Technological Forecasting & Social Change 160 (2020) 120248

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Balancing innovation and exploitation in the fourth industrial revolution: Role of intellectual capital and technology absorptive capacity

Tarique Mahmood[a,*], Muhammad Shujaat Mubarik[b]

[a] Mohammad Ali Jinnah University, Karachi, Pakistan
[b] Faculty of Business Administration & Social Sciences, Mohammad Ali Jinnah University, Karachi, Pakistan

ARTICLE INFO

Keywords:
Fourth industrial revolution (Industry 4.0)
Innovation
Technology absorptive capacity
Intellectual capital
Organizational ambidexterity
Structural equation modeling

ABSTRACT

Industry 4.0, which features the Internet of things (IoT), cloud computing, big-data, digitalization, and cyber-physical systems, is transforming the way businesses are being run. It is making the business processes more autonomous, automated and intelligent, and is transmuting the organizational structures of businesses by digitalizing their end-to-end business processes. In this context, balancing innovation and exploitation—*organization's ambidexterity*—while stepping into the fourth industrial revolution can be critical for organizational capability. This study examines the role of intellectual capital (IC)—*human capital, structural capital and relational capital*—in balancing the innovation and exploitation activities. It also examines the role of technology's absorptive capacity in the relationship between IC and organizational ambidexterity (OA). Data were collected from 217 small and medium enterprises from the manufacturing sector of Pakistan using a closed-ended Likert scale-based questionnaire. The study employs partial least square-Structural Equation Modeling (PLS-SEM) for data analysis. Findings indicate a profound influence of all dimensions of IC, both overall and by dimensions on organizations' ambidexterity. Findings also exhibit a significant partial mediating role of technology absorptive capacity (TAC) in the association of IC and ambidexterity. The findings of the study emphasize the creation of specific policies aimed to develop IC of a firm, which in turn can enable a firm to maintain a balance between innovation and market exploitation activities. The study integrates the TAC with the IC-OA relationship, which is the novelty of the study.

1. Introduction

The world is on the verge of a fourth industrial revolution (Industry 4.0), which is ready to transmute the way businesses exploit the markets, innovate and adopt technologies. The pace and momentum of this revolution is unmatched, turbulent and exponential. Both practitioners and researchers envision that Industry 4.0 can enable firms to gain efficiency and faster innovation. It is worth mentioning that this revolution is transforming the global economic structure and is ineluctable for any single country or organization (EEF-The Manufacturers' Organization, 2016). In such situation, businesses are required to upgrade their technological and innovative capabilities according to the Industry 4.0 needs for competing in the dynamic environment (Horváth, and Szabó, 2019; Frank et al., 2019). It is also essentially revolutionizing the way organizations interact with their customers, employees and suppliers. It is worth mentioning that Industry 4.0 requires businesses to transform themselves by replacing the old technologies, processes, and interactions with new ones. Further, in the presence of staggering effects of COVID-19, the need to transform businesses according to the paradigm of Industry 4.0 is ever-increasing as the firms not only have to maintain a balance between their innovation and market exploitation activities but also need to enhance their technological absorption capacity (TAC) to cope with the challenges posed by the this pandemic. There is mounting pressure on almost every industry across the globe (Vlačić et al., 2019; Kafouros et al., 2020). Researchers claim that the impacts of the fourth industrial revolution are not only limited to large businesses but can also have a profound influence on the small and medium enterprises (SMEs). Hence, present day businesses, irrespective of their size and nature, are entering a turbulent, challenging and dynamic business environment (Ashton and Morton, 2005; Hitt et al., 1998). In this situation, the survival and growth of a business greatly depends upon the way it balances innovation and market exploitation—*organizational ambidexterity* (OA)—and the extent to which it can absorb the technology-

This article belongs to the special section on Technological Innovations & Their Financial & Socio-economic Implications in the Era of Fourth Industrial Revolution.

* Corresponding author e-mail: ranatariqphdmaju@gmail.com
E-mail address: ranatariqphdmaju@gmail.com (T. Mahmood).

https://doi.org/10.1016/j.techfore.2020.120248
Received 21 June 2020; Received in revised form 6 August 2020; Accepted 7 August 2020
Available online 20 August 2020

related knowledge—*technology absorptive capacity* (TAC)—from the external environment. TAC provides firms with the capability to adapt and evolve in the era of Industry 4.0. It allows firms to sustain a competitive advantage by means of organizational innovation in the context of a dynamic industry. TAC can also foster the capacity to absorb new technological knowledge—knowledge that is valuable because it leads to further organizational innovation. Researchers (Ahmed et al., 2019;Mubarik, 2015) claim that the fourth industrial revolution is profoundly changing the basis of competitive advantage from tangible resources to intangible resources (Grant, 1996; Hitt et al., 1998; Wong and Aspinwall, 2005; Secundo et al., al.,2020). In such case, a firm's intellectual capital (IC) can play a fundamental role in attaining OA, technology absorption and competitive advantage. The importance of IC can be traced back to the resource-based researchers mentioned earlier (e.g. Penrose, 1959; Becker, 1962; Wernerfelt, 1984) who pointed out that a business's external environment and its level of intangible resources determine its level of success. The resource-based view (Wernerfelt 1984) claimed that competitive advantage of corporation are rooted through organizations that have VRIN resources (*valuable, rare, inimitable and non-substitutable*) (Kor and Mahoney, 2004). VRIN can be acquired through human capital (HC), relationships and processes collectively termed as IC (Lev and Zambon 2003; Chu et al., 2006; Mubarik et al., 2019). By developing IC, a firm can attain OA—*a fit between its firm's innovation and exploitation activities* (Barney, 2001; ; Russo and Fouts, 1997). In an IC-ambidexterity dyad, a firm's capacity to absorb outside technology related knowledge can play an instrumental role (Mubarik 2015; Antonelli and Colombelli, 2011). A number of studies (e.g. Ashton and Morton 2005; Barathi 2007; Arenas, and Lavanderos, 2008; Hsu and Fang 2009; Asiaei, and Jusoh, 2015) examine the role of OA in the association between IC and firm performance. However the scholastics work examining the role of TAC in IC- OA is missing (Mubarik et al., 2019 Carte, 2005; Mouritsen, 1998, 2005; Seleim and Khalil, 2011; Alvarez and Barney, 2001; Nonaka and Konno, 1998). Against this backdrop, examining how TAC intervenes in the interplay of IC—OA is essential for devising strategies for IC led ambidexterity. This study undertakes this task, and in doing so, it contributes to the literature in three ways. First, it integrates the dispersed variables of IC, ambidexterity and absorptive capacity in the framework, and provides empirical evidence on this triad. Second, it provides application of IC-ambidexterity models in the context of SMEs as the majority of the studies conducted on this conception focused on the larger firms. Third, for the first time, the study introduces and examines the role of top management team in IC, ambidexterity and absorptive capacity triad.

The paper has been divided into five sections. The following section briefly discusses the theoretical and empirical literature on the association of IC, OA and absorptive capacity interplay. Section 3 entails the methodology employed for analysis whereas Section 4 discusses the findings of the study. Section 5, the last section, concludes the study.

