 15 indicates that there is a presence of inverse association among the two variables and the relationship is insignificant, thus the hypothesis is rejected.

H13 to H20 are indirect associations and present results of mediation hypotheses therefore they will be discussed later. The 21st hypothesis formulated in the study states that “*SEO affects*

SEP (economic)”. The results demonstrate that there is a presence of positive and direct associations among the variables. However, as the relationship is insignificant, the hypothesis is rejected. The 22nd hypothesis is that “*SEO affects SEP (environmental)*”. The results indicate that there is a presence of positive, direct and significant associations among the constructs. It can be seen that a unit increase in sustainable orientation will influence an increase of 11.1% in the SEP related to environmental activities. As the relationship is significant, the hypothesis is accepted. The 23rd hypothesis states that “*SEO affects SEP (social)*”. It can be seen that the association is significant and a positive change of 14.4% is triggered in SEP related to social activities. As the relationship is significant, the hypothesis is accepted. The next two hypotheses state that “*SEO has an effect on exploitative innovation*” and “*SEO has an effect on exploratory innovation*”. The table values indicate that the associations for both of these relations are significant and thus the hypotheses are accepted.

The next group of hypotheses being tested are the mediation hypotheses (i.e., indirect associations and relationships among the variables will be tested). Hypothesis 13 states that “*SEO significantly mediates the relationship between BDM (democratization) and exploitative innovation*”. The results show that the mediation effect of SEO on the dependent and independent variables is insignificant and thus this hypothesis is rejected. The next hypothesis states that “*SEO significantly mediates the relationship between BDM (contextualization) and exploitative innovation*”. The results can be seen to confirm the mediation role played by SEO and a change of 6.9% is triggered in exploitative innovation due to the change in SEO through big data contextualization so the hypothesis is accepted. The next hypothesis 15 states that “*SEO significantly mediates the relationship between BDM (experimentation) and exploitative innovation*”. The table values confirm the positive and significant mediating effects of SEO and a change of 4.4% will be triggered in exploitative innovation. Thus, the hypothesis is accepted. Hypothesis 16 states that “*SEO significantly mediates the relationship between BDM (execution) and exploitative innovation*”. The table values confirm the positive and significant mediating effects of SEO and a change of 8.9% will be triggered in exploitative innovation. Thus, the hypothesis is accepted.

The next hypothesis 17 states that “*SEO significantly mediates the relationship between BDM (democratization) and exploratory innovation*”. The table values confirm the positive

mediating effects of SEO and a change of 2.4% will be triggered in exploratory innovation. However, the results are insignificant and the hypothesis is rejected. The next relationship is proposed as “*SEO significantly mediates the relationship between BDM (contextualization) and exploratory innovation*”. The table values confirm the positive and significant mediating effects of SEO and a change of 6.7% will be triggered in exploratory innovation. Thus, the hypothesis is accepted. The next statements of relationships are “*SEO significantly mediates the relationship between BDM (experimentation) and exploratory innovation*” and “*SEO significantly mediates the relationship between BDM (execution) and exploratory innovation*”. The table values confirm positive and significant mediating effects of SEO in the case of both relations and a change of 5.3 and 8.6% will be triggered in exploratory innovation. Thus, as the associations are significant the hypotheses will be accepted.

The next group of hypotheses focused on the mediation of exploitative and exploratory innovation. The statements for these relationships are as follows “*Exploitative innovation significantly mediates the relationship between SEO and SEP (economic)*”, “*Exploitative innovation significantly mediates the relationship between SEO and SEP (environmental)*”, “*Exploitative innovation significantly mediates the relationship between SEO and SEP (social)*”, “*Exploratory innovation significantly mediates the relationship between SEO and SEP (economic)*”, “*Exploratory innovation significantly mediates the relationship between SEO and SEP (environmental)*” and “*Exploratory innovation significantly mediates the relationship between SEO and SEP (social)*”. All six of these mediation relations are found to be significant and therefore the hypotheses are accepted.

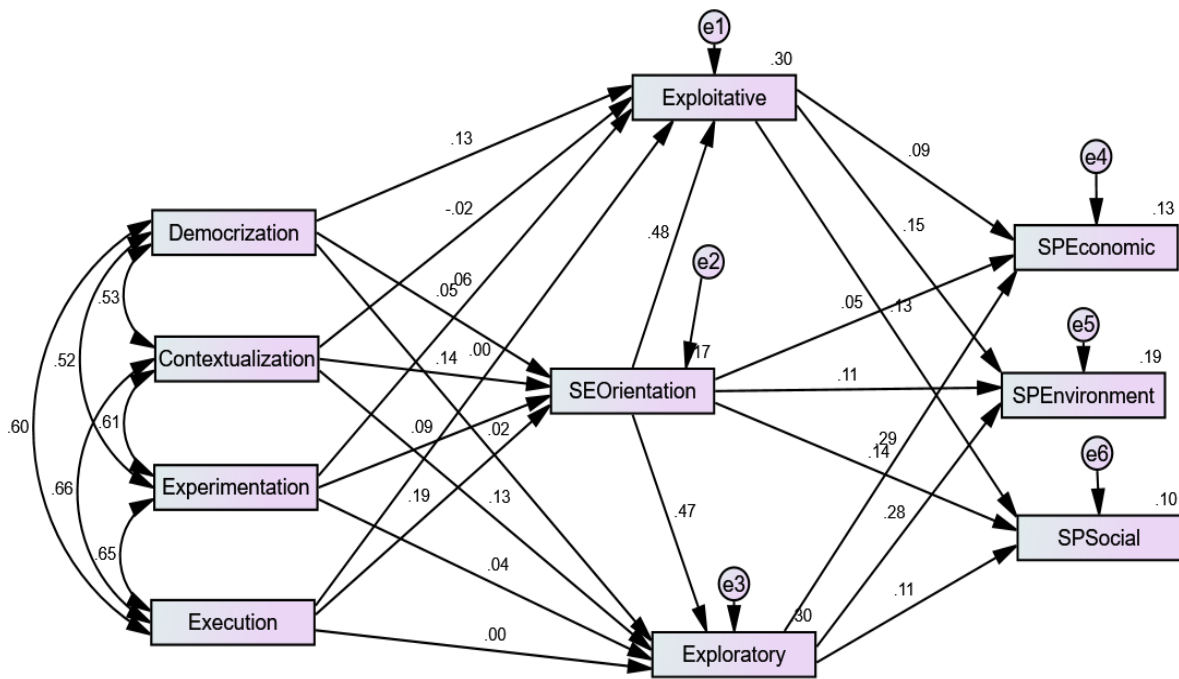


Figure 12: Structural equation modelling model

4.10. Summary

The present chapter presented the analytic methods and interpreted the findings. The data was thoroughly scrutinized and checked for the presence of any kind of underlying or preliminary issues like missing data and outliers. The data was initially checked for its normal distribution and it was evidenced to be normal. CFA was performed on all the variables of the study separately to ensure the properties and fitness of the projected model. All the indicators of model fitness were found to have a value within the prescribed ranges. The loadings of all the variables were checked and found within the standardized value. Finally, SEM was performed to analyze the hypotheses formulated in the study.

