Received: 15 January 2022 | Accepted: 14 March 2022

DOI: 10.1002/kpm.1711

SPECIAL ISSUE ARTICLE

WILEY

COVID-19 pandemic influence on organizational knowledge management systems and practices: Insights from an Indian engineering services organization

Shantanu Apte[1] | Abhijeet Lele[1,2] | Atul Choudhari[3]

[1]Symbiosis International University (Deemed University) (SIU), Pune, India

[2]Symbiosis Institute of Business Management (SIBM), Pune, India

[3]Tata Consulting Engineers Limited (TCE), Airoli, India

Correspondence
Shantanu Apte, Symbiosis International University (Deemed University) (SIU), Lavale, Pune, Maharashtra, India.
Email: polite_shantanu@yahoo.com

Abstract

COVID-19 pandemic unleashed uncertainties around the world. Organizations scrambled to ensure business continuity. COVID-19 pandemic was unprecedented as disruptions were far beyond business continuity scenarios planning with respect to severities, timelines, and geographies. Initially, business disruptions were assumed to last just for a few days or weeks at a local governing region, county, or state level. However, the pandemic lasted much longer and sustained efforts were needed to stay compliant with ever-evolving and changing local, state, federal, and international guidelines, rules, and regulations. Prolonged work from home became an unavoidable and only way to ensure business continuity for many service-oriented organizations. Organizations not only tried to leverage existing knowledge management (KM) practices but also were compelled to critically relook at the efficacy and effectiveness of KM practices. Organizational KM systems and practices (OKMSP) in a typical Indian engineering consulting and design organization were studied. The changes in employee perceptions about OKMSP during the pandemic period were captured and critically analyzed. The study evaluated employee perceptions related to four critical aspects of OKMSP namely, KM processes, usage of KM tools, KM effectiveness, and KM culture. Lack of face-to-face meetings during the COVID-19 period made an important change in the way of working. This paper captures COVID-19 pandemic-induced changes and provides pointers to further research opportunities in the field of OKMSP. The study highlights the need for robust knowledge management systems to face pandemic-induced disruptions.

1 | INTRODUCTION

The current COVID-19 pandemic has quickly engulfed the globe. The sheer audacity of the pandemic took individuals, societies, businesses, and governments by surprise. The organizations suddenly scrambled for survival. Irrespective of products or services business, the business continuity plans assumed significance. Many such plans were found inefficient to face the magnitude of disruptions caused by the pandemic.

Jennex and Raman (2011) have studied knowledge management (KM) during crisis management. They found that many firms failed to ensure the right resource availability at the time of crisis. They believe that KM can support managers to arrive at better decisions quicker. The knowledge about lessons learnt needs to get effectively leveraged and deployed. The crisis response system needs a fusion with KM. Contemporary businesses need effective supply chain management. Pinto (2020) observed that as time availability to respond to challenges during a pandemic is short, the access to knowledge repository of firm's actions and response to similar situations in the past proves valuable. In the era of information overload, the availability and access to parametrized and essential knowledge assets are crucial.

The supply chains are not only important for product manufacturing and distribution but are equally crucial and essential in services sectors as well.

As per Bratianu and Bejinaru (2021), the Deliberate strategies treat the future as an extrapolation of the past whereas the emergent strategies focus upon what is not yet known. The pandemics like COVID-19 have forced organizations to explore the options for the survivor and then recovery as against the growth mindset. The COVID-19 pandemic has underlined the importance of emergent strategies of the KM as they help organizations to face sudden and unexpected changes while the future unfolds itself. Organizations cannot get to the stage of emergent strategies unless they have sound processes, practices, and experiences in the fundamental of KM itself.

Literature review was conducted to understand organizational KM systems and practices (OKMSP) during pre-pandemic times (PPT) and during pandemic times (PT) across organizations. The literature review provided key factors influencing OKMSP namely, people, process, and technology-led tools. The literature in the areas of OKMSP is very substantial but the one applicable to Indian Engineering Consulting and Design outsourcing organization is very negligible. The literature review establishes the background of KM, articulates influencing factors in effective implementation of OKMSP, and supports the need for research for Indian engineering consulting and design organizations.

COVID-19 pandemic is still evolving and raging. The understanding of its impact with respect to various facets of businesses is still in the infancy phase. This paper critically examines the impact of the COVID-19 pandemic on OKMSP. The paper is structured around five sections. The first section introduces KM concepts while setting the context. The next section examines various aspects of OKMSP during PPT and PT through the literature review. The literature review captures OKMSP in overall product and service-oriented organizations including engineering service-oriented organizations. The second section also articulates research hypotheses. The third section provides a brief about organization under research besides articulating research methodology. The fourth section discusses the methods and results of hypotheses testing. The fifth section discusses the conclusion and limitations of the study. This section also provides pointers for future research.

2 | LITERATURE REVIEW

As KM is a multidimensional topic, it is essential to study the body of work available in the areas of organizational KM practices alongside organizational ability to face a pandemic. Such an approach was necessary to understand the interplay between two constructs. As the types of organizations have a vast spread, it was also necessary to define the type of organization to study. To provide the logical flow of the study and subsequent data collection and analysis, the literature review is contextualized in terms of KM practice before and during the COVID-19 pandemic across organizations. Although it is essential to note that there are no watertight compartments in these categories, such an approach helps in contextualizing research by defining the boundaries.