2. Review of literature

Organizations in the modern era are existing in a complex environment of ever-increasing dynamism and uncertainty. For the success of an organization, it is vital for it to develop and acquire tacit resources and knowledge (Hitt et al., 2001; Hitt et al., 1998), leading to a shift from physical resources to intangible (imitable) resources, and for gaining both ambidexterity and competitiveness (Ashton and Morton, 2005; Wong and Aspinwall, 2005). Thus, management of knowledge-based resources has become a key driver for better performance and sustainable competitive advantage (Grant, 1996; Mubarik et al., 2019; Sharkie, 2003; Teece, 2012). The literature on IC contains attention-grabbing opinions about the technique in which organizations adjust exploration and exploitation activities. In the same vein, HC, structural capital (SC) and relational capital (RC) represent different knowledge stocks at different organizational levels (Mubarik et al., 2019; Mubarik, 2015). These IC dimensions will interact across different organizational levels, playing distinct roles when creating ambidextrous capabilities (Fernández-Pérez et al., 2017; Kang and Snell, 2009) and leading to superior organizational performance (Andrews, 2010; Liu and Chen, 2009). Before discussing how the IC interacts with OA and the role TMT plays in IC-ambidexterity dyad, it is essential to review the various definitions of IC and how it is measures. To this effect, the following section briefly reviews the definition of IC and its way of operationalization.

2.1. Intellectual capital

The fourth Industrial Revolution creates new relationships between humans and machines, along with changes in the work characteristics, organizational structure and relationships. This has brought IC into the heart of fourth industrial revolution and is the reason that researchers claim that stepping into the fourth industrial revolution requires having strong IC. The concept of IC primarily incorporates activities of employees, directors, intelligent human beings and stakeholders of the company that create value. John Kenneth Galbraith (Itami, and Roehl., 1991) first coined the term “intellectual capital” or IC in 1969. According to Edvinsson (1997) and Jørgensen and Boje (2010), the term includes a degree of relative 'intellectual action'. Researchers mention IC as the knowledge and relationships that can be transformed into organizational performance. However the framing of IC as a subject of research is a fairly new trend. It started from after the seminal article of Stewart (1997) published in *Fortune* magazine where he discussed IC as being the knowledge, ability, and strength of employees, which could strengthen the competitiveness of an organization. He also mentioned that the distinction between the market value and the book value of an organization is IC. Various researchers (e.g. Barathi Kamath, 2007; Bontis and Fitz-Enz, 2002; Bontis and Nikitopoulos, 2001; Kang and Snell, 2009) from distinctive backgrounds explain the concept of IC differently; however three components of IC can be found in almost every definition: HC, RC and SC. The following lines briefly explain each of these components.

Human Capital (HC): Defined as the knowledge, skills, and capabilities of an individual the notion of HC can be traced back to the early 1950s (Mubarik et al., 2018). However, the inception of HC theory (Becker, 1962a) and theory of firm (Penrose, 1959) exposed the importance of HC both at firm and country levels. These researchers defined HC as the knowledge, skills, and abilities of a person that can be instrumental in improving his job-related performance. Becker (1964) explained that improving HC through education and training can in turn improve an organization's performance. He also considered health as an essential component of HC. Scholars in the early 1990s, (e.g. Grant, 1996; Russo and Fouts, 1997; Edvinsson, 1997; Mouritsen, 1998; Hitt et al., 1998) included qualities like attitude, creative thinking, and problem solving as being part of HC, and they developed several constructs to measure it at the firm level. Likewise, HC of an organization is also defined as the combined competencies of employees to resolve problems of customers, suppliers, and the organization. The organization-wide HC is the knowledge and institutional memory about prioritizing the importance of the organizational issues. This resource comprises the individual skills, collective experience, general know-how and management expertise of all of the employees (Edvinsson, 1997). Gupta and Roos (2001) determine that HC includes skills and knowledge, so intellectual ability in employees work for quickly adopt change, innovation and effective solution to the problem etc. Various studies (Arshad et al., 2015; Hershberg, 1996; Mubarik et al., 2018) considered HC as being the repository of knowledge, abilities and skills exemplified in labor for the production and economic value. Thus, HC can be defined as the knowledge and skills achieved by the worker through experience and education (Sullivan and Sullivan, 2000). Diaz-Fernandez et al. (2017) supported this definition and pointed out that HC is comprised of personal attributes such as skills, knowledge, and

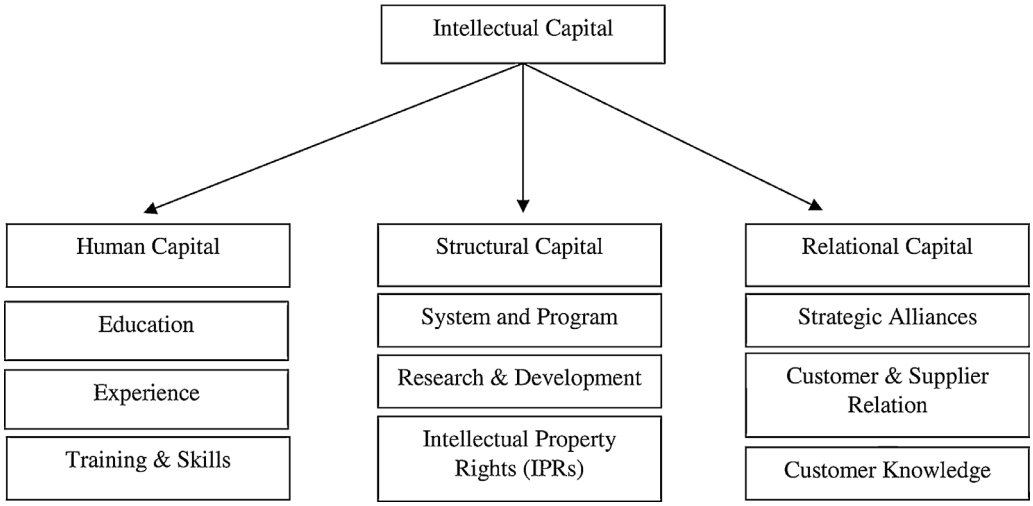

Fig. 1. IC taxonomy.

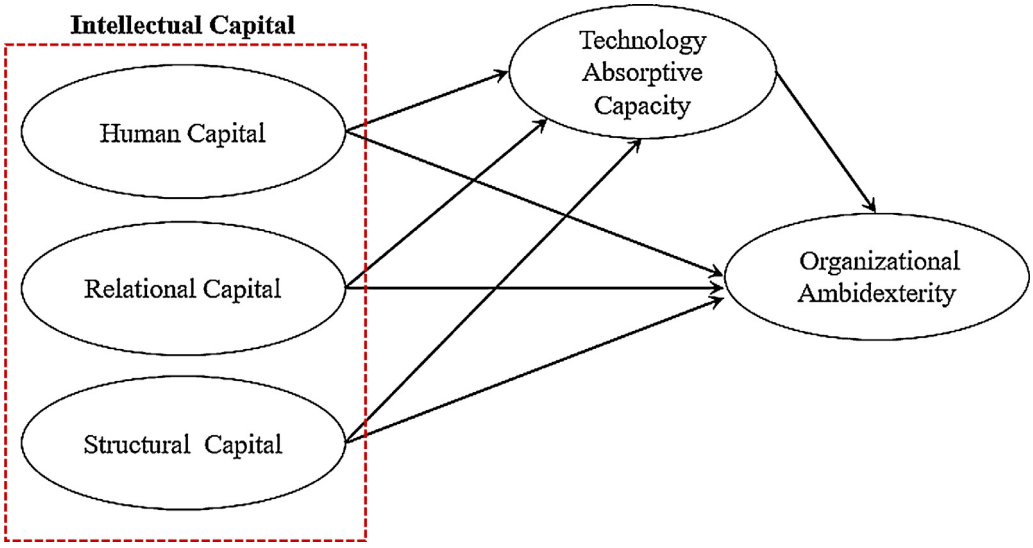

Fig. 2. Conceptual framework.

expertise. It is HC that plays a substantial part in organizational performance as well as in the economic development of any country. Drawing from the HC theory and resource-based theory, we define HC as the knowledge, skills and abilities of the employees that are instrumental in increasing organizational performance (Figs. 1 and 2).