Chapter 5: Discussion and Conclusion

5.1 Discussion

The purpose of this study is to analyze the effect of BDM (democratization, contextualization, experimentation and execution) on SEP under the theoretical underpinnings of entrepreneurial theory and DCV while keeping a keen eye on the mediating role of SEO on the relationship between the factors of BDM and exploitative innovation and exploratory innovation. Moreover, this study analyzes the mediating role of exploitative innovation and exploratory innovation in the relationship between SEO and SEP.

To accomplish the goal the present study individually analyzes the relationships among variables and generates numerous hypotheses. In this regard, the first hypothesis of the present study states that democratization in the realm of BDM has an effect on SEO in software houses in Pakistan. The derived results of the study rejected the claim of this hypothesis. The theoretical reasoning is that entrepreneurial theory indicates that democratization deals with open access to communication, which does not encourage the SEO of various software houses in Pakistan. The results are further confirmed by numerous research studies that support this result and indicate that the implementation of democratization causes inefficiency in entrepreneurial innovation for various organizations. The studies of Rode and Gwartney (2012), Wendt (2017), Fails (2019) and Oral (2020) proposed that democratization has no effect on entrepreneurial orientation and stated that the purpose of democratization is to embrace diverse opinions and information and, as a result, employees of companies waste time over the discussion of issues that can be easily resolved by the management. Accordingly, the negative effect of democratization has been indicated. In contrast to this, various other researchers think that democratization affects entrepreneurial orientation. The studies of Hyun, Hosoya, and Kamioka (2019) and Nazarov and Obydenkova (2020) indicate that the agility of entrepreneurial orientation is strengthened in a democratization culture. The studies of Chen (2018) also propose a positive influence of democratization on entrepreneurial orientation; the studies assert that from the sharing of diverse opinions, companies can get valuable information which has a positive influence on the entry of innovative data (i.e. entrepreneurial orientation). However, the result of the present study denied the effect of democratization (BDM) on the entrepreneurial orientation of software houses in Pakistan.

The second hypothesis of this study states that the contextualization of BDM affects SEO. In the present study, this hypothesis was accepted. In contextualization, the quality of BDM is enhanced which, in turn, implies a positive effect on SEO. Various studies reported that contextualization enhances the accuracy of BDM which leads to improved entrepreneurial orientation (Allard et al., 2018; Huang, Liu, & Li, 2020). On other hand, other studies (Gawronski et al., 2018; Kurita, Vyas, Pareek, Black, & Tsvetkov, 2019) reported that contextualization of the multinational firms was harmed because it caused inefficiencies in firms' performance and innovation. In contrast, the results of this study support the view that contextualization of BDM has a positive effect on entrepreneurial orientation.

The third hypothesis of this study evaluated the effect of experimentation on SEO. The results indicated that experimentation as a factor of BDM has a significant effect on SEO. The cause of this effect is that experimentation with big data plays an important role in creating valued data and efficiently influences SEO. Other studies (Baesens, Bapna, Marsden, Vanthienen, & Zhao, 2016; Coulton, Goerge, Putnam-Hornstein, & de Haan, 2015) reported that experimentation can lead to the identification of new opportunities which enhanced SEO in multinational firms of India. In contrast, other studies (Frické, 2015; Rodrigues, Santos, & Bernardino, 2019) reported a negative effect of experimentation on SEO on enterprises in the fashion industry. However, the results of this study indicate a positive effect of experimentation on SEO for the software houses of Pakistan.

The fourth hypothesis of the current study proposed that the execution of BDM execution affects SEO. The hypothesis was accepted: the execution of BDM had a significant impact on SEO. The positive impact of BDM execution on SEO suggests that it furnishes capabilities of data-generated insights, which lead to the identification of entrepreneurial opportunities. The finding has been confirmed by other studies (Chaudhuri, 2012; Siddiqi et al., 2016; Wiech et al., 2020) that reported the significant impact of execution on the entrepreneurial innovations of an organization. However, other studies (Al-Agele & Ali, 2017; Lemaire, Brun, & Regner, 2018) reported a negative impact of execution on SEO under the guidance of KBDCV theory, as execution hindered organizations' response to innovative opportunities promptly. The results of the current study indicate the significant positive impact of the execution of BDM on SEO.

Four other hypotheses asserted that all factors of BDM (i.e., democratization, contextualization, experimentation and execution) affect exploitative innovation. In the light of the results, an effect of democratization was found, but contextualization, experimentation and execution were found not to affect exploitative innovation. This research, underpinned by entrepreneurial theory, asserts that since exploitative innovation deals with the implementation of new ideas and innovative ways, democratization has a positive effect on exploitative innovation; accordingly, the hypothesis claims an effect of democratization on exploitative innovation was accepted. The results were confirmed by other studies (Heidhues, Kőszegi, & Murooka, 2016; Limaj & Bernroider, 2019; Mueller, Rosenbusch, & Bausch, 2013) that also reported the effect of democratization of BDM on exploitative innovation. However, other studies (Sheng & Hartmann, 2019; Zhang & Luo, 2020) indicated that there is no effect of democratization on exploitative innovation. In the context of contextualization, this study formulated the hypothesis that contextualization affects exploitative innovation; however, the results indicated that contextualization does not enhance activities under exploitative innovation. This result (i.e., the lack of effect of contextualization on SEO) was confirmed by other studies (Ko & Liu, 2019; Zahra, Wright, & Abdelgawad, 2014) that reported that contextualization has no effect on exploitative innovation in the firms of the medical sector in Bangladesh. In contrast, other studies (Pérez-Luño, Gopalakrishnan, & Cabrera, 2014; Teagarden, Von Glinow, & Mellahi, 2018) argued that contextualization affects exploitative innovation because context-based data paves an innovative path to exploitation. For experimentation, the present study denied the hypothesis that experimentation of BDM has an effect on exploitative innovation in the software houses of Pakistan. The current study verified the results of other studies (Limaj & Bernroider, 2019; Ngo, Bucic, Sinha, & Lu, 2019) that indicated no effect of experimentation on exploitative innovation. In contrast, the results from other studies (Fartash et al., 2018; Popadić & Černe, 2016) indicated that experimentation affects exploitative innovation. Concerning execution as a factor of BDM, the results of the current study denied the hypothesis which stated that execution has an impact. The result from other studies (Park & Kim, 2015; Sariol & Abebe, 2017) validated that execution of BDM does not affect exploitative innovation. In contrast, other studies (Berraies & El Abidine, 2019; Duodu & Rowlinson, 2019) reported that execution affects exploitative innovation.