The field of OKMSP is quite vast. There is no universally accepted single definition of KM itself. Various scholars have provided different interpretations of KM. Girard and Girard (2015), undertook research to arrive at a universally accepted definition of KM. They collated commonly used definitions across multiple sectors, domains, and entities namely, accounting, aerospace, business management, defense, education, energy, engineering, finance, government, health sector, human resources, information management, library management, science and technology, social sciences, statistics, and so on. More than 50 definitions are mentioned under various categories of management itself. In this paper, the KM definition is in line with the one proposed by Girard and Girard (2015) as "the process of creating, sharing, using and managing the knowledge and information of an organization." The systems and processes built around this core concept are collectively referred to in this paper as OKMSP. Such systems and practices are either documented and practiced or in some cases are practiced without detailed documentation.

2.1 | OKMSP perspectives

The information and knowledge are not quite synonymous terminologies. Information management is only a subset of overall KM. Carrillo and Chinowsky (2006) state that, many organizations fail to differentiate between information management systems and KM systems. Simply because the intranet or extranet are made available does not mean the firm has a strong and effective KM system in place. Conducting "lessons learned" sessions at the project close-out stages do not necessarily validate the availability of effective KM. Since such sessions are not well-structured to guarantee the information conversion into knowledge, such information exchange cannot necessarily form a knowledge-sharing exercise. If the firms fail to empanel employees in the process of KM, the employees tend to treat KM initiative as another management fad and hence fail to participate in the KM journey wholeheartedly.

2.1.1 | OKMSP during PPT

Singh and Kant (2007) studied the KM barriers, the factors that adversely affect successful KM at the organizational level. It was found that lack of top management commitment was the most influential barrier. Lack of clear methodology and organizational structure which is non-conducive to cooperation was next set of barriers. Poorly designed and implemented technological infrastructure came as the next level of barriers. The lack of organizational culture, as well as lack of motivation and reward, were the outcome of such poorly conceptualized, inadequately supported, and casually implemented KM initiatives. All this results in ownership problems. The careful focus to identify and reduce these barriers go a long way towards the success of organization-wide KM implementation. As pandemic caught organizations unaware of sorts, the hasty work from home (WFH) shift from face-to-face work environment aggravated such KM

barriers. Even organizations having KM in place, faced challenges during the pandemic as barriers were felt due to changes in the way of working.

Researchers have been studying the relationship amongst various performance measures and the effectiveness of KM processes. Cegarra-Navarro et al. (2016) studied the relationship amongst the role of organizational agility, organizational performance, and KM processes. The study provided evidence about knowledge application and organizational processes being supplementary in nature. Organizational performance also depends upon organizational agility with respect to prior KM processes.

Resource-based view elegantly describes how firm's resources play important role in providing a sustainable competitive advantage over a long period. The resources that are valuable, rare, inimitable, and non-substitutable provide a competitive advantage. Meso and Smith (2000) mention that at the core of any organizational KM system are its employees. Employees consume available organizational knowledge through the database, procedures, and tacit knowledge through interactions. Employees generate a new set of explicit and tacit knowledge. Such addition of knowledge helps a firm to achieve a distinct competitive advantage. Firms need to be careful about the codification of its knowledge. The more it codifies, the more it could be available to get exploited by the competition and hence deterioration of competitive advantage. Though without knowledge codification and sharing, the new knowledge generation within an organization becomes challenging. Thus, organizations need very carefully thought through policies around OKMSP.

Girard and Girard (2015) define KM in the engineering sector as a process whereby an enterprise methodically gathers, organizes, analyses, and shares knowledge relevant to its business environment and operating disciplines. Engineering is widely considered a field of applied science. In the field of engineering, it is not only essential to understand the basic concepts and theories but also experience and expertise in various design tools, processes, systems, and technologies become essential. Engineers convert knowledge into products and services to be deployed and used in the physical world. This interplay of theory and practice is a dominant force in engineering. Cook and Brown (1999) explain the meaning of two distinct yet interchangeably used terms namely, knowledge and knowing. The epistemology of possession is knowledge. This usually refers to explicit knowledge possessed by individuals and groups. It does not refer to tacit knowledge possessed by individuals and groups. Organizations need to understand the distinction amongst explicit, tacit, individual, and team knowledge to device processes and systems to leverage knowledge assets. Knowing is an epistemology of practice. Simply possessing knowledge is not enough without having the requisite skills, methods, and tools to apply. Knowing is essential to generate something meaningful and useful out of knowledge. The interplay of knowledge and knowing gives rise to new knowledge and new knowing. Thus, a systematic approach to OKMSP is necessary. This clear understanding of knowledge and knowing is crucial in the engineering consulting, design, and construction industry.

As the engineering field encompasses disciplines as wide as civil engineering, mechanical engineering, chemical engineering, electrical engineering, instrumentation and control engineering, environmental engineering, electronics engineering, computer engineering, and so on the OKMSP becomes essential glue. The complexities of engineering solutions need various engineering disciplines to work in unison to provide products and services. These products and services need to be safe, environmentally friendly, easy to manufacture, and easy-to-use while being cost-effective and fit to purpose. Modern engineering design activities need geographically dispersed teams having specialized knowledge. As per McMahon et al. (2004), KM is a key to exploiting firm's intellectual assets. Unlike information, knowledge cannot be easily created, stored, shared, or used. The design team is central to effective KM in the engineering design process. The individual team members, as well as their relationships, are crucial factors to ensure effective KM practices. Information and communication technologies (ICT) are now routinely deployed across the organization. Such technology leveraged KM is not necessarily effective when it comes to small and dynamic teams that are involved in the design process. During the design process, the vast amount of knowledge gets generated but usually stays with an individual team member or with only a smaller group and hence could not be made available across the organization. It is not only necessary to have an effective mechanism to collate knowledge, but one needs effective and easy-to-use tools to retrieve such knowledge. In the absence of such ease of retrieval, the knowledge although available as a repository cannot be exploited effectively. As KM is a vast and complex field, the "one size fits all" approach does not work. Engineering activities need to adhere to applicable legal and industry-mandated codes and standards. It also needs to encourage originality and innovation. Such contradictions make KM much more complex in the case of engineering design.