Structural capital (SC): From the perspective of the organization, SC incorporates all non-human knowledge resources. SC represents an organization's processes and structures through which it performs its business transactions. These structures range from tangible to intangible stuff that the organization offers, for instance, copyrights, patents, software systems, databases, processes and trademarks, accountability, organizational culture, trust among employees and efficiency (Zameer et al., 2020). Structural or organizational capital accordingly comprises of internal value drivers of an organization, namely, routines, processes, customer files, database, manuals, and the literature and structure of an organization (Reza et al., 2020)(). Asiaei and Jusoh (2015) state that organizational capital comprises of internal capital, which encompasses management philosophy, intellectual property, management processes, financial relations, information and networking systems, and corporate culture.

Relational capital (RC): RC is characterized by the organization's reputation and the loyalty of customers. All of these resources are connected to the organization's external relations with its suppliers, stakeholders, and customers. In this regard, relational or social capital is considered as the bond that is formed with organizational relationships with stakeholders, and that impacts the lives of the organization. Researchers (e.g., Eisenhardt and Sull, 2001;Kang et al., 2007; Mom et al., 2015; Mubarik et al., 2016) explain relational or social capital as being a blend of different relationships such as market relationships, power relationships and cooperation. RC encompasses trust, stronger understanding, collaboration and the relationship among the strategic partners in this regard, and it characterizes interactions, connection stocks, closeness, linkages, loyalty, and goodwill between an organization and downstream clients, upstream suppliers, external stakeholders, and strategic partners (Lazzarotti et al., 2017; Mubarik et al., 2019; Naghavi and Mubarak, 2019). It is also called external capital that comprises customers, brands, and the reputation of the company business collaboration; and channels of distribution, licensing agreements and customer satisfaction.

2.2. Organizational ambidexterity

Although OA was coined back in 1976 by Duncan, 1976) , the concept gained heightened attention after the popularity of the fourth industrial revolution. Industry 4.0 requires a balanced yet dynamic approach to simultaneously drive the innovation and exploitation

activities, which cannot be attained without having OA. This notion of an ambidextrous organization was substantiated by March, 1991), suggesting exploitation (market capitalization) and exploration (innovation) as the two learning activities carried out by organizations. Exploration entails innovation, experimentation, search, and discovery whereas exploitation, in contrast, is linked with efficiency, selection, refinement and implementation activities. Exploration and exploitation, therefore, essentially require different strategies, organization structures and contexts. Various scholars agree that an organization faces trade-off between properly exploiting existing competencies and exploring new opportunities by aligning their functions (García-Morales et al., 2007;Alänge and Steiber, 2018; Baškarada et al., 2016; Junni et al., 2013; Mubarik et al., 2019).

The most prevalent ambidextrous organizations are categorized as contextual ambidexterity, innovative ambidexterity, structural ambidexterity, and sequential ambidexterity.

Contextual Ambidexterity: This denotes the behavioural and interactive capacity to simultaneously determine adaptability and alignment (Gibson and Birkinshaw, 2004). Meanwhile, the alignment includes the consistency among the activities of organization units, while adaptability is related to the ability for quickly configuring the activities in connection with variations in the task environment. In contrast, other concepts of OA state that contextual ambidexterity is based on the instantaneous pursuit of paradoxical agendas within the single unit of an organization. Innovative ambidexterity can be considered as an ambidextrous result variable that captures the exploitation and exploration performance of an organization (Simsek et al., 2009). Innovative ambidexterity indicates the firm's ability to instantaneously follow both discontinuous [exploratory] and incremental [exploitative] innovation.

Structural ambidexterity: Is associated with essential trade-off innovative ambidexterity such as exploitative vs. exploratory innovation, it is not determined with one organization unit. Structural ambidexterity grounds on spatial separation of organizational units which are furnished with paradoxical activities. (Jansen et al., 2012; Volberda and Lewin, 2003), in this regard, referred to enabling mechanism of structural differentiation as segmenting organization system into subunits, each tends to establish specific attributes in line with requirements of the external environment and acknowledge this is a possible avenue to organizations ambidexterity.

Sequential ambidexterity: In contrast to structural ambidexterity, sequential ambidexterity involves a vibrant perception on an either exploratory or exploitative decision and is gained through the mechanism of temporal separation. Thus, sequential ambidexterity rises from dynamic, temporal sequencing of exploration and exploitation. This sequential ambidexterity perception is supported by Good and Michel, 2013; Güttel and Konlechner, 2009; Junni et al., 2013). The sequential ambidexterity is time paced sequence of exploitation and exploration and stated that this is consistent with dynamic capability view.

2.3. Association between IC and organizational ambidexterity

Researchers (Asiaei et al., 2018; Bontis and Nikitopoulos, 2001; Khalique et al., 2015; Mubarik et al., 2019) mention IC as being the key capability needed to acquire OA—*a fit between exploitation and exploration*. Mubarik et al. (2019) argue that organizational-level ambidexterity can only be adopted by improving the ICs (firms processes, HC, and relationships). They further explain that transforming the IC on the lines of ambidexterity may enable firms to effectively maintain a balance between exploration and exploitation activities. Likewise, Bontis (1998) also mentions the need for the IC in maximizing and balancing both exploitation and exploration activities of a firm. When the organizations explore and exploit simultaneously, it is called the organization ambidextrous learning. Because the organization together use exploration, that is, identifying and learning new knowledge along with their current knowledge to make of an organization and exploitation, they make great use of its present organization resources when giving an explanation. Hence, organizations have to bring about the right mix of both exploration and exploitation. It implies that all three components of IC play a fundamental role in the adaptation of ambidexterity.

First HC—operationalized as education, skills and capabilities of employees—plays a significant role in promoting both innovation and productivity. It promotes ambitexterous capacity as employees possess the creativity and competence that is essential to refine existing knowledge and develop new knowledge (Kang and Snell, 2009;). *It is precisely through such HC that* ambidexterity *is able to access and utilize knowledge from multiple domains, discover novel solutions to existing problems, and challenge assumptions behind prevailing knowledge and practices.* Effectively managed HC contributes to the incremental and radical innovations (Mubarik et al., 2016; Raisch et al., 2009). Asiaei et al. (2018) argue that experience, education, skills and training are important dimensions of HC and they contribute to the ambidextrous behaviours. The higher levels of experience and knowledge enable employees to resolve problems in a quick and effective matter. Likewise, these HC constructs also enables employees to work smartly and effectively, thus increasing their ambidextrous characteristics (Mubarik et al., 2019). Considering these arguments, the author proposes that:

H1: Human capital (HC) has a positive influence on organizational ambidexterity (OA).

Likewise, the RC, the second most important dimension of IC, influences the firm's ability to manage exploitation and exploration simultaneously. According to researchers (Mubarik et al., 2019, 2016), improving relationship with suppliers and customers helps the organization not only in market exploitation but also in developing the new market trends. Consequently, relational systems will facilitate interactions between humans and processes to help them work together, creating ambidexterity. Further, proper social perspective will help the firm to overcome the tensions between exploitative and exploratory activities (Lavie et al., 2010; Stettner and Lavie, 2014).