Besides exploitative innovation, the current study analyzes the factors of BDM on exploratory innovation. In this regard, this study proposed four hypotheses. These hypotheses stated that democratization, contextualization, experimentation and execution of BDM affect exploratory innovation. After the testing of hypotheses, the subsequent results indicated that contextualization has an effect on exploratory innovation but democratization, experimentation and execution have no effect on exploratory innovation. Accordingly, this study accepted the hypothesis which states that contextualization has an effect on exploratory innovation in the software houses of Pakistan, while the hypotheses claiming an effect of democratization, experimentation and execution on exploratory innovation were rejected. The achieved results were verified by other studies (De Toni et al., 2021; Mütterlein et al., 2019) that claimed that contextualization affects the exploratory innovation of various firms. However, many studies recorded that contextualization does not affect the exploratory innovation of multinational firms (Kurita et al., 2019; Rossi & Lopez, 2017). In the context of democratization, the study rejected the hypothesis stating that democratization has an effect on exploratory innovation as, in light of entrepreneurial theory, democratization does not integrate big analytics with innovation which leads to no effect on exploratory innovation. The results of other studies (Ferrucci et al., 2020; Ganesan, 2019) supported the results of this study by indicating that democratization in BDM does not affect various family-based organizations. In contrast, other studies (Ahluwalia et al., 2018; Nazarov & Obydenkova, 2020) indicated that democratization has an effect on exploratory innovation by broad scaling exploratory innovations in firms. The results of this study also rejected the hypothesis claiming an effect of experimentation on exploratory innovation. Experimentation with data does not create innovative data from exploratory innovation. Other studies verified the finding (Aghion et al., 2018; Bocken et al., 2019) that experimentation with BDM does not affect exploratory innovation. On the other hand, other studies (Bocken et al., 2018; Von Wirth et al., 2019) reported that experimentation with BDM affects exploratory innovation. The study rejected the hypothesis that the execution of BDM affects exploratory innovation. The results are validated by other studies (Moussa et al., 2018; Ravichandran, 2018) that reported that the execution of BDM does not affect exploratory innovation of medical and various other firms. However, in contrast, other studies (Chaudhary et al., 2018; Zeng & Glaister, 2018) indicated that the execution of BDM has an effect on exploratory innovation as the execution of data enhances the capabilities of explorative innovation.

Another purpose of the study is to evaluate the mediating role of SEO on the relationship between democratization, contextualization, experimentation and execution of exploitative innovation and exploratory innovation. To accomplish this purpose, the present study evaluated the mediating role of SEO individually for every variable and drew four hypotheses in the context of exploitative innovation and four concerning exploratory innovation. For exploitative innovation, the hypothesis proposed that SEO significantly mediates the relationship between democratization, contextualization, experimentation and execution and exploitative innovation. Based on the results, the hypothesis of a significant mediating role of SEO on the relationship between democratization (BDM) and exploitative innovation has been rejected, while the hypotheses proposing a significant mediating role of SEO on the relationship between contextualization, and experimentation and execution and exploitative innovation have been accepted. The mediating effect of SEO on the relationship between democratization and exploitative innovation was not proved significant, as it affects the ability of a firm to strategically manage democratization, which ultimately affects the degree of exploitative innovation for software houses in Pakistan. The results from other studies (Ciampi et al., 2021; Kollmann & Stockmann, 2010) verified the results of this study because they reported that SEO does not play a significant role in the relationship between the democratization of BDM and exploitative innovation for adolescent companies and highly dynamic organizations as democratization does not raise levels of their automation in their relationship with exploitative innovation. In contrast to other studies (Genc et al., 2019; Real et al., 2014), SEO plays a significant role in the association between BDM's democratization and exploitative innovation for SMEs as the value of entrepreneurial orientation in the relationship between BDM democratization and exploitative innovation is enhanced in various SMEs. The results of this study accept the hypothesis asserting that the mediating role of SEO is significant in the relationship between contextualization (BDM) and exploitative innovation. The cause of a significant mediating role of SEO in software houses of Pakistan is that contextualization is very specific in the IT sector and it formulates a strengthened relationship with exploitative innovation. Other studies (Mirzaie et al., 2019; Shamim et al., 2020) validated the significant mediating role of SEO on the association between contextualization and exploitative innovation in multinational enterprises in China. In comparison, the study of Del Vecchio et al. (2018) reported an insignificant mediating role of SEO on contextualization and exploitative innovation under the theoretical underpinnings of RBV in the sectors related to tourism. The

next hypothesis of this study in this regard stated that SEO significantly mediates the relationship between the experimentation of BDM and exploitative innovation. Based on the results, the current study approved the hypothesis because SEO exerts a remarkable effect on the experimentation of software houses in Pakistan, which is significant for the improved value of exploitative innovation. Similar results were derived by Oktavio et al. (2019) in a study conducted on the textile firms of Surabaya; the results of their study indicated the significant role of SEO in the experimentation of BDM and exploitative innovation as exploitative innovation reached a high level of innovativeness with the experimentation of BDM. Another hypothesis stated that the mediating role of SEO is significant in the relationship between execution and exploitative innovation. The results approved this hypothesis in software houses of Pakistan and indicated an enhanced role of SEO. Other studies (Lokuge & Sedera, 2014; Oke et al., 2012) verified the significant mediating role of SEO after conducting research using innovative theory in a health care centre where SEO reflected a highly valued mediating role. In contrast, the study of Moussa et al. (2018) did not indicate a significant mediating role of SEO in public sector organizations.

Furthermore, the present study analyzes the mediating role of SEO on the relationship between democratization, contextualization, experimentation and execution of BDM on exploratory innovation. In this regard, the study formulated four individual hypotheses for every factor based on entrepreneurial theory, which asserts that SEO plays a significant mediating role in the relationship between democratization, contextualization, experimentation and execution and exploratory innovation. The results of the current study led to the rejection of the hypothesis that proposed that SEO plays a significant mediating role in the relationship between BDM's democratization and exploratory innovation. Accordingly, the mediating role of SEO on the relationship between democratization and exploratory innovation is insignificant for the software houses of Pakistan, as their SEO does not exhibit an improved effect of open access to data that degrades the value of exploratory innovation. Similar results were reported by other studies (Yeniaras et al., 2020; Zotoo et al., 2020), which validate the results of the present study, for example, their results indicated that SEO does not play a significant role in the association between democratization and exploratory innovation for multinational enterprises of India and Turkey under the theoretical guidance of KBV. In contrast, the study of Pergelova et al. (2019) underlined the significant mediating role of SEO on democratization

and exploratory innovation for various firms in Singapore. In the context of the role of SEO on BDM's contextualization, the present study accepted the hypothesis that SEO plays a significant mediating role in the association between contextualization and exploratory innovation in the software houses of Pakistan. The theory supports the view that SEO plays a significant role, as the ability to contextualize data are crucial for various enterprises and pave a wide path for exploratory innovation. The results were verified by other studies (Beliaeva, 2019; Santoso et al., 2020) that reported the significant role of SEO on contextualization and exploratory innovation under the guidance of narrative method theory. However, numerous studies did not agree with these findings on the role of SEO (Huang et al., 2020; Türk et al., 2020) and proposed that the role of SEO in the relation between contextualization and innovation needs further research as it does not encourage the quality of exploratory innovation. Another analyzed factor of BDM was experimentation, for which a hypothesis claimed a significant mediating role of SEO on its association with exploratory innovation; this hypothesis was accepted by the software houses of Pakistan. SEO plays a significant role as it encourages experimentation with data to add value to exploratory innovation. The results from the study of Basco et al. (2020) validated the significant effect of SEO on contextualization and exploratory innovation in multi-group firms in Mexico and Spain. While the results from Frederiks et al. (2019) did not propose a significant effect of SEO because experimentation did not adjust strategies to new opportunities of exploratory innovation. In the context of the role of SEO in the execution of BDM and its association with exploratory innovation, this study accepted the hypothesis that SEO significantly mediates the relationship between BDM's execution and exploratory innovation for the software houses of Pakistan. SEO significantly mediates the relationship by transforming data-generated insights into more agile ways, which enhances the characteristics of exploratory innovation for software houses in Pakistan. The results have been verified by the study of Musa et al. (2017), which proposed the significant mediation of SEO on the relationship between contextualization and exploratory innovation in various firms. While, in contradiction, other studies (Block & Spiegel, 2013; Okangi, 2019) reported a negative mediating effect of SEO on execution and exploratory innovation based on the theoretical notions of entrepreneurial theory. The reason for the insignificant mediating role of SEO in the execution of BDM is that it does not facilitate the process of exploratory innovation.