As engineering activities range from individual product design to design and construction of mammoth factories, dams, and structures, the field is extremely complex. There is no single firm that can truly claim desired expertise across fields and hence the alliance and partnership eco-systems are very essential. As the industry is based on knowledge and knowing, it needs to ensure proper usage of OKMSP not only within an organization but also across partnering organizations. Forcada et al. (2013) studied the KM in the Spanish firms engaged in construction and engineering design. They surveyed senior civil engineering officials from over 70 such firms. The increasing awareness of KM practices was found across these industries, but the perception and practices were found different in the design firm and in the construction firm. The firms were increasingly treating KM as a strategic asset and hence were more open to investing in the development and deployment of KM strategy. But the high level of KM awareness has not necessarily got converted into methodical implementation. It was noticed that employee culture played a bigger role in the successful implementation of KM practices than tools and technology. The successful KM implementation depends largely on employees. People management plays a far more decisive role in the success of KM implementation. If employees are empanelled throughout the KM life cycle, the adaptation and implementation were found healthier. While in the case of construction firms, the personal

interactions and meetings were found to be the preferred mode of KM, the design firms were leveraging ICT better.

Various researchers have studied the role played by senior management in the adoption of KM practices to derive business benefits. The situations where multiple organizations need to work together on complex systems, the KM proves even more crucial. Smuttrasen and Heo (2020) studied leadership role in cross-border KM in the Thai construction industry. They observed that when firms work on complex projects involving different organizations, effective KM becomes a key result influencer. The leaders who pay close attention to KM in terms of setting up effective practices and policies find themselves in a better position to guide KM usage and can monitor and ensure progress. Such managers form a minority though. The majority of managers either act as gatekeepers in knowledge sharing or are completely indifferent. It is not only managers' indifference or inaction that proves to be a roadblock in trans-organizational knowledge sharing but incompatible KM tools also act as impediments.

As the design phase sets the direction for the subsequent stages of the product lifecycle, proper attention to detail during the design phase is very essential. As an example, unless the design has energy efficiency built-in, the product cannot deliver energy efficiency during its usage even though it gets manufactured and assembled in energy-efficient plants. When the investments are high and safety concerns are paramount, the organization values past successes and experience. It values such experienced resources and clients demand experienced engineers to handle their designs. The engineering field is known for respecting individual, team, and organizational experience. Joe et al. (2013) studied how older employees retiring from the organizations adversely impact the knowledge base of the organization. They found the most important aspects requiring careful attention to knowledge codification and retention were subject matter expertise, knowledge of business systems, processes, and governance. It is essential to understand clearly which part of older employees' knowledge, needs to be retained. Not all knowledge that an employee possesses is relevant today and hence clarity helps in the retention of only essential knowledge. The study emphasizes the need to develop systems to effectively transfer such knowledge before the employee retires from the services. The KM that not only encourages retaining knowledge from existing employees but also able to successfully retain knowledge from retirees becomes an effective tool in the firm's differentiating efforts.

2.1.2 | OKMSP during PT

COVID-19 pandemic has caused big disruptions across business practices. It is essential to understand its impact on OKMSP.

As the COVID-19 pandemic is still unfolding, the research in this area is still in its early stages. Available literature touches some aspects of the topic albite with modest empirical data. Sharma et al. (2020) studied COVID-19 pandemic impact on business communities. Globalization quickly transfers ripples of manmade and natural calamities across communities and businesses. Although organizations have developed knowledge repositories to help tackle some of the calamities, the quick spread of COVID-19 proved too much to handle. In a conventional way, modern organizations have access to vast information regarding the pandemic. But it is very difficult to filter the necessary information through the authenticity perspective. Every organization is trying different ways to ensure stakeholders are effectively kept informed and connected to weather out the pandemic situation.

There is always a possibility that under the disguise of "practical experience" or "field experience," the counter knowledge finds its way into OKMSP and becomes a "rule of thumb" standard. The counter knowledge although appears like scientific knowledge; lacks scientific *rigour* and scrutiny. Bolisani and Cegarra-Navarro (2021) have advised organizations to be careful about counter knowledge finding its way into the organizational knowledge base. In the times like COVID-19 pandemic, if careful attention is not paid to ensure the robustness of OKMSP, the counter knowledge can pose a real threat. Bolisani et al. (2021) have provided elaborate examples through case studies on how to identify and eliminate the threats of counter knowledge. Such understanding is essential to build the safeguards against counter knowledge and maintain the credibility of OKMSP.

Advancements in information management systems like Big Data are pushing the frontiers of KM systems. Jackson et al. (2020) studied factors influencing KM system success through qualitative literature review. The study unearthed the following six distinctive aspects of managerial actions that influence the KM system.

1. Management formulating a clear strategy for the KM across the organization.
2. Management's ability to put in place a formal KM process as against individual-based informal KM processes.
3. Senior management commitment and active participation right from formulating KM strategy up to methodical implementation through a well-defined top-down approach.
4. Organizational culture across different geographies and different departments towards KM.
5. Employee motivation towards active participation in different aspects of KM. Unless employees are part of the KM system, success remains elusive and KM becomes more theory than practice.
6. The quality of the KM system itself is crucial as it is necessary to ensure that the KM system is effective in serving the needs of different stakeholders.

The current COVID-19 pandemic is pushing firms to adopt digital transformation as employees are facing severe restrictions due to social distancing and lack of commuting. This is forcing organizations to relook at their existing business processes and improve upon those as part of the digital transformation exercise. Soto-Acosta (2020) argues that employees invest roughly 80% of active time to attend to such business activities that contribute to achieving only 20% business results. Such disproportionate efforts drain out precious resources. The dedicated efforts are necessary to integrate both internal and external stakeholders in a more effective manner.