Relational/social capital also establishes itself in the associated ties that ambidexterity can develop with external parties (e.g., alliance partners, suppliers, customers and consumers). Connecting such ties enables ambidexterity to both improve and renew their knowledge base by having superior potential control and access to over a various range of perspectives, specialized knowledge and skills (Mom et al., 2015; Tiwana, 2008). Accordingly, we theorize that a relational/social capital will promote the pursuit of ambidextrous learning activities by developing a perspective that supports access to and combination of diverse skills and knowledge both within and across the confines of ambidexterity. Along these lines, the author proposes that:

H2: Relational capital (RC) has a positive influence on organizational ambidexterity (OA).

There is no ambidextrous organizations is based on individual learning. No organization can grow unless the individuals of that organization are well-skilled, but this is an inadequate condition for ambidextrous organizations. Structural/organizational capital is the knowledge that resides in organization system, patents, databases, processes, and structures (Youndt et al., 2004). Hence, rather than different firm's possessing, structural/organizational capital to develop exploration and exploitation as two disconnected blocks, a versatile and flexible structural/organizational capital is considered to attain OA. Crossan et al. (1999) suggests that structural/organizational capital is understood as the set of rules, structures, routines and standardized processes followed by the organization to help build an organizational culture with a similar frame of reference for all employees. It is exploitation in nature, and employees in the organization intend to solve their problems based on the decisions that were previously proved useful (Chang et al., al.,2020). On the other hand, for Eisenhardt and

Table 1
Sampling distribution.

S. no	Industry	Percentage	Number
1	Textile	33%	72
2	Leather	28%	61
3	Sports	16%	34
4	Food	14%	31
5	Metal	9%	19
Total			217

Sull (2001), the notion of structural/organizational capital is less connected to rules, procedures and common style of work (Daft and Weick, 1984) and provides new opportunities and autonomy for individual and group work in order to explore and experiment with the new styles of work environment and the way in which they unify the work. Drawing on the aforementioned discussion, the last proposition is:

H3: Structural capital (SC) has a positive influence on organizational ambidexterity (OA).

2.4. Technology absorptive capacity, IC and organizational ambidexterity

TAC is considered as being an essential organizational capability in order to embrace the fourth industrial revolution. It appears to have a profound influence on the activities related to technology and innovation in organizations. It is closely linked with OA and is considered to be the prime enabler of OA (Barney, 1991; Prahalad and Hamel, 2007). Researchers (e.g. Lund Vinding, 2006; Zahra and George, 2002) argue that organizations need to improve their capacity to absorb outside technological knowledge—*TAC*—for improving their ambidexterity (Lund Vinding, 2006; Zahra and George, 2002). Vinding (2006) defines absorptive capacity as "*the firm's ability to identify, assimilate and exploit knowledge from the environment*". Drawing from the premise of HC theory, resource-based view and IC theory, when IC can directly contribute to a firm's ambidexterity, it has the potential to improve the firm absorptive capacity (Mubarik, 2015). Absorptive capacity has two major types: First, potential absorptive capacity, which represents acquisition and assimilation of knowledge outside the firm. Second, realized absorptive capacity, which includes assimilation and transformation of knowledge outside the firm (Lund Vinding, 2006). García-Morales et al., 2007, p.531) defines TAC as the process that "involves acquisition (through which the firms obtains so called technological stock), assimilation and transformation (the capacity to develop and refine routines to facilitate combining existing technological knowledge with that acquired, and to assimilate this knowledge and to exploit technological knowledge)". TAC helps a firm to upgrade, expand and utilize existing capabilities and technologies to innovate, incorporating the technological knowledge acquired and transforming the firm's operations to increase the productivity of the goods and capital employed. Firms can reinforce their technological competences by importing external technologies and technological knowledge, and then diffusing, assimilating, communicating and absorbing these into their organizations. Identifying, transforming, acquiring and exploiting technological knowhow can only be done based on the knowledge and learning processes that have already been mastered by the firm. As mentioned by Bontis (2019) IC is an essential mainstay of TAC. Ahmed et al. (2019) further argue that IC can play an instrumental role in improving the TAC of a firm. They claim that all three dimensions of IC can help a firm to interact with external environment and to identify, acquire and assimilate the external knowledge related to the technology. A firm with a strong TAC can have better capabilities to attain OA, whereas deficient TAC acts an obstacles for the transfer of better practices, technological knowledge, and OA. In short, enabling TAC can be instrumental in attaining OA.

H4: Technology absorptive capacity (TAC) mediates the relationship between human capital (HC) and organizational ambidexterity (OA).

H5: Technology absorptive capacity (TAC) mediates the relationship between relational/social capital and organizational ambidexterity (OA).

H6: Technology absorptive capacity (TAC) mediates the relationship between structural/organizational capital and organizational ambidexterity (OA)

3. Methodology

3.1. Population & sampling

For the study, the data was collected from the manufacturing sector SMEs (Small Medium Enterprises) of Pakistan. According to the definition provided by the SMEDA (2018), organizations with the staff between 10 and 100 are small, and between 101 and 250 are categorized as medium organizations. We approached 450 SMEs with the help of Small and Medium Enterprises Development Authority (SMEDA) of Pakistan. A total of 221 SMEs responded to our questionnaire by providing the required data. After screening 04 cases were removed from the data because of unengaged responses and missing values. Hence 217 cases were processed for analysis. Table 1 shows the industry-wide distribution of the final sample used in the study.

3.2. Measurement

To collect the primary data from a large number of respondents, the questionnaire proves to be a reliable tool. We developed a close-ended questionnaire to collect the data. Table 2 exhibits the detail of the constructs with sources. The questionnaire employed for the study had two portions; first part containing the demographic information of the respondent organization and the second part containing the items related to our conceptual framework. All the constructs were measured

Table 2
Constructs and their sources.

Construct	Sub-constructs	Items	Sources
Intellectual Capital	Green Human Capital	12 Items	Becker, 1962a, 1962b; Hershberg, 1996; Mubarik et al., 2018;Devadason, 2016
	Green Structural capital	09 Items	Burt, 2017;Kamall Khan, 2016)
	Green Relational Capital	09 Items	Lazzarotti et al., 2017; Lopes-Costa and Munoz-Canavate, 2015; Mom et al., 2015; Mubarik et al., 2019; Devadason, 2016
Technology Absorptive Capacity	Realized	03 Items	(Andrawina, 2009, 2008; Lund Vinding, 2006; Zahra and George, 2002)
	Potential	03 Items	(Andrawina et al., 2008; Lund Vinding, 2006; Zahra and George, 2002)
Organizational Ambidexterity	Green Exploration	04 Items	(Birkinshaw and Gupta, 2013; Fernández-Pérez de la Lastra et al., 2017b, 2017a, 2017c; Fu et al., 2016; Mubarik et al., 2019; Raisch et al., 2009)
	Green Exploitation	04 Items	(Andriopoulos and Lewis, 2009; ; Lavie et al., 2010; Mubarik et al., 2019; Stettner and Lavie, 2014)

on five points Likert scale where 1 (Strongly Disagree) 2 (Disagree) 3 (Neutral) 4 (Agree) 5 (Strongly Agree). The description of the individual constructs is given below.

Human capital (HC) is defined as the knowledge skills and abilities exploit by individual employees. This resource comprises education, experience, training, and skills.

Relational capital (RC) is defined as the knowledge embedded with networks of interrelationships and their interactions among individuals. This resource includes strategic alliances, customer and supplier relations, and customer knowledge.

Structural capital (SC) is the institutional Knowledge utilized through patents, databases, structures, processes, and systems. This resource encompasses the System and program, research and development, intellectual property rights (IPRs).

Organizational Ambidexterity (OA) has been operationalized as exploration and exploitation are two matchless learning activities that organizations split their resources and attention. This resource encompasses Exploration mentions to variation, experimentation, search, and discovery; In contrast, exploitation is linked with efficiency, selection, refinement and implementation activities. Exploration and exploitation, therefore, require radically different strategies, organization structures and contexts.