In addition, the purpose of the study is to evaluate the effect of SEO on SEP. To fulfil the aim, the effect of SEO on SEP was analyzed for three contexts of performance, these contexts are economic, environmental and social. Accordingly, the present study proposed a hypothesis for every context individually. Among them, the first hypothesis stated that SEO affects SEP in an economic context. Based on the results, this hypothesis has been rejected. In the light of the proposed theory, SEO does not have any effect on the economic entrepreneurial performance of Pakistan's software houses as SEO does not promote competition by a combination of aggressive and agile moves which downrated economic SEP. The result from the study of Al Mamun and Fazal (2018) indicated the same result: SEO has no effect on the SEP of Singaporean multinational firms under the theories of the causal model. The previous studies highlighted that the roaming of complex information acquisition in strategic management of SEO makes it to causes no effect on economic SEP. In contrast, many other studies found that SEO affects economic entrepreneurial performance, which is optimized and significant. Other studies (Acosta et al., 2018; Al Mamun & Fazal, 2018) indicated the effect of SEO on SEP asserting that SEP monitors the need to improve creativity by organizing innovations which increase economic sustainable economic performance. In regards to environmental SEP, the present study formulated a hypothesis under the guidance of entrepreneurial theory which stated that SEO affects SEP in an environmental context. The results led to the acceptance of the hypothesis and indicated that SEP has a positive effect on environmental SEP as SEO encourages environmental management to reduce environmental costs, which delivers many benefits to SEP of software houses in Pakistan. The result has been verified by other studies (Ahmed et al., 2020; Jiang et al., 2018) that also reported the positive effect of SEO on SEP in the environmental context, asserting that SEO can help organizations to face their environmental responsibilities which can lead to improved environmental entrepreneurial performance. However, the result from the study of Gibassier (2012) stated that SEO does not affect environmental innovative production and hence has no effect on SEP, rather it causes an effect on the size of organizations. In regards of the analysis of SEP in social context, under the guidance of entrepreneurial theory the present study formulated the hypothesis that SEO has an effect on SEP in a social context. Based on the results, the present study accepted the hypothesis; SEO has an effect on SEP in a social context as SEO focuses on social entrepreneurship and draws new business activities to fund innovation, which exhibits enhanced performance on SEP in a social context. The results were verified by the results of

other studies (Darmanto & Bukirom, 2021; Núñez-Pomar et al., 2020), which tested the same hypothesis under the guidance of partial least squares SEM and with the theory of linear model in SMEs and the banking sector of China and Indonesia, they proposed that SEO affects SEP in the social context as SEO exerts the best effort in market orientation and pursues aspects of innovation, which ultimately marks an optimized effect on social SEP. However, the results of other studies (De Clercq et al., 2010; Mahfud et al., 2019) contradicted these findings as they reported that SEO did not exhibit an effect on social SEP for medium enterprises and firms related to the academic sector because, for them, SEO does not focus on all directions of social entrepreneurial performance.

Another two hypotheses of the study analyzed the effect of SEO on exploitative innovation and exploratory innovation. In the context of exploitative innovation under the guidance of entrepreneurial theory and DCV, the hypothesis states that SEO affects exploitative innovation as SEO encourages to testing of the firm-based entrepreneurship level and encourages the implementation of new skills in an organization which exerts an optimized effect on exploitative innovation. Based on the results, this hypothesis is accepted for the software houses of Pakistan: the effect of SEO on exploitative innovation. Other studies (Arzubiaga et al., 2018; Ferreira et al., 2020) reported the same results for the effect of SEO on exploitative innovation under the guidance of market orientation theory. While, in contrast, other studies (Bachmann et al., 2021; Ferreira & Coelho, 2020) reported that SEO exerted no effect on exploitative innovation as SEO does not enhance satisfactory innovation in the banking sector of Portugal or for other competitive firms. In the context of exploratory innovation, this study proposed a hypothesis under the guidance of DCV which asserts that SEO affects exploratory innovation as SEO promotes the dynamic environment of new entrepreneurial skills, which enhances the value of exploratory innovation. Based on the results, this study accepts this hypothesis for the software houses of Pakistan (i.e., SEO affects exploratory innovation). Other studies (Arzubiaga et al., 2018; Genc et al., 2019) proposed the same results for the effect of SEO on exploratory innovation as it causes long-term sustainability of innovation in a firm. Nevertheless, the results of Su and Yang (2018), who used linear regression analysis, showed an effect of SEO on exploitation innovation but not on exploratory innovation.

Furthermore, the current study analyzed the mediating roles of exploitative innovation and exploratory innovation in the relationship between SEO and SEP. The study proposed hypotheses on the mediation roles of exploratory innovation and exploratory innovation on the economic, environmental and social contexts of SEP. Among them, one hypothesis stated that exploitative innovation significantly mediates the relationship between SEO and SEP in an economic context. This hypothesis is stated in light of the entrepreneurial theory that exploitative innovation enhances SEO by introducing entrepreneurial approaches which contribute to financial development and ultimately enhanced the SEP in an economic context. Based on the results, this hypothesis has been accepted by the software houses of Pakistan (i.e., a significant mediating role of exploitative innovation between SEO and SEP in an economic context). The study of Vorhies et al. (2011) validated these results as they reported a significant mediating role of exploitative innovation on SEO and economic performance. According to their study, exploitative innovation plays a significant mediating role by improving customer-focused marketing capabilities, which enhanced entrepreneurial implications and accordingly raised the level of economic SEP. In contrast, the results of Morgan and Berthon (2008) found no significant mediating role of exploitative innovation in the association between SEO and economic SEP in bioscience firms. Another hypothesis guided by entrepreneurial theory asserted that exploitative innovation has a significant mediating role in the relationship between SEO and SEP in an environmental context, as the environmental measures of exploitative innovation enhance the entrepreneurial orientation of software houses in Pakistan, which leads them to put forth optimized entrepreneurial performance in an environmental context. Based on the results, this study accepts the hypothesis that exploitative innovation significantly mediates the relationship between SEO and SEP in the environmental milieu. The results are further validated by the study of Jansen et al. (2005), which reported a significant mediating role of exploitative innovation as it is centralized on the implementation of new environmental methods which enhance SEO and its capability to affect environmental SEP. However, the results of Jansen et al. (2006) contradicted this finding as their comparative study showed that exploitative innovation does not have a mediating effect on SEO and environmental SEP, as pursuing exploitative innovation is not beneficial to the dynamic competitiveness of environmental SEP. Another hypothesis of this study highlights this relationship in a social context: exploitative innovation significantly meditates the relationship between SEO and SEP in a social context as the implementation of innovative skills boosts SEO, which enhances the

performance of SEP in all dimensions of social innovative performance. Based on the results, the study accepts this hypothesis (i.e., exploitative innovation significantly mediates the relationship between SEO and social SEP). The results of Atuahene-Gima and Murray (2007) validated the result as they highlighted the significant mediating role of exploitative innovation in new technology ventures in China. Their finding suggested that exploitative innovation is significantly related to SEO and all dimensions of social entrepreneurial performance. However, the results of Hull and Rothenberg (2008) did not support this relationship as according to their study exploitative innovation significantly mediates the relation between SEO and social SEP in low-innovative firms, but not for high-innovative firms.