As WFH has given rise to virtual teams, it is essential to understand some research in this area. Alavi and Tiwana (2002) observed that virtual teams are finding increasing acceptance in harnessing, integrating, and applying knowledge in the business setup. The suboptimal effectiveness of such virtual teams could be improved by eliminating the following four constraints. These constraints namely are shortcoming of transactive memory, lack of enough understanding amongst team members, failures in sharing contextual knowledge, and inflexible organizational ties. These research findings are important from the context of WFH during the COVID-19 pandemic.

Meluso et al. (2020) analyzed shift from face-to-face work environment to virtual work environment at such a rapid pace that the hybrid work environment step was skipped. The virtual collaboration tools were developed to aid the face-to-face working as well as hybrid working but they were not designed to support full virtual working. Due to this sudden shift, the teams are facing challenges in sustaining a virtual work environment. To make a virtual work environment deliver results, the gaps in the existing virtual environment need to be critically identified, analyzed, and improved upon. There is a need to ensure virtual environment considers technical, social, and personal aspects. Overemphasis on technology is not enough. The efforts are needed to bring in trust, diversity, collaboration, empathy, psychological safety, coordination, shared reality, and intentional communication. In the interconnected world, the KM needs not only intra-organization view but also inter-organization view. The recent advancements in ICT have given rise to crowdsourcing of ideas. The OKMSP needs to get geared up to tap a large crowd knowledge. Vermicelli et al. (2020) studied 16 initiatives of crowdsourcing during the COVID-19 pandemic. These initiatives are from different disciplines, domains, geographies, and technologies. All these initiatives provided positive results and thus reaffirmed the importance of crowdsourcing. There are four major types of crowdsourcing namely, internal, community, open, and via a broker. In the case of crowdsourcing, a well-defined OKMSP helps technology-led broker structure to convert crowd contribution in the methodical, useful, and deployable solutions to achieve desired results. In the COVID-19 pandemic, the importance of strong KM systems was profoundly felt. The strong KM systems within the firm and across firms proved effective to ensure business continuity.

Wang and Wu (2021) researched the role played by IT in the areas of both crisis management (CM) and KM. The authors argue that as KM is based upon the processes and systems that leverage collective knowledge capital, the sound KM practices play a crucial role in ensuring effective CM practices. Organizations cannot probably develop agile and responsive CM practices unless they have considerable investment and experience in KM practices. IT plays a crucial role in combining both CM and KM practices as well as making those more accessible across organizations. Through their studies of effective CM during the COVID-19 pandemic, Li et al. (2021) conclude that the effectiveness of CM has strong roots in the sophisticated KM practices in the organization. As the COVID-19 pandemic-induced crisis is shifting rapidly, there is an increasing need to devise agile CM practices by leveraging various stakeholders within an organization. During WFH as against working from the office, the variety of possible methods, tools, and software come into play. The effective integration of KM becomes a key in such a scenario.

Ardito et al. (2021) studied impact of technological exaptation on COVID-19-induced crisis management. They studied the phenomenon of repurposing of the existing medicines in the treatment of COVID-19 patients. A strong understanding of existing drugs and treatment mechanisms is a key to exploring ways to possible treatment to the new disease. The study is important as it analyses the practical real-life phenomenon and connects it with the topic of organizational KM practices to help prepare to face newer challenges effectively. As the work environment suddenly shifted from work from the office to WFH, some assumptions made during work from office scenarios are no longer valid for WFH scenarios.

2.2 | Research hypotheses

The detailed literature review unearthed four important aspects of OKMSP namely, KM processes, usage of KM tools, KM effectiveness, and KM culture. To study the employee perception about OKMSP during pre-COVID-19 and during the COVID-19 period, the following four research hypotheses are formulated.

Organization-wide KM deployment needs a robust process-based approach. The definition, formulation, deployment, and reviews of the processes spanning across knowledge acquisition, knowledge enhancement, and knowledge reuse make a significant impact on organizational KM deployment. Smuttrasen and Heo (2020) emphasize the need for clarity in the formulation and deployment of KM processes as these activities influence the success of organizational KM efforts. It is hence necessary to examine employee experience, views, and perceptions around this important aspect of OKMSP. KM processes mainly involve knowledge creation and the generation that includes both explicit and tacit knowledge. It also involves knowledge transfer within internal and external knowledge resources and their application. This formed the basis for the first research hypothesis:

> **H1.** *There is a significant change in employee perception about KM processes before COVID-19 and during the COVID-19 period*.

Organizational knowledge repository is not quite effective without availability and access to tools to leverage it. Whether one is exploring past project data or value addition opportunities, the tools become necessary to navigate through the knowledge base. The effective tools can also provide opportunities to extend the reach of an individual to seek expert guidance and advice to explore already tried solutions or new suggestions to solve problems at hand. It is not only the effectiveness to draw from the existing knowledge base but also the ease with which one can contribute to enriching existing knowledge is important too. Forcada et al. (2013) have studied importance and usage of KM Tools. KM tools address the basic needs of knowledge users. Tools are necessary to build a knowledge repository

and to ensure effective knowledge storage and retrieval. This formed the basis for the second research hypothesis:

> **H2.** *There is a significant change in employee perception about usage of KM Tools before COVID-19 and during COVID-19 period.*