Technology Absorptive Capacity (AC), is defined as "the firm's ability to identify, assimilate and exploit the technology related knowledge from the external environment". This resource encompasses the Supplier development department, Face-to-face meetings with supplier, Intranet with knowledge management system and Cross-functional meetings.

3.3. Analytical method: PLS-SEM

The study will apply PLS-structural equation modeling for testing the framework. PLS-SEM has been preferred because of its ability to model multiple relationships simultaneously. Similarly, the use of this technique was opted due to its ability to control the endogeneity problem. PLS is also a preferred technique to model relationships when one variable is dependent and independent at the same time. This technique well caters the problem of non-normality of data and is considered highly robust against non-normal data.

4. Results and discussions

4.1. Demography of the respondents

Table 3 shows the brief demography of the respondents' organizations. The unit of analysis of the study is organization. A total of 450 organizations were approached for data collection whereas 217 organizations responded positively. It shows an average response rate of 48%. Among respondent firms 33% belong to textile, 28% leather, 16% sports, 14% food and 9% from leather. The majority of the firms' life spans from 7 to 18 years.

Table 3
Respondents demography.

	Percentage	Number (n = 217)
Industry		
Textile	33%	72
Leather	28%	61
Sports	16%	34
Food	14%	31
Metal	9%	19
Size		
Small	48%	104
Medium	52%	113
Firm life		
1–6 years	23%	49
7–12 years	30%	65
13–18 years	30%	66
> 19 years	17%	37

Table 3
Reliability and validity.

Construct		Item	Loadings	AVE	CR	CB Alpha
Intellectual Capital	Human Capital	HC1	0.68	0.61	0.87	0.91
		HC2	0.75			
		HC3	0.71			
		HC4	0.81			
		HC5	0.91			
		HC6	0.72			
		HC7	0.82			
		HC8	0.91			
		HC9	0.69			
		HC10	0.71			
		HC11	0.72			
		HC12	0.73			
	Structural Capital	SC1	0.79	0.59	0.79	0.87
		SC2	0.72			
		SC3	0.78			
		SC4	0.81			
		SC5	0.7			
		SC6	0.72			
		SC7	0.79			
		SC8	0.81			
		SC9	0.77			
	Relational Capital	RC1	0.75	0.58	0.83	0.89
		RC2	0.73			
		RC3	0.77			
		RC4	0.76			
		RC5	0.79			
		RC6	0.71			
		RC7	0.77			
		RC8	0.79			
		RC9	0.88			
Technological Absorptive capacity		AC1	0.81	0.59	0.81	0.91
		AC2	0.82			
		AC3	0.77			
		AC4	0.72			
		AC5	0.71			
		AC6	0.81			
		AC7	0.73			
		AC8	0.87			
		AC9	0.71			
		AC10	0.72			
		AC11	0.81			
		AC12	0.75			
		AC13	0.72			
		AC14	0.73			
Organizational Ambidexterity	Exploration	OA1	0.7	0.57	0.86	0.94
		OA2	0.76			
		OA3	0.77			
		OA4	0.87			
	Exploitation	OA5	0.81	0.58	0.81	0.89
		OA6	0.72			
		OA7	0.83			
		OA8	0.74			

al., 2011; Hulland, 1999; Latan and Ghozali, 2012a)
b. Average Variance Extracted (AVE) > 0.5 indicates Convergent Validity (Bagozzi and Yi, 1988; Fornell and Larcker, 1981)
c. Composite Reliability (CR) > 0.7 indicates Internal Consistency (Gefen et al., 2000)
d. CB alpha > 0.7 indicates indicator reliability (Dijkstra and Henseler, 2015).

4.2. Reliability and validity of the model

The study has examined the reliability and validity of the construct and model by adopting the procedure recommended by Hair et al. (2016). For checking the reliability and internal consistency, we computed the values of CB alpha and CR. The threshold values of CR and CB alpha of all constructs are higher than the threshold values of 0.70. The validity of the construct has been ascertained by adopting the twofold

Table 4
Fornel-Larcker criteria.

	HC	RC	SC	TAC	OA
Human Capital (HC)	***0.78***				
Relational Capital (RC)	0.25	***0.74***			
Structural Capital (SC)	0.36	0.52	***0.74***		
Technological Absorptive capacity (TAC)	0.30	0.54	0.42	***0.76***	
Green Organizational Ambidexterity (OA)	0.41	0.39	0.49	0.57	***0.75***

Note: Diagonal values are the square root of AVE.

Table 5
Hypotheses testing.

	Path	Beta	*p*-value	Decision
Hypothesis 1	Human Capital → OA	0.48	0.000	Supported
Hypothesis2	Relational Capital → OA	0.31	0.000	Supported
Hypothesis 3	Structural Capital → OA	0.28	0.004	Supported
Hypothesis 4	Human Capital → TAC→ OA	0.13	0.008	Supported
Hypothesis 5	Relational Capital →TAC→ OA	0.21	0.014	Not Supported
Hypothesis 5	Structural Capital → TAC→ OA	0.05	0.142	Supported
R Square		*0.67*		
Q Square		*0.48*		
f Square		*0.55*		
GFI		*0.93*		
RMSEA		*0.051*		

*$p \leq 0.05$ Hypothesis reject.
R-square values of 0.75, 0.50, and 0.25 represent substantial, moderate and weak model respectively.
f- square, effect size are according to Cohen (1988), f 2 values 0.35 (large), 0.15 (medium), and 0.02 (small).
q-square, predictive relevance of predictor exogenous variables as according to Henseler et al. (2009), q2 values 0.35 (large), 0.15 (medium), and 0.02 (small).
SRMR and CFI are the values used to ascertain the overall model fitness. For model fitness SRMR <0.08, CFI >0.90.

approach recommended by Hair et al. (2018). First we ascertained the convergent validity by estimating the values of Average Variance Extracted (AVE). The AVE values of all constructs are greater than 0.50 confirming convergent validity. Further, discriminant validity of the construct has been ascertained by computing Fornell-Larcker criteria as exhibited in Table 4. The square rooted values of AVE, shown in diagonal in Table 4, are greater than inter-construct correlations.

4.3. Hypotheses testing

The results of the hypotheses testing appear in Table 5. The results show that IC ($\beta = 0.21$, $p = 0.001$) has a profound positive impact on OA. Further, results show that TAC ($\beta = 0.32$, $p = 0.000$) significantly mediates the relationship between IC and OA. The results of IC dimensions show that all three dimensions of IC, namely, HC ($\beta = 0.18$, $p = 0.002$), RC ($\beta = 0.31$, $p = 0.000$), and SC ($\beta = 0.28$, $p = 0.004$), have a significant direct impact on OA. The results of mediation show that absorptive capacity significantly mediates the relationship between two out of three dimensions of IC (HC and RC). The value R square shows that the strength of the model is moderate. Further, the results of blindfolding (Q square 0.48) show the predictability of the model. In condensed form, the findings reveal a significant impact of IC (overall and by dimensions) on OA both directly and indirectly. The results of the study concur with those of Stettner and Lavie (2014), Mubarik et al. (2019), and Mubarik et al. (2016). These studies show that improving knowledge, skills and abilities of firms' human resource improves their capacity to absorb knowledge outside the firms, which further contributes to both strands of performance that is, exploration and exploitation. Likewise, Rasiah (2018) argues that both improving HC and maintaining a collaborative relationship with customers and suppliers enable firms to expand their horizons and their absorptive capacity. These results explain the application of HC theory in the context of IC, thus expanding its applicability. Although majority of the studies explain how HC, RC and SC contribute to the absorptive capacity of a firm, researchers disagree about the direct impact of these three dimensions on OA. For example Mubarik et al. (2019) claim that HC has a direct association with firm performance; however firms processes (operationalized as structural capital) and RC (operationalized as the relationship of a firm with its suppliers, employees and customers) do not directly exert any effect on their OA. Nevertheless, according to Mubarik et al. (2019), these two dimensions contribute in improving the capacity to absorb outside knowledge.