To evaluate the significant mediating effect of exploratory innovation this study formulated three hypotheses under the guidance of DCV and entrepreneurial theory. Among them, one states that exploratory innovation significantly mediates the relationship between SEO and SEP in an economic context as it offers new innovative designs, which enhances the sustainable orientation of entrepreneurial activities and the exertion of innovative products boosts the financial performance and economic entrepreneurial performance of firms. Based on the results, this hypothesis has been accepted by the software houses of Pakistan. The results are validated by studies by Cainelli et al. (2016) and Cainelli et al. (2020) who evaluated the mediating effect of exploitative innovation by implementing a longitudinal firm-level dataset; they found that exploratory innovation boosts economic performance at firm-level analysis and significantly impacts the relationship between SEO and SEP in an economic context. Nevertheless, Kumar and Subrahmanya (2010) reported that exploratory innovation does not cause an effect on SEO and economic SEP in Indian automobile industries, but technological innovation enhanced the economic performance of the firms. Another hypothesis asserts that exploratory innovation has a significant mediating role in the relationship between SEO and SEP in the environmental context. Under the guidance of entrepreneurial theory, the study formulated this hypothesis for the software houses of Pakistan because exploratory innovation would help them enhance their environmental innovative capabilities, which would accordingly enhance their SEO, which efficiently optimizes environmental entrepreneurial performance. The hypothesis was tested and accepted (i.e., exploratory innovation has a significant mediating role in the relationship between SEO and SEP in an environmental context). The result from the study of Gibassier (2012) validated this result by proposing that

exploratory innovation enhances the potential effects of SEO, which enhances its association with SEP in an environmental context. However, the results of Staniskis and Stasiskiene (2013) contradicted these results as they found that exploratory innovation did not affect all the indicators of environmental innovation for SEO, which led to no effect on environmental SEP. Another hypothesis of this study proposed that exploratory innovation has a significant mediating role in the relationship between SEO and SEP in a social context as exploratory innovation facilitates social enterprises which enhance entrepreneurial orientation and eventually increase the value of SEP in a social context. The results of the study supported this hypothesis for the software houses of Pakistan (i.e., explorative innovation plays a significant mediating role in the relationship between SEO and SEP in a social context). The results from the study of Phillips et al. (2015) validated the results of the present study and highlighted that exploratory innovation offers an innovative path to SEO, which enhances social innovation and social entrepreneurial performance. Nevertheless, the same results were not found for SMEs in China and they stated that exploratory innovation caused no effect on the relationship between SEO and SEP in a social context as the innovative ways of exploratory innovation did not facilitate SEO and social SEP.

The hypotheses are now discussed in the context of the theory of entrepreneurship and DCV, which were discussed in the literature review. According to DCV, the business world is coping with increasingly complex dynamism; it has become very necessary for organizations to have all the dynamic capabilities that can help them explore and exploit environmental changes and dynamism (Agarwal & Dhar, 2014). Dynamic capabilities enable an organization to develop, configure and integrate several competencies so that a diversified form of the business environment can be addressed and coped with. Previously, RBV consisted of some similar ideas, but DCV, an extension of RBV, also proposes that organizations utilize strategic resources to gain a competitive advantage in the market (Bibri & Krogstie, 2017). Another similar view in this regard is KBV, which revolves around the idea that knowledge is an important and major asset possessed by an organization, whether the knowledge is at an individual level or an organizational level. KBV also indicates the idea that an organization has the major objective to create value through the knowledge base of the organization (Braganza et al., 2017).

Entrepreneurship theory consists of basically four paradigms that are practically applied in businesses and organizations: innovation, opportunity recognition, business creation and value creation (Carayannis et al., 2017). Moreover, all the researchers and authors who have studied entrepreneurship theory agree upon the concept of newness: according to this theory, innovation means the destructive discovery of some new process, product service or resources is required. Researchers have assigned other meanings to innovation, such as extension, invention, synthesis and duplication (Dubey et al., 2018).

The next paradigm is opportunity recognition and development. This paradigm refers to the recognition and exploitation of some opportunity which might provide more profit as compared to the competitors' profit. It has been argued that entrepreneurs are continuously in a state of alertness or are receptive to all available opportunities. Opportunity refers to any future situation that is not only attractive but also feasible to perform and provides profit. Here, the difference between entrepreneurs concerning innovation and opportunity recognition can be observed (Dubey, Gunasekaran, Childe, Papadopoulos, et al., 2019). This difference is based on the fact that entrepreneurs in the context of innovation are bolder and more visionary and have a long-term orientation. On the other hand, entrepreneurs in the context of opportunity recognition are more alert to the changes around them and thus recognize opportunities and might have a short-term orientation (Dubey, Gunasekaran, Childe, Roubaud, et al., 2019). The next paradigm in value creation; according to this paradigm, entrepreneurs are a source of profit and wealth for an organization as well as society. Therefore, organizations that are involved in sustainable development can be considered to be involved in an entrepreneurial act.

Both of these discussed theories will be utilized in the process of acceptance and rejection of hypotheses so that the results of this study can be related to the applied theories (Dubey, Gunasekaran, Childe, Roubaud, et al., 2019). Based on entrepreneurial theory, it has been accepted that the effect of BDM on SEO is significant and positive as entrepreneurial theory significantly supports innovation, and innovation has been highlighted as a very important paradigm of entrepreneurial theory (El-Kassar & Singh, 2019). According to past research, the entrepreneurial resources of an organization are considered to be one of the major or key resources possessed by organizations to cope with the changing and dynamic business environment. In the same way, the dynamic capabilities that are specifically associated with

BDA are essential for organizations to gain a competitive advantage over their rivals (El-Kassar & Singh, 2019). Based on this, big data is a very significant innovation in the business world and the world of technology as well; with the business world and organizations moving toward BDM, organizations strive to attain competitive advantage and comparative advantage as compared to their competitors (Etzion & Aragon-Correa, 2016). Moreover, the entrepreneurial theory also focused on the concept of newness, which also points to the fact that BDM is a very significant and innovative addition to the business world, providing organizations with newness and innovation at the same time. Moreover, when organizations possess BDM capabilities, it provides them with opportunities to reconfigure their available resources so that they can cope with the dynamic nature of the business environment (George et al., 2014).

In the previous literature, it has been clearly and repeatedly argued that big-data-driven decision support systems increase access to, and the sharing of, knowledge and enhance the analytical skills of organizations, which lead to the improved entrepreneurial orientation of organizations (Gupta et al., 2019). So, based on the theory there is a significant effect that can be caused by BDM on the SEO, and it is also anticipated that SEO will positively enhance with the enrichment of BDM in the organizations.