Organizations may have great KM Processes and user-friendly tools but that does not guarantee business benefits. One needs to evaluate KM effectiveness in terms of improvements in business parameters. Forcada et al. (2013) emphasize the importance of understanding various KM effectiveness perceptions to help develop improved knowledge sharing strategies. Akbari and Ghaffari (2017) studied factors that influence KM effectiveness. Thus, the role of KM effectiveness to realize business benefits formed the basis for the third research hypothesis:

> **H3.** *There is a significant change in employee perception about KM Effectiveness before COVID-19 and during COVID-19 period.*

As per Jennex and Raman (2011), knowledge sharing culture plays a crucial role in OKMSP. Unless such a culture is in place, the tools and processes do not deliver desired results. Smuttrasen and Heo (2020) emphasize upon senior management providing visible and vocal support to establishing and deployment of various facets of organization KM practices. The culture of acceptance of knowledge sharing needs efforts from senior management. Carrillo and Chinowsky (2006) also emphasize the importance of culture in exploiting the potential of KM to derive business results. KM culture is a part of overall organizational culture. The culture is essential to treat KM as a strategic initiative. Culture encompasses various aspects that involve human resources and their interplay with respect to KM. Appreciations and incentives at regular intervals motivate KM workers and help build a good KM culture over the years. This formed the basis for the forth research hypothesis:

> **H4.** *There is a significant change in employee perception about KM Culture before COVID-19 and during COVID-19 period.*

3 | RESEARCH METHODOLOGY

In the field of KM, several scholars have used a single case study approach. Two examples are quoted here to substantiate the appropriateness of the same. Smuttrasen and Heo (2020) have used a single case study approach to research the impact of a leadership role on the KM journey in the Thai construction company. To study the exploitation of knowledge from an engineering and construction perspective, Carrillo and Chinowsky (2006) too adopted the single case study model. As COVID-19 is still underway, the empirical data about its impact on KM is quite limited. Hence it makes sense to study this phenomenon in a typical organization that is willing to provide data access. The detailed debate about the appropriateness of a single case study method is out of the scope of the current paper. With quoted examples as a precursor, a single case study method was chosen to analyze the impact of the COVID-19 pandemic on the OKMSP.

A typical Indian organization engaged in the business of engineering consulting and engineering design was finalized owing to familiarity with the organization and management's willingness to support the research. The said organization is in the business for over 60 years and is known as a market leader in this space. The organization has been practicing OKMSP for long period even since pre-COVID-19 pandemic times. During COVID-19 pandemic times, the organization was able to make an accelerated shift to WFH. For the research purpose, the organization provided access to the vast amount of data in the field of OKMSP and granted permission to conduct the survey.

3.1 | Research organization

A typical business process flow in the firm under study is as described below. A business opportunity gets identified either by the sales team proactively or through the enquiry received from the potential customer. In some cases, the requirement is restricted to only consulting at the pre-feasibility or feasibility stages. Some requirements relate to high-level alternative concept designs along with cost estimation to help customers shoring up necessary finances through lending agencies. The requirements can be related to high-level design, detailed design, and project management assistance during various phases of project implementation. The firm understudy undertakes either a part of the requirement or takes up end-to-end responsibilities from concept to commissioning. The organization works with both private and public sectors. It also serves both domestic and international clientele. As the organization's OKMSP helps create unique differentiators, the study does not elaborate the actual processes in an identifiable manner. The study rather provides the findings at an aggregate level to protect confidentiality.

The organization operates from different geographical locations and these locations are referred to as Development Centres (DCs). Hundreds of employees serve multiple business verticals from various DCs. OKMSP are common across such DCs and thus location does not make any difference in terms of accessibility to OKMSP. Pre-pandemic time was mostly work from office scenario, wherein all employees worked from the office environment across different DCs.

3.2 | Data collection

The primary data for the study was through employee surveys and secondary data was made available through internal data repositories related to various aspects of OKMSP.

Mohajan (2017) has discussed various systematic methods to evaluate the reliability and validity of the research data. The validity

TABLE 1 Questionnaires and categories

Q. no	Question	Category
1	Was/is past project data available for reference and reuse?	KM tools
2	How satisfied were/are you about interaction with experienced and senior team members (direct or through expert system) for regular project delivery guidance?	KM effectiveness
3	How often did/do you access past project data using systems such as completed project report, lessons learnt session, and so forth?	KM tools
4	Were/are the interactions with experienced and senior team members pre-scheduled?	KM processes
5	Were/are the interactions with project team members pre-scheduled?	KM processes
6	How important were/are activities related to continuous updation of "Knowledge Repository"? (e.g., lessons learnt, document management standards, automation of designs, etc.)	KM effectiveness
7	Was/is a mode of knowledge sharing practices voluntary?	KM processes
8	Did knowledge management practices help in avoiding "Reinvention of Wheel"?	KM effectiveness
9	How frequently the need was/is felt for "Crowdsourcing Platforms" in problem-solving?	KM tools
10	How was/is your usage of "Crowdsourcing Platforms"?	KM tools
11	How was/is your experience of using "Crowdsourcing Platforms"?	KM effectiveness
12	Did/do you feel the need for Innovation platforms during project execution?	KM tools
13	Did/do you use innovation platforms?	KM tools
14	How was/is your experience of using innovation platforms?	KM effectiveness
15	Did/are you regularly document stakeholder interactions (client, vendor, team members, and expert) through MoM?	KM processes
16	How was/is important to receive appreciation from senior management, as a motivating factor?	KM culture
17	Did/do you feel the need to amend knowledge management practices?	KM processes
18	Was/is a formal "Reward & Recognition" an important trigger to contribute to knowledge management initiatives?	KM culture
19	Was/is appreciation from senior management an important trigger to contribute to knowledge management initiatives?	KM culture
20	Were/are KM systems effective?	KM effectiveness
21	Did/does employee location (DC) make an impact on project delivery from the knowledge management point of view?	KM processes