5. Conclusion, implications, and limitations

Industry 4.0, featuring digital technologies like the *internet of things (IoT), cloud computing, big-data, and cyber-physical systems,* is radically changing the conventional business processes. It improvesthe business processes and makes them robust, autonomous, automated and intelligent. The change includes the incorporation of the latest technologies (e.g. blockchain), machines and infrastructure to create automated, seamless and interconnected networks of the firms. Further, Industry 4.0 is also converting the organizational structures by digitalizing their end-to-end business processes. In such context, balancing innovation and exploitation—*the organization's ambidexterity*—while stepping into the fourth industrial revolution can be critical for an organization's capability. Industry 4.0 is the apex case of digital transformation, and it is not limited to the application of advanced digital gadgets and tools but is also about incorporating them into production and business processes. It is important to note that Industry 4.0 is not limited to the manufacturing sector but is equally applicable to the service sector and thus has far-reaching economic and organizational implications. The present study aims to go beyond the surface level to understand the performance parameters of Industry 4.0 especially in the context of Pakistan. The country is trying to leap-frog its transformation along the lines of Industry 4.0. Against this backdrop, the objective of this study was to examine the influence of IC (overall and by dimensions) on the OA. Likewise, the study also investigated the role of TAC between IC and OA. Our findings exhibit a profound influence of overall IC and its components on OA. Likewise, our findings reveal a significant mediating role of TAC in the relationship between IC and OA. In short, the findings reveal an axial role of IC in maintaining a balance between an organization's ability to explore and exploit. In this context, the role of, TAC is critical. The TAC routes organization's IC toward maintaining a balance between the activities of exploration and exploitation.

Our findings offer important policy implications. First and foremost, firms first have to introspect—evaluating their present position as compared to Industry 4.0 requirements. A successful transformation to Industry 4.0 requires a broad set of capabilities, pivotal among which is OA, which can be best attained by strengthening the IC and improving the capacity to absorb technology related knowledge. It requires organizations to re-examine their strategy for approaching IC. Conventionally, organizations do not properly devise any specific strategy to maintain and improve IC, leaving it at the mercy of others. In such case, the IC, specific to the OA, may not be improved but rather compromised. Our findings imply that organization should develop a comprehensive IC development (ICD) strategy in synch with their other business strategies. Execution of the ICD strategy can help organizations to improve their productivity and innovation simultaneously. As a matter of fact, incorporating a sense of ambidexterity in IC can provide firms with a competitive edge. It implies that organizations should develop HC, which possesses both the ability to ramp up productivity and innovation. Likewise, firms should develop internal organizational processes in a way that help these organizations to perform on both market exploitation and exploration. The same is the case with RC. Diffusing the ability of ambidexterity in relationships of an organization with its suppliers, customers and employees could greatly help to attain

a balance between innovation and productivity.

The study has some limitations, the first and foremost being that the study is static in nature. As we have collected cross-sectional data, the collection of longitudinal data on the same concepts can provide a better understanding of the IC-ambidexterity association. Second, the study focuses on selected SMEs from the manufacturing sector of Pakistan. Hence the generalizability of the results needs to be done with care.

Acknowledgment

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.techfore.2020.120248.

References

Ahmed, S.S., Guozhu, J., Mubarik, S., Khan, M., Khan, E., 2019. Intellectual capital and business performance: the role of dimensions of absorptive capacity. Journal of Intellectual Capital 21 (1), 23–39.

Alänge, S., Steiber, A., 2018. Three operational models for ambidexterity in large corporations. Triple Helix 5 (1), 1–25.

Alvarez, S.A., Barney, J.B., 2001. How entrepreneurial firms can benefit from alliances with large partners. Acad. Manag. Perspect. 15 (1), 139–148.

Andrawina, L. (2009). Relationship Between Knowledge Sharing and Absorptive Capacity Moderated by Organizational and Technology Factors: A Conceptual Model. 1865–1869.

Andrawina, L., Govindaraju, R., Samadhi, T.A., Sudirman, I., 2008. Absorptive capacity moderates the relationship between knowledge sharing capability and innovation capability. In: Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management. IEEE, pp. 944–948.

Andrews, R., 2010. Organizational social capital, structure and performance. Hum. Relat. 63 (5), 583–608.

Andriopoulos, C., Lewis, M.W., 2009. Exploitation-exploration tensions and organizational ambidexterity: managing paradoxes of innovation. Organ. Sci. 20 (4), 696–717.

Antonelli, C., Colombelli, A., 2011. The generation and exploitation of technological change: market value and total factor productivity. J. Technol. Transf. 36 (4), 353–382.

Arenas, T., Lavanderos, L., 2008. Intellectual capital: object or process? J. Intell. Cap. 9 (1), 77–85.

Arshad, R., Noor, A.H.M., Yahya, A., 2015. Human capital and Islamic-based social impact model: small enterprise perspective. Procedia Econ. Financ. 31, 510–519.

Ashton, C., Morton, L., 2005. Managing talent for competitive advantage: taking a systemic approach to talent management. Strateg. HR Rev. 4 (5), 28–31.

Asiaei, K., Jusoh, R., 2015. A multidimensional view of intellectual capital: the impact on organizational performance. Manag. Decis. 53 (3), 668–697.

Asiaei, K., Jusoh, R., Bontis, N., 2018. Intellectual capital and performance measurement systems in Iran. J. Intell. Cap. 19 (2), 294–320.

Barathi Kamath, G., 2007. The intellectual capital performance of the Indian banking sector. J. Intell. Cap. 8 (1), 96–123.

Barney, J., 2001. The resource-based view of the firm: ten years after 1991. J. Manag. 27 (6), 625–641.

Baškarada, S., Watson, J., Cromarty, J., 2016. Leadership and organizational ambidexterity. J. Manag. Dev. 35 (6), 778–788.

Becker, G.S., 1962a. Investment in human capital: a theoretical analysis. J. Polit. Econ. 70 (5, Part 2), 9–49.

Birkinshaw, J., Gupta, K., 2013. Clarifying the distinctive contribution of ambidexterity to the field of organization studies. Acad. Manag. Perspect. 27 (4), 287–298.

Bontis, N., 1998. Intellectual capital: an exploratory study that develops measures and models. Manag. Decis. 36 (2), 63–76.

Bontis, N., Fitz-Enz, J., 2002. Intellectual capital ROI: a causal map of human capital antecedents and consequents. J. Intell. Cap. 3 (3), 223–247.

Bontis, N., Nikitopoulos, D., 2001. Thought leadership on intellectual capital. J. Intell. Cap. 2 (3), 183–191.

Burt, R.S., 2017. Structural holes versus network closure as social capital. In: Lin, N., Cook, K., Burt, R.S. (Eds.), Social Capital Routledge: New York, 1st ed. pp. 31–56.

Carte, N., 2005. The maximum achievable profit method of patent valuation. Int. J. Innov. Technol. Manag. 02 (02), 135–151.

Chang, A.A., Mubarik, M.S., Naghavi, N., 2020. Passing on the legacy: exploring the dynamics of succession in family businesses in Pakistan. J. Fam. Bus. Manag https://doi.org/10.1108/JFBM-10-2019-0065.