According to the H1 and H2 results, there is a positive and significant influence of contextualization on SEO based on DCV, it can be stated that contextualization can significantly and positively affect SEO (Hazen et al., 2016). Hazen et al. (2016) proposed that in a dynamic and changing business world and competition, businesses and organizations are supposed to have specific capabilities to deal with the dynamic environment and competition. Contextualization influences SEO because it provides a sustainable context to business activities and orients the business toward sustainable growth and development. Moreover, Kerdpitak et al. (2019) suggested that contextualization in BDM has a significant and positive effect on SEO. DCV also supports the view that for successful SEO, common businesses are required to acquire capabilities of contextualization, experimentation and democratization (Kitchin, 2014).

The third hypothesis has also been accepted based on entrepreneurial theory because entrepreneurial theory suggests that innovation and newness should be a constant part of organizations and businesses if organizations are to continue to do business in the long run and

survive the complex and dynamic market competition and ever-changing business environment (Lim et al., 2018). Moreover, the theory also focused on the need for opportunities that businesses need to explore and exploit, so that innovation can be achieved by exploiting each new opportunity in the market. Moreover, the theory also suggested that without innovation and newness, businesses tend to enter into a stage of recession or slump very quickly, so it is proven that experimentation is necessary for innovation and newness in businesses, which significantly impacts SEO (Liu et al., 2020).

The fourth proposed hypothesis has also been accepted, which proposed that BDM execution has a significant effect on SEO; the results show a significant relationship in a positive direction. This means that with an enhancement in BDM execution, SEO will be enhanced as well. According to Liu et al. (2020), BDM is the future because it not only integrates all of the functions and operations of businesses but also minimizes other physical resources required for the business. Moreover, BDM execution is based on smart working and bringing technology into the business, which enhances efficiency and decreases the disturbance in normal business operations, resulting in a more sustainable and innovative entrepreneurial orientation. The same concept has been implemented and exaggerated in the theory of entrepreneurship as well, as discussed before (Lytras et al., 2017).

The fifth hypothesis proposed was that the effect of BDM (democratization) is significant on exploitative innovation, this hypothesis has been accepted based on the results of the study: there exists a positive and significant effect between BDM democratization and exploitative innovation (Mangla et al., 2020). This hypothesis is supported by entrepreneurial theory as well because the theory significantly emphasized opportunity recognition; opportunity recognition involves recognition of every possible market opportunity, then exploiting and exploring the opportunity as well. Market opportunities are supposed to bring innovation, newness and competitive advantages to companies, thus, to bring in exploitative innovation, BDM is very important (Mikalef et al., 2020). Mikalef et al. (2020) also suggested that big data plays a significant role in providing organizations with up-to-date market data and information that is required by the companies to survive the competition and dynamic innovation in the long run. By keeping up with market needs and competition using BDM, companies can significantly

exploit upcoming market opportunities, thus enhancing exploitative innovation positively (Mikalef et al., 2018).

The sixth proposed hypothesis of this study concerns the relationship between BDM (contextualization) and exploitative innovation. According to the results of the study, the effect of BDM (contextualization) is insignificant on exploitative innovation and negative, which means that an increase or decrease in BDM contextualization will not affect exploitative innovation (Pappas et al., 2018). According to the theory of entrepreneurship, the key to innovation is continuous newness and change according to market need and demand. Moreover, the major concept behind innovation and newness lies in the exploitation and exploration of new market opportunities, which is why the study rejected the association between BDM contextualization and exploitative innovation (Provost & Fawcett, 2013).

The seventh hypothesis proposed a relationship between BDM experimentation and exploitative innovation. It has been observed that there is an insignificant association between these two variables, so this hypothesis has been rejected as the impacts are insignificant (Provost & Fawcett, 2013). This hypothesis is rejected based on dynamic capabilities theory; the theory emphasizes that organizations should acquire different and dynamic effectors and characteristics so that dynamic and ever-changing competition and market conditions can be survived and competed. The study of Secundo et al. (2017) also suggested an insignificant effect of BDM experimentation on exploitative innovation. Moreover, similar results have been suggested by the study of Shamim et al. (2019) as well, in which it is suggested that for exploitative innovation, the most important factors are opportunity exploration and exploitation by the businesses and organizations of today.

The eighth hypothesis proposed a significant effect of BDM execution on exploitative innovation, the study rejected this hypothesis because there was no significant effect of BDM execution on exploitative innovation. According to Shamim et al. (2019), the presence of BDM execution cannot significantly affect exploitive innovation because exploitative innovation is mostly a result of opportunity recognition, opportunity exploration and opportunity exploitation. Also, the theory of entrepreneurship supports these results (i.e., the effect of BDM execution on exploitative innovation is insignificant). Singh and El-Kassar (2019) support the fact that entrepreneurship theory better explains the dynamics of the relationship between BDM

execution and exploitative innovation, whereas there is no significant effect of BDM execution on exploitative innovation.

The ninth hypothesis proposed that the effect of BDM democratization on exploratory innovation is significant; the study rejected this hypothesis based on entrepreneurship theory, as entrepreneurship theory supports the idea that opportunity recognition is the major factor that can affect opportunity exploration and opportunity exploitation, which can result in innovation and newness in an organization (Singh & El-Kassar, 2019). So, based on these claims, it can be stated that there is no significant effect of BDM democratization on exploratory innovation (Varian, 2014).

The tenth hypothesis of this study proposed that the effect of BDM contextualization is significant on exploratory innovation; this hypothesis has been accepted based on the results of this study (i.e., BDM contextualization can significantly affect exploratory innovation) (Wamba et al., 2020). As stated in entrepreneurship theory, contextualization can enhance the level of opportunity recognition, which can significantly lead to opportunity exploration and opportunity exploitation. In this way, organizations and businesses can gain the competitive advantage required to survive in a competitive market (Braganza et al., 2017).

The eleventh hypothesis proposed that the effect of BDM experimentation on exploratory innovation is significant; however, this hypothesis has been rejected based on the facts and claims of entrepreneurship theory. The twelve hypotheses proposed that the effect of big data execution on exploratory innovation is significant; however, this hypothesis has been rejected because an insignificant relationship was obtained as a result of the analysis and also based on entrepreneurship theory the relationship is insignificant (Agarwal & Dhar, 2014).

Hypothesis 13 concerns the mediation of SEO on the relation between BDM (democratization) and exploitative innovation; this hypothesis has been rejected because according to the dynamic capabilities theory, no significant relationship could be found (Braganza et al., 2017).

After economic performance, the next important aspect of sustainability performance is environmental sustainability performance, which refers to all the positive outcomes of certain sustainability activities, which are related to both the internal as well as the external natural

environment of an organization (Kerdpitak et al., 2019). To be more specific and precise, compliance with environmental standards, decreased emissions of air pollutants and other hazardous material, and decreased consumption of the resources (Mangla et al., 2020). Hypotheses 14, 15 and 16 have been accepted because the effect of SEO as a mediator between BDM (contextualization, experimentation, and execution) and exploitative innovation was found to be significant, based on the theory of entrepreneurship and dynamic capabilities (Varian, 2014).