Note: (Each question had two responses—preCOVID and during COVID 19). The responses were sought on a 5-point Likert scale. Response of 1 indicates strong disagreement while the response of 5 indicates strong agreement. Response to each question was compulsory.

of the questionnaire was ensured by following two-step approach. Face validity was the first step. The questionnaire was prepared and shared with a group of 15 Subject Matter Experts (SME) who are in leadership roles and are part of KM management initiatives for more than 15 years. The SMEs provided their review observations regarding duplication of questions, choice of wordings, and identifying leading questions. Based upon these reviews, the questionnaire was modified. The second step was to conduct the pilot survey. The questionnaire was administered to 20 engineers and managers across different DCs. The reliability of survey data was checked for internal consistency by Cronbach's alpha. Only after establishing both validity and reliability of the survey instrument, the survey was launched to larger participants.

A group of 1000 engineers and managers across different DCs were administered the survey instrument consisting of 21 short and specific questions to capture their perceptions with respect to OKMSP during PPT and during PT. A total of 648 employees responded to the survey. The survey data was then analyzed with the help of statistical tools. The process of analysis and outcomes are explained in the subsequent sections. Although various data points related to OKMSP were made available by the organization, the detailed statistical data analysis was performed on the primary data captured through the employee survey response. The original questions contained references to some of the proprietary processes, tools, and nomenclatures. Table 1 consists of a survey questionnaire with filtered out references to such proprietary items.

4 | DATA ANALYSIS AND RESEARCH FINDINGS

In all 648 individual employees responded to the survey consisting of 21 questions. The responses were on a 5-point Likert scale. Responses for each question were captured for both PPT and

PT. Thus for 21 questions, a matrix of 648 rows (number of respondents) and 42 columns (21 responses each for PPT and PT) emerged. All 21 questions were part of the four categories as explained above namely, KM processes (six questions), usage of KM tools (six questions), KM effectiveness (six questions), and KM culture (three questions).

Cronbach's alpha values were computed for entire data as well as for four individual categories to verify internal data consistency. The summary of Cronbach's alpha values is captured in Table 2.

Further data analysis was undertaken only after the internal data consistency was statistically established.

When the significance of changes on outcome are to be compared before and after the intervention, the paired sampled *t*-test is used by various scholars. Although there are literally hundreds of research papers that use paired-sample *t*-test, the two recent studies are mentioned here. In their study about the effect of digital storytelling on employee engagement, Bangun et al. (2020) used paired sample *t*-test. In another study of the application of KM platform in digital art media courses Wei et al. (2019) have used paired-sample *t*-test. The purpose of the current research is to ascertain changes in employee perception about OKMSP during and before the pandemic period. Although there is availability of more sophisticated statistical tools, the paired sample *t*-test is an effective statistical tool to serve current research needs. Thus, all four research hypotheses are tested using paired sample *t*-test.

4.1 | Hypothesis testing related to KM processes

There were six questions related to KM Processes. These questions covered various aspects of KM processes namely, knowledge creation, knowledge deployment, explicit and tacit KM, knowledge transfer, and application of internal and external knowledge resources. The questions were designed to capture employee experience and perceptions related to KM processes like

1. Opportunities for interactions with senior team members in the absence of face-to-face meetings. Experiences in tacit versus explicit knowledge sharing processes.
2. Changes in formal documentation of meeting as teams were dispersed and meetings were more pre-planned than extempore over the coffee table. Again, a shift towards more explicit knowledge sharing.
3. The need for WFH-induced changes in KM processes.
4. Impact of location on project delivery in leveraging KM processes.

As in this category, there were six questions, the responses were averaged under category 1.

In a sample ($N = 648$), perception during COVID-19 pandemic times improved after a move from M = 3.4414 (SD = 0.59974, SEM = 0.02356) to M = 3.5342 (SD = 0.58963, SEM = 0.02316). The changes were found significant for t (647) = −5.507 with $df = 647$, p (2-tail) = .000. As the p (.000) ≤ α (0.05), the null hypothesis got rejected. *Thus, it can be concluded that employee perception about KM processes before COVID-19 and during the COVID-19 period are significantly different*. The summary of statistical analysis is presented in Table 3.

4.2 | Hypothesis testing related to usage of KM tools

There were six questions related to the usage of KM tools. These questions covered various aspects of usage of KM tools namely, knowledge repository, knowledge storage and retrieval, document management system, and so on. Information technology plays a vital role in the development and deployment of KM Tools. The questions were designed to capture

1. Availability of tools to access past project data. Ease of tool usage in terms of finding desired information.
2. Availability of user-friendly crowdsourcing tools to reach wider team members to seek help in developing better solutions.

TABLE 2 Cronbach's alpha

No	Categories	Cronbach's alpha	Internal consistency
1	For all categories (All 21 questions)	0.9207	As α ≥ 0.9 Excellent
2	KM processes (six questions)	0.7225	As 0.8 ≥ α ≥ 0.7 Acceptable
3	Usage of KM tools (six questions)	0.8495	As 0.9 ≥ α ≥ 0.8 Good
4	KM effectiveness (six questions)	0.8675	As 0.9 ≥ α ≥ 0.8 Good
5	KM culture (three questions)	0.9006	As α ≥ 0.9 Excellent

TABLE 3 KM processes—*t* test statistics

	Mean	*N*	Std deviation	Std error of mean
Pre-pandemic time (PPT)	3.4414	648	0.59974	0.02356
Pandemic times (PT)	3.5342	648	0.58963	0.02316
	t		***df***	***sig* (2-tailed)**
(PPT–PT)	−5.507		647	.000

3. Availability of tools to arrive at value addition opportunities through OKMSP.
4. Ease of tool usage and familiarity with such tools.