Chu, P.Y., Lin, Y.L., Hsiung, H.H., Liu, T.Y., 2006. Intellectual capital: an empirical study of ITRI. Technol. Forecast. Soc. Change 73 (7), 886–902.

Crossan, M.M., Lane, H.W., White, R.E., 1999. An organizational learning framework: from intuition to institution. Acad. Manag. Rev. 24 (3), 522–537.

Daft, R.L., Weick, K.E., 1984. Toward a model of organizations as interpretation systems. Acad. Manag. Rev. 9 (2), 284–295.

Diaz-Fernandez, M., Pasamar-Reyes, S., Valle-Cabrera, R., 2017. Human capital and human resource management to achieve ambidextrous learning: a structural perspective. Bus. Res. Q. 20 (1), 63–77.

Edvinsson, L. (1997). *Developing Intellectual Capital at Skandia*. 30, 8.

Duncan, R.B., 1976. The ambidextrous organization: Designing dual structures for innovation. The management of organization 1 (1), 167–188.

EEF - The Manufacturers' Organization, 2016. The 4th Industrial Revolution (4IR): A Primer For Manufacturers. EEF. https://www.eef.org.uk/resources-and-knowledge/researchand-intelligence/industry-reports/the-4th-industrial-revolution-a-primerfor-manufacturers Accessed on: March 12, 2020.

Eisenhardt, K.M., Sull, D.N., 2001. Strategy as simple rules. Harvard business review 79 (1), 106–119.

Fernández-Pérez de la Lastra, S., García-Carbonell, N., Martín-Alcázar, F., Sánchez-Gardey, G., 2017a. Building ambidextrous organizations through intellectual capital: a proposal for a multilevel model. Intang. Cap. 13 (3), 668.

Fernández-Pérez de la Lastra, S., García-Carbonell, N., Martín-Alcázar, F., Sánchez-Gardey, G., 2017b. Intellectual capital role in ambidexterity emergence: a proposal of a multilevel model and research agenda. J. Intell. Cap. 18 (4), 733–744.

Fernández-Pérez de la Lastra, S., García-Carbonell, N., Martín-Alcázar, F., Sánchez-Gardey, G., 2017c. Intellectual capital role in ambidexterity emergence: a proposal of a multilevel model and research agenda. J. Intell. Cap. 18 (4), 733–744.

Frank, A.G., Mendes, G.H., Ayala, N.F., Ghezzi, A., 2019. Servitization and Industry 4.0 convergence in the digital transformation of product firms: a business model innovation perspective. Technol. Forecast. Soc. Change 141, 341–351.

Fu, N., Ma, Q., Bosak, J., Flood, P., 2016. Intellectual capital and organizational ambidexterity in Chinese and Irish professional service firms. J. Organ. Eff. People Perform. 3 (2), 94–114.

García-Morales, V.J., Ruiz-Moreno, A., Llorens-Montes, F.J., 2007. Effects of technology absorptive capacity and technology proactivity on organizational learning, innovation and performance: An empirical examination. Technology Analysis & Strategic Management 19 (4), 527–558.

Gibson, C.B., Birkinshaw, J., 2004. The antecedents, consequences, and mediating role of organizational ambidexterity. Acad. Manag. J. 19.

Good, D., Michel, E.J., 2013. Individual ambidexterity: exploring and exploiting in dynamic contexts. J. Psychol. 147 (5), 435–453.

Grant, R.M., 1996. Toward a knowledge-based theory of the firm: knowledge-based theory of the firm. Strateg. Manag. J. 17 (S2), 109–122. https://doi.org/10.1002/smj.4250171110.

Gupta, O., Roos, G., 2001. Mergers and acquisitions through an intellectual capital perspective. J. Intell. Cap. 2 (3), 297–309.

Güttel, W.H., Konlechner, S.W., 2009. Continuously hanging by a thread: managing contextually ambidextrous organizations. Schmalenbach Bus. Rev. 61 (2), 150–172.

Hershberg, T., 1996. Human capital development: America's greatest challenge. Ann. Am. Acad. Pol. Soc. Sci. 544 (1), 43–51.

Hitt, M.A., Bierman, L., Shimizu, K., Kochhar, R., 2001. Direct and moderating effects of human capital on strategy and performance in professional service firms: a resource-based perspective. Acad. Manag. J. 44 (1), 13–28.

Hitt, M.A., Keats, B.W., DeMarie, S.M., 1998. Navigating in the new competitive landscape: building strategic flexibility and competitive advantage in the 21st century. Acad. Manag. Perspect. 12 (4), 22–42.

Horváth, D., Szabó, R.Z., 2019. Driving forces and barriers of Industry 4.0: do multinational and small and medium-sized companies have equal opportunities? Technol. Forecast. Soc. Change 146, 119–132.

Hsu, Y.H., Fang, W., 2009. Intellectual capital and new product development performance: the mediating role of organizational learning capability. Technol. Forecast. Soc. Change 76 (5), 664–677.

Itami, H., Roehl, T.W., 1991. Mobilizing Invisible Assets. Harvard University Press, Boston: USA.

Jansen, J.J.P., Simsek, Z., Cao, Q., 2012. Ambidexterity and performance in multiunit contexts: cross-level moderating effects of structural and resource attributes. Strateg. Manag. J. 33 (11), 1286–1303.

Jørgensen, K.M., Boje, D.M., 2010. Resituating narrative and story in business ethics. Bus. Eth. Eur. Rev. 19 (3), 253–264.

Junni, P., Sarala, R.M., Taras, V., Tarba, S.Y., 2013. Organizational ambidexterity and performance: a meta-analysis. Acad. Manag. Perspect. 27 (4), 299–312.

Kafouros, M., Love, J.H., Ganotakis, P., Konara, P., 2020. Experience in R&D collaborations, innovative performance and the moderating effect of different dimensions of absorptive capacity. Technol. Forecast. Soc. Change 150, 119757.

Kamall Khan, Y. (2016). *Impact of Structural Capital on Innovation in the Australian SMEs*. 302–312.

Kang, S.-C., Morris, S.S., Snell, S.A., 2007. Relational archetypes, organizational learning, and value creation: extending the human resource architecture. Acad. Manag. Rev. 32 (1), 236–256.

Kang, S.-C., Snell, S.A., 2009. Intellectual capital architectures and ambidextrous learning: a framework for human resource management. J. Manag. Stud. 46 (1), 65–92.

Khalique, M., Bontis, N., Abdul Nassir bin Shaari, J., Hassan Md. Isa, A., 2015. Intellectual capital in small and medium enterprises in Pakistan. J. Intell. Cap. 16 (1), 224–238.

Kor, Y.Y., Mahoney, J.T., 2004. Edith Penrose's (1959) contributions to the resource-based view of strategic management. J. Manag. Stud. 41 (1), 183–191.

Lavie, D., Stettner, U., Tushman, M.L., 2010. Exploration and exploitation within and across organizations. Acad. Manag. Ann. 4 (1), 109–155.

Lazzarotti, V., Manzini, R., Nosella, A., Pellegrini, L., 2017. Innovation ambidexterity of open firms. The role of internal relational social capital. Technol. Anal. Strateg. Manag. 29 (1), 105–118.