Similarly, Hypothesis 17 has been rejected because the theory of entrepreneurship also proposes that SEO cannot significantly affect the association of BDM democratization and exploratory innovation. However, Hypotheses 18, 19 and 20 have been accepted because the mediation of SEO on the relation between BDM (contextualization, experimentation and execution) and exploratory innovation is significantly based on the theory of dynamic capabilities. The performance of a business is dependent on the strategy selected by the entrepreneurs and managers, which is based on either of the two types of innovation (Pappas et al., 2018; Provost & Fawcett, 2013). As discussed earlier, exploratory innovation involves the development of new and innovative products and services for new markets and customers by identifying gaps and opportunities in the market through the usage of new knowledge; in this way, competitive advantage is gained by the organizations, especially new ventures, thus increasing their sale returns and market share (Mikalef et al., 2020).

Hypothesis 21 has been rejected because there is no significant effect of SEO on SEP from an economic perspective; it has been discussed in entrepreneurship theory that business creation is a very significant paradigm of the theory. The theory of entrepreneurship indicated that sustainability can be considered a green prison for entrepreneurs (Provost & Fawcett, 2013). The researchers' concept of green prison is based on game theory in such a way that the design of incentives can be influenced by entrepreneurs, then the adoption of sustainability behaviors will be worthy not only at an organizational level but also at an individual level (Secundo et al., 2017). In the context of incentives, the effect of centralized and decentralized institutions on the implementation process of incentives has been studied (Shamim et al., 2019). Following an integrated approach, a past study suggested that theories based on entrepreneurship, neo-institutions and management can be integrated to form sustainable development theory (Singh

& El-Kassar, 2019). However, according to the hypothesis, SEO should affect SEP but it cannot bring about significant economic results; so, this point does not align with the theory discussed and that is why the hypothesis was rejected by the study.

Hypotheses 22 and 23 have been accepted, as the effect of SEO is significant on SEP in the context of environment and society. Sustainability is in the best interest of both the environment and society and, according to the DCV, the presence of dynamic capabilities like SEO can significantly enhance the environmental performance and social performance of organizations and businesses, thus enhancing overall market value and goodwill (Wamba et al., 2020; Wamba et al., 2018).

Hypotheses 24 and 25 have been accepted based on the facts of dynamic capability theory, as it proposes that the dynamic capability of sustainable and strategic change in such a construct that has various dimensions such as exploration, reconfiguration, and identification capabilities of the firm, and finally the interpretation of the issues related to the environment as the potential opportunities of the firm (Wamba et al., 2018; Zeng & Khan, 2019). So, the effect of SEO on exploitative and exploratory innovation was found to be significant.

The mediation of exploitative innovation in the relation between SEO and SEP (economic, environmental and social) and the mediation of exploratory innovation in the relation between SEO and SEP (economic, environmental and social) have also been confirmed to be significant by the results of this study. Moreover, Kerdpitak et al. (2019) confirmed and supported similar results as well. The theories of entrepreneurship and dynamic capabilities have also got facts and content that support the mediation of exploitative innovation and exploratory innovation on the relation between these variables (Lim et al., 2018; Lytras et al., 2017) as organizations that pursue exploitative innovation are involved in the search for those opportunities that are found in their primary landscape and they rely on their primary search activities as well (Mikalef et al., 2020). The elements that are associated with exploitative innovation include choice, efficiency, refinement, production, execution and implementation (Dubey, Gunasekaran, Childe, Roubaud, et al., 2019). Exploitative innovation involves the knowledge and skills, and the structures and processes that currently exist in an organization. In other words, this type of innovation involves the improvement and innovation of existing products and services (Hazen et al., 2016).

5.2 Conclusion

The present study researched variables of BDM to evaluate their effects on SEO and SEP while evaluating the effect of variables of BDM on exploitative innovation and exploratory innovation. Furthermore, the study contributes to the existing literature by focusing on the mediating role of SEO in the relationship between the variables of BDM (democratization, contextualization, experimentation and execution) and exploitative innovation and exploratory innovation. Besides, the direct results of the effect of SEO on SEP in economic, environmental and social contexts have also been studied. In the end, the study analyzed the direct effect of SEP on exploitative innovation and exploratory innovation, and the mediating role of exploitative innovation and exploratory innovation on the relationship between SEO and SEP was also analyzed in economic, environmental and social contexts. The study was conducted using a quantitative method in the software houses of Pakistan.

The findings of the study indicate the importance of various accepted hypotheses that can enhance the entrepreneurial value of firms. In the context of the effect of BDM variables on SEO the study put forth that contextualization, experimentation and execution are optimized variables for firms related to software houses in Pakistan, which suggests that these firms must enhance their implementation of these variables to present optimized SEO. It has been argued that through BDAC, such as BDM, human-based decision making can be supported and the actions that organizations make in response can be automated. Various firms currently rely on big data to orchestrate real-time processes for activities that are related to the supply chain and logistics (Schoenherr & Speier-Pero, 2015). In the same way, various organizations now consider smart manufacturing, following the paradigm of Industry 4.0, in which cyber-physical systems are involved, which results in faster and more efficient processes and operations resulting in high-quality products. Similarly, in the case of customer management and service-providing activities, the market approaches of organizations can be personalized and priority can be given to the more profitable segments, all thanks to the proper management and analysis of big data available to the firms, and customized products and services can be provided as well. Concerning the effect of variables of BDM on exploitative innovation, the present study suggests that democratization is the only factor of BDM which enhances the capabilities of exploitative innovation for the software houses of Pakistan as exploitative innovation related to the most optimized value while implementing democratization in respective firms.

Regarding explorative innovation, the present study proposed that contextualization of BDM has been recorded as the most significant variable which can efficiently improve explorative innovations for software houses in Pakistan.

The findings of the mediating role of SEO bring forth that for the software houses of Pakistan the mediating role of SEO on relationships between variables of BDM and innovation was not changed by changing the context of innovation. As SEO significantly meditates the relationship between contextualization, experimentation and execution and exploitative innovation and similarly exerts a significant mediating role on the relationship between contextualization, experimentation and execution and explorative innovation. In the context of the effect of SEO on economic, environmental and social SEP, the study found that SEO has a significant effect on environmental and social SEP; the interpretation of which suggests that in the sustainable orientation of entrepreneurial activities only environmental and social contexts are optimized for the software houses of Pakistan to exert SEP. The last findings of the study bring forth that SEO affects exploitative innovation and exploratory innovation while these two kinds of innovation also significantly meditate the relationship between SEO and SEP in all three given contexts (i.e., economic, environmental and social). These findings are necessary for the software houses of Pakistan as they help them to keep track of their SEP by implementing all those variables which have a positive effect on it. The findings of this study contribute a new dimension to the existing literature by evaluating the direct effect of all variables along with all the mediating variables. In the context of software houses of Pakistan, the findings of the study can be implemented as Pakistan is developing in IT sectors; so, there is a need to increase the implementation of those variables that enhance entrepreneurial performance and capabilities of innovation. The implementation of significant variables enhances entrepreneurial performance so that a satisfactory level of development can be achieved.

5.3 Implications of the study

The purpose of every research is to contribute and bring benefits to the theoretical, practical and social milieu.