In a sample ($N = 648$), perception during COVID-19 pandemic times improved after a move from M = 3.2191 (SD = 0.72580, SEM = 0.02851) to M = 3.2485 (SD = 0.75343, SEM = 0.02960). The changes were found not significant as t (647) = −1.921 with $df = 647$, p (2-tail) = .055. As the p (.055) ≥ α (0.05), the null hypothesis did not get rejected. *Thus, it can be concluded that employee perception about KM Tools before COVID-19 and during the COVID-19 period are not significantly different*. The summary of statistical analysis is presented in Table 4.

4.3 | Hypothesis testing related to KM effectiveness

There were six questions related to KM Effectiveness. These questions covered various aspects of KM Effectiveness namely, efficacy and efficiency of OKMSP in meeting organizations' business goals. The purpose was to capture experiences and views about various aspects of KM effectiveness

1. Impact of continuous updates in knowledge repositories like lessons learnt, automation usage, access to standard work procedures, capturing discussion summaries, and so on.
2. OKMSP effectiveness to avoid reinvention of the wheel.
3. Effectiveness of crowdsourcing platforms and tools.
4. Effectiveness of innovation tools to provide better solutions to customers.
5. The major changes in the way of working had an impact on the effectiveness of OKMSP during COVID-19 Pandemic times.

In a sample ($N = 648$), perception during COVID-19 pandemic times improved after a move from M = 3.6587 (SD = 0.59513, SEM = 0.02338) to M = 3.6831 (SD = 0.62291, SEM = 0.02447). The changes were found significant as t (647) = −2.126 with $df = 647$, p (2-tail) = .034. As the p (.034) ≤ α (0.05), the null hypothesis got rejected. *Thus, it can be concluded that employee perception about KM Effectiveness before COVID-19 and during the COVID-19 period are significantly different*. The summary of statistical analysis is presented in Table 5.

4.4 | Hypothesis testing related to KM culture

There were three questions related to KM culture. These questions covered various aspects of KM culture namely, strategic initiative to promote appreciation and incentives at regular intervals, senior management initiatives to motivate employees and necessary change management initiatives to build healthy KM culture. The experiences and perceptions regarding reward and recognition were also captured.

In a sample ($N = 648$), perception during COVID-19 pandemic times improved after a move from M = 4.1163 (SD = 0.79011, SEM = 0.3104) to M = 4.2052 (SD = 0.77565, SEM = 0.3047). The changes were found significant as t (647) = −6.674 with $df = 647$, p (2-tail) = .000. As the p (.000) ≤ α (0.05), the null hypothesis got rejected. *Thus, it can be concluded that employee perception about KM*

TABLE 4 Usage of KM tools—*t* test statistics

	Mean	N	Std deviation	Std error of mean
Pre-pandemic time (PPT)	3.2191	648	0.72580	0.02851
Pandemic times (PT)	3.2485	648	0.75343	0.02960
	t		***df***	***sig* (2-tailed)**
(PPT–PT)	−1.921		647	.055

TABLE 5 KM effectiveness—*t* test statistics

	Mean	N	Std deviation	Std error of mean
Pre-pandemic time (PPT)	3.6587	648	0.59513	0.02338
Pandemic times (PT)	3.6831	648	0.62291	0.02447
	t		***df***	***sig* (2-tailed)**
(PPT–PT)	−2.126		647	.034

TABLE 6 KM culture—*t* test statistics

	Mean	N	Std deviation	Std error of mean
Pre-pandemic time (PPT)	4.1163	647	0.79011	0.3104
Pandemic times (PT)	4.2052	647	0.77565	0.3047
	t		***df***	***sig* (2-tailed)**
(PPT–PT)	−6.674		647	.000

culture before COVID-19 and during COVID-19 period are significantly different. The summary of statistical analysis is presented in Table 6.

Thus, employees had statistically significant perception changes about three critical aspects of OKMSP during the COVID-19 period namely, KM processes, KM effectiveness, and KM culture. While no statistically significant perception changes were observed in the usage of KM tools.

4.5 | Discussion

The organization under study provided access to internal data that was maintained with respect to the number of employees accessing and contributing to the knowledge repository. It also provided access to data related to the completion and uploading of KM artefacts during any specified time. The access was also made available to the project completion report repository. All such data was accessible through different in-house tools. For the research purpose, the primary data was collated through an online survey. The survey results provided insights into employee perceptions about OKMSP and especially during PT times compared to PPT times.

The survey participation request was sent to 1000 employees and responses were received from 648 of those (64.8%). Such a high level of response could indicate the importance that employees attach to the topic of OKMSP. The data conclusively proved employee perception about three key elements of OKMSP namely, *KM processes*, *KM effectiveness*, *and KM culture have shown significant improvements during PT than PPT*. During pandemic times and in the WFH scenario, the benefits of OKMSP were felt more vividly. What was taken for granted during PPT came to the fore during PT.

Few researchers have studied the positive impact of organizational KM practices on overall business outcomes. Akbari and Ghaffari (2017) observed that when employees of the firm exchange knowledge amongst themselves, they create a positive work environment. Such practices help knowledge get exchanged, enhanced, and refined to leverage on a continuous basis. The organization under study had well-defined KM processes and necessary IT infrastructure even during PPT. As knowledge exchange results in enhanced performance, the employees get more active in the KM journey. The study observed more familiarity and usage of OKMSP during PT which provided positive impetuous to employee engagement with respect to OKSMP.

Due to WFH, the need for formal information exchanges increased which resulted in the need for systematic documentation like preparation of minutes of meetings, written communication amongst the stakeholders, and so on. Some practices like daily standup meetings (though virtual) were found to be much more widespread during PT as compared to PPT. The action taken report preparation and cascading of lessons learnt through periodic sessions were also observed. The project closure reports were observed to be much content-rich as they got developed alongside project progress and not at the end of the project delivery. The study clearly indicated better appreciation, understanding, and usage of OKMSP during PT.

Every business activity has a definitive purpose along with associated costs and benefits. If already acquired knowledge and ongoing knowledge generation receive due attention, then KM becomes an important business activity. Bolisani and Bratianu (2017) observed that the firms with profit maximization strategy, effectively use organizational knowledge. Knowledge creation is a helpful strategy during a turbulent environment to try and achieve sustainable competitive advantage. Knowledge strategy could be approached through two different perspectives namely, rational approach and emergent approach. The rational approach stems from the rational analysis of a firm to decide what kind of knowledge and which sources of knowledge are important. This approach works well in an environment wherein external and internal predictability is high. In the case of an emergent approach, the daily practices and methods form the important base. Thus, what gets practiced and what is found useful to solve practical problems at hand, forms the basis of the KM approach and influences the knowledge strategy of the firm. The organization under study was found to be taking an emergent approach during the COVID-19 pandemic period.

While studying telecommunication service providers in Indonesia during the COVID-19 pandemic, Kristanti (2020) analyzed various KM practices of the firm. The study found a positive correlation between organizational KM and service innovation and employee performance. Such improvements in innovation and performance provided a competitive advantage to the firm. In their study of COVID-19 impact on the financial health of small and medium enterprises, Klein and Todesco (2021) found that the organizations having well-defined and practiced OKMSP were better equipped to tackle the disruptions. As such groundwork proved necessary to quickly adapt to digital transformation. Response from such organizations was more mature and demonstrated resilience. This is another study that reiterates the need to invest in OKMSP to make organizations better prepared to face disruptions like the COVID-19 pandemic.

The pandemic situation has proved that effective OKMSP is very important for the employees. The platforms for knowledge sharing, knowledge creation, and knowledge exchange were available to all employees even before the pandemic. The awareness and usage of KMS and KM practices improved during the pandemic period. This strong and positive outcome emphasizes that KM is no more a fad. COVID-19 pandemic necessitated KM practices such as capturing, usage, transfer, and conversion happening in a collaborative manner. The pandemic situation helped to move towards capturing knowledge assets in a more formal way as the pandemic situation does not allow extempore face-to-face interactions and discussions.

The current study clearly underlines the importance that employees place on various aspects of OKMSP namely, KM processes, KM effectiveness, KM tools, and KM culture. As employees have experienced the benefits of OKMSP while navigating through COVID-19 pandemic times, management can dedicate more efforts to enhance OKMSP further. The study highlights the need to make KM Tools more user-friendly so that OKMSP practices can witness further employee participation. As the business world is still uncertain about returning to pre-pandemic normalcy, the OKMSP appears to be an

important factor aiding business continuity. Abualqumboz (2021) studied five knowledge-intensive firms (KIF) to understand how these firms responded to COVID-19-induced disruption. The study proposed a 3-phase framework to prepare KIFs to navigate through such disruptions. The KIFs that had good OKMSP in place, could quickly transition from disharmony phase to normalization phase and then to harmony phase. This corroborates with the study findings discussed here.

The post COVID-19 pandemic times could witness the systemic shift to a mixed or hybrid way of WFO and WFH. Such a shift will throw open several business challenges that would need further studies. The study provides an understanding of key aspects of employees' perception about OKMSP during pandemic times and while WFH. It may be worth mentioning that the study helps to understand employees' perceptions about OKMSP through primary data analysis.

Gustafsson (2017) argues that a single case study provides a deeper understanding with context to a person or a group of people as compared to multiple case studies. The single case study method is less demanding on efforts and time while collecting and analyzing data. Although a single case study provides rich insights, it lacks opportunities for comparison with respect to similarities and differences with other situations unlike in multiple case studies. This limitation of single case study methodology is applicable to current research too. As the study is carried out in an Indian organization, it has a built-in geographical limitation. It could mean those study findings are strongly influenced by geographical context and may not be replicable in another geographical context on "as is" basis.

During PT, usage of IT increased but that necessarily did not reflect in the improvement of employee perception about the KM tools. It is possible that with increasing familiarity with overall IT tools, employee expectations about the KM tools might have increased, resulting in less positive perception about existing KM tools during PT compared to PPT. This needs further analysis. It could also mean that continued and dedicated efforts are needed to train employees on KM Tools and keep investing efforts to make KM tools more accessible and easier to use.

Engineering consulting being knowledge-intensive business, the importance attached by employees to OKMSP is very encouraging. Armed with the experience of WFH, the post-pandemic era would unleash collaborative business models by leveraging geographically dispersed teams. Knowledge-intensive organizations, irrespective of the domain would need to establish and leverage OKMSP. This study will nudge managers to pay close attention to OKMSP to prepare themselves to tap new opportunities.

5 | CONCLUSION

Human resources influence how a firm differentiates itself in the marketplace. Thus, it makes sense to ensure human resources are empowered. The effective KM practices help employee empowerment that results in a reduction in time, cost, and efforts. Such employee enablement aids innovations, ensuring further differentiation. Investment in KM policies and practices is not only good to have but also a must to have a business strategy. The study found that employees were aware of the benefits of OKMSP and had shown perception improvements about KM processes, KM effectiveness, and KM culture. The study objective was to evaluate the changes in employee perception about the Covid-19 pandemic influence on various aspects of OKMSP. The employees were having a strong appreciation for OKMSP even during pre-pandemic times. These findings are