Lev, B., Zambon, S., 2003. Intangibles and intellectual capital: an introduction to a special issue. Eur. Account. Rev. 12 (4), 597–603.
Liu, H., Chen, C., 2009. Corporate organizational capital, strategic proactiveness and firm performance: an empirical research on Chinese firms. Front. Bus. Res. China 3 (1), 1–26.
Lopes-Costa, J.A., Munoz-Canavate, A., 2015. Relational capital and organizational performance in the Portuguese hotel sector (NUTS II Lisbon). Procedia Econ. Financ. 26, 64–71.
Lund Vinding, A., 2006. Absorptive capacity and innovative performance: a human capital approach. Econ. Innov. New Technol. 15 (4–5), 507–517.
March, J.G., 1991. Exploration and exploitation in organizational learning. Organization science 2 (1), 71–87.
Mom, T.J.M., van Neerijnen, P., Reinmoeller, P., Verwaal, E., 2015. Relational capital and individual exploration: unravelling the influence of goal alignment and knowledge acquisition. Organ. Stud. 36 (6), 809–829.
Mouritsen, J., 1998. Driving growth: economic value added versus intellectual capital. Manag. Account. Res. 9 (4), 461–482.
Mubarik, M.S., Chandran, V.G.R., Devadason, E.S., 2018. Measuring human capital in small and medium manufacturing enterprises: what matters? Soc. Indic. Res. 137 (2), 605–623.
Mubarik, M.S., Govindaraju, C., Devadason, E.S., 2016a. Human capital development for SMEs in Pakistan: is the “one-size-fits-all” policy adequate? Int. J. Soc. Econ. 43 (8), 804–822.
Mubarik, M.S., Naghavi, N., Mahmood, R.T., 2019a. Intellectual capital, competitive advantage and the ambidexterity liaison. Hum. Syst. Manag. 38 (3), 267–277. https://doi.org/10.3233/HSM-180409.
Mubarik, M.S., Naghavi, N., Mubarak, M.F., 2019b. Impact of supplier relational capital on supply chain performance in Pakistani textile industry. Asian Econ. Financ. Rev. 9 (3), 318–328.
Mubarik, S., Chandran, V., Devadason, E.S., 2016b. Relational capital quality and client loyalty: firm-level evidence from pharmaceuticals, Pakistan. Learn. Organ. 23 (1), 43–60.
Naghavi, N., Mubarak, M.S., 2019. Negotiating with Managers from South Asia: India, Sri Lanka, and Bangladesh. In: *The Palgrave Handbook of Cross-Cultural Business Negotiation*. Palgrave Macmillan, Cham, pp. 487–514.
Nonaka, I., Konno, N., 1998. The concept of “Ba”: building a foundation for knowledge creation. Calif. Manag. Rev. 40 (3), 40–54.
Penrose, E., 1959. The theory of the growth of the firm. Oxford University Press, New York, NY.
Prahalad, C.K., Hamel, G., 2007. Strategy as a field of study: why search for a new paradigm? Strateg. Manag. J. 15 (S2) 5–16. 02.
Raisch, S., Birkinshaw, J., Probst, G., Tushman, M.L., 2009. Organizational ambidexterity: balancing exploitation and exploration for sustained performance. Organ. Sci. 20 (4), 685–695.
Reza, S., Mubarik, M.S., Naghavi, N., Nawaz, R.R., 2020. Relationship marketing and third-party logistics: evidence from hotel industry. J. Hosp. Tour. Insights 3 (3), 371–391.
Russo, M.V., Fouts, P.A., 1997. A Resource-Based perspective on corporate environmental performance and profitability. Acad. Manag. J. 40 (3), 534–559.
Secundo, G., Ndou, V., Del Vecchio, P., De Pascale, G., 2020. Sustainable development, intellectual capital and technology policies: a structured literature review and future research agenda. Technol. Forecast. Soc. Change 153, 119917.
Seleim, A.A.S., Khalil, O.E.M., 2011. Understanding the knowledge management-intellectual capital relationship: a two-way analysis. J. Intell. Cap. 12 (4), 586–614.
Sharkie, R., 2003. Knowledge creation and its place in the development of sustainable competitive advantage. J. Knowl. Manag. 7 (1), 20–31. https://doi.org/10.1108/13673270310463590.
Simsek, Z., Heavey, C., Veiga, J.F., Souder, D., 2009. A typology for aligning organizational ambidexterity's conceptualizations, antecedents, and outcomes. J. Manag. Stud. 46 (5), 864–894.
Stettner, U., Lavie, D., 2014. Ambidexterity under scrutiny: exploration and exploitation via internal organization, alliances, and acquisitions: exploration and exploitation. Strateg. Manag. J. 35 (13), 1903–1929.
Stewart, T.A., 1997. Intellectual Capital. The New Wealth of Organizations. Nicholas Brealey, London.
Sullivan, P.H., Sullivan, P.H., 2000. Valuing intangibles companies – an intellectual capital approach. J. Intell. Cap. 1 (4), 328–340.
Teece, D.J., 2012. Dynamic capabilities: routines versus entrepreneurial action: routines versus entrepreneurial action. J. Manag. Stud. 49 (8), 1395–1401.
Tiwana, A., 2008. Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. Strateg. Manag. J. 29 (3), 251–272.
Vlačić, E., Dabić, M., Daim, T., Vlajčić, D., 2019. Exploring the impact of the level of absorptive capacity in technology development firms. Technol. Forecast. Soc. Change 138, 166–177.
Volberda, H.W., Lewin, A.Y., 2003. Co-evolutionary dynamics within and between firms: from evolution to co-evolution. J. Manag. Stud. 40 (8), 2111–2136.
Wernerfelt, B., 1984. A resource-based view of the firm. Strateg. Manag. J. 5 (2), 171–180.
Wong, K.Y., Aspinwall, E., 2005. Knowledge management: case studies in SMEs and evaluation of an integrated approach. J. Inf. Knowl. Manag. 04 (02), 95–111.
Youndt, M.A., Subramaniam, M., Snell, S.A., 2004. Intellectual capital profiles: an examination of investments and returns: intellectual capital profiles. J. Manag. Stud. 41 (2), 335–361.
Zahra, S.A., George, G., 2002. Absorptive capacity: a review, reconceptualization, and extension. Acad. Manag. Rev. 27 (2), 185–203.
Zameer, H., Wang, Y., Yasmeen, H., Mubarak, S., 2020. Green innovation as a mediator in the impact of business analytics and environmental orientation on green competitive advantage. Manag. Decis. https://doi.org/10.1108/MD-01-2020-0065. Ahed of print.
Becker, G. S. (1964). Investment in human beings. The Journal of Political Economy, 70, Part-2(5), 9–49.
Mubarik, M. S. (2015). *Human capital and performance of small & medium manufacturing enterprises: a study of Pakistan* (Doctoral dissertation, University of Malaya). Accesed from: http://studentsrepo.um.edu.my/6573/1/Shujaat_Mubarik_Thesis_Final_Submission_.pdf (Date: 03 March 2020).

Tarique Mahmood: Tarique Mahmood is senior Lecturer and PhD research fellow at Mohammad Ali Jinnah University, jarachi. His-areas of interest are intellectual capital management and organizational ambidexterity.

Prof. Dr. Muhammad Shujaat Mubarik: Muhammad Shujaat Mubarak is Professor at Mohammad Ali Jinnah University Karachi, Pakistan. He is also Dean of Faculty of Business Administration & Social Sciences, Karachi. His-areas of interest are intellectual capital, human capital, supply chain economics, and sustainability. On the methodology side, he is also expert in applying Multi-attributes Data Management like AHP, ANP, DEMATEL, etc. He has published in journals of high repute including Management Decision, International Journal of Emerging Markets, Social Indicator Research and Emerging Markets Trade and Finance. Dr. Mubarik also hosts the TV talk show “Corporate Lounge” at a private satellite TV channel in Pakistan. He also provides consultancy on supply chain and service excellence to national and multinational companies.