5.3.1. Theoretical Implications

This study also contributes to theory and practice. The findings of this study guide software houses of Pakistan and other firms to enhance their SEP by the successful implementation of the factors of BDM. In terms of theoretical implications, this study extends the literature on DCV and entrepreneurial theory by highlighting BDM capabilities in this framework. It provides a wide path for firms to enhance SEP and exploitative innovation and explorative innovation capabilities, which are crucial for the entrepreneurial advancement of firms in a global context. This study theoretically extends the knowledge-based perspectives for various firms by introducing the significant variables of BDM and its capabilities. The current literature focuses on the innovative implementation of data to enhance performance and this study contributes in this regard by highlighting such significant variables which enhance the innovative and entrepreneurial abilities of firms. By extending entrepreneurial theory, this study highlights the significant variables of BDM and their significant performance in different scenarios. In this regard, first, this study focuses on SEO for global firms. This is one of few quantitative studies which also evaluates the mediating effect of variables in numerous dimensions to completely grasp the entrepreneurial performance of firms. Accordingly, this study evaluates the democratization, contextualization, experimentation and execution of BDM from multiple directions. In the literature, the prime focus of researchers is to measure the competitiveness of firms using effective entrepreneurial performance and they left a gap concerning the measurement of those factors which boost entrepreneurial performance. Within this context, this study fills this gap in the context of Pakistan by highlighting big data management capabilities which affect both innovation and entrepreneurial firms. This study will help peer researchers and other scholars by providing them with a wide knowledge of the respective era of BDM and SEP.

5.3.2. Practical Implications

For practical implications, this study contributes to the practice of BDM in IT-related and software-related sectors and multiple other firms in a global context. Based on the findings of this research, firms can implement the proven significant variables in the practice of entrepreneurship development to enhance their performance. To implement BDM for SEP, this study will help firms to devise strategies which aim to develop entrepreneurial performance. The firms may use the significant factors of BDM to enhance exploitative and explorative innovation, which leads to the optimized value creation of entrepreneurial activities. For practical implementation, this study will help various organizations to focus on the implementation of BDM in their recruitment and selection process. The proclivities of BDM can strengthen entrepreneurial performance through the capabilities of its factors. Besides, their mediation role enhances exploitative and exploratory innovation. The relevant literature on strategic management suggests that BDM capabilities are crucial to achieving the desired outcomes of entrepreneurial performance. Accordingly, democratization, contextualization, experimentation and execution of BDM are operational-level capabilities which should be practiced, keeping in view the significant findings in the context of organizations in Pakistan and the global context.

5.3.3. Policy and Social Implications

Moreover, this study also contributes to policymakers and extends its benefits to the social milieu. For policymakers, this study will help managers and other related personnel by informing them of the significant effect of democratization, contextualization, experimentation and execution of BDM on entrepreneurial performance. It will help them to formulate policies and strategies based on the findings of this research in this context. It will centralize the focus of organizations on developing these capabilities on a managerial level. The findings of this research help policymakers adopt suitable leadership styles, technologies and technology management to boost BDM capabilities, which ultimately improve SEP. Implementing factors of BDM helps to gain innovative benefits, it is extremely important to get satisfactory entrepreneurial performance, and guides managers to not only make decisions but also to justify those decisions. The contribution of this study in the social context is that this study highlights the significant positive effect of BDM on society, which helps other organizations

to improve their entrepreneurial ways. It helps society to enable new markets, which will lead to the optimized establishment of a country's overall economy. The findings of this study imply that it highlights the BDM and SEP relationship that helps to maximize the social benefit of entrepreneurial organizations.

5.4 Research Limitations and Future Directions

A fundamental effect of factors of BDM on SEP has been studied. The study analyzed the findings by considering the mediating role of SEO, exploitative innovation and explorative innovation. Although the present study is extensive, it has some limitations. The first limitation is that the study implements a cross-sectional design to collect and analyze data due to the limitation of time. Accordingly, as many researchers believe that a cross-sectional study does not formulate causality, future studies could conduct a longitudinal study to evaluate the long-term effects of BDM on SEP. The second limitation of the study is based on the research design implemented in the study. The study only used the technique of quantitative method for evaluation of the research objectives. Future studies could evaluate the association between the variables and study the influence of innovation and BDM capabilities in firms through a qualitative or mixed methods approach. The third limitation is that this study restricts itself to software houses of Pakistan because in the context of Pakistan these sectors need more entrepreneurial development. Future studies could evaluate the effect of BDM on various other enterprises, like SMEs or multinational firms, in the context of Pakistan or in a global context. The fourth limitation is that this research study chose a small population as only those software houses registered with PSEB were selected. In this regard, future studies could conduct studies with private and family-based enterprises. Furthermore, this study put a limitation on the sample as well, as only those individuals who know the factors of BDM and other advanced innovative ways were selected. Future studies can collect data randomly from employees after moderating a questionnaire so that everyone can answer its questions. In addition, the present study analyzed the effect of factors of BDM as variables, but future studies can analyze the effects of other factors of BDA, such as massive content, new business models and radical innovation, on the entrepreneurial performance of firms. This study limited SEO and SEP to three contexts while the same variables can be utilized to evaluate the competitive firm performance in upcoming research studies.

BDM is becoming popular and implementations of BDM are increasing rapidly, this study has been done to ensure that Pakistani software companies utilize BDM technology successfully and minimize or remove performance inhibitors in the process of implementing this management procedure. Even though BDM is popular among experts in IT, its implications are significant and vast for other sectors as well, including the health sector, the education sector and the manufacturing sector. The study has played a very significant role in generalizing the information regarding BDM and its associated factors. Moreover, the study has also played a significant role in defining the worst applications of management technology. Using explanations derived from DCV, this study has shown the importance of implementing BDM and its capabilities. Right now, different sectors and companies are facing saturated market competition conditions and heavily increasing dynamism and innovation. So, to cope with the high level of dynamism and innovation, it has become very important for software companies to adopt the different capabilities of BDM and variables that come along. The study also focuses on the entrepreneurial abilities of software companies, it has been elaborated through entrepreneurship theory that newness and innovation are two very important factors for organizations if they wish to survive the heavy competition and dynamism in the business environment. Data generation and storage are important to create sustainable performance of firms, However, how the firms utilize or benefited from the data after generation and storage is for more important that need to be explore further.

It has been elaborated that BDM, its variables and capabilities allow software companies to enhance their performance and their entrepreneurial abilities significantly. Moreover, the studies can be analyzed the moderating role of SEO on BDAC) on firm performance. Besides SEO, this study utilized the limited mediating variables of exploitative innovation and exploitative innovation, but future studies can evaluate the results by using different mediating variables of different kinds of innovation, such as disruptive innovation, incremental innovation and radical innovation. The sector of this study is limited to one country, future studies have a wide scope to draw a cross-country study to compare the efficiency of BDM in different cultures. The moderating role of ecologically sustainable entrepreneurship could also be considered by future studies to highlight the ecological measures of innovative firms. Moreover, along with evaluating the effect of BDM, future studies could also evaluate entrepreneurial performance through different management practices, such as data governance.

Last, since replication is an important way to validate results, the research questions of the current study can be evaluated in the context of countries other than Pakistan, which would enhance the significance of the proposed variables and their relationships.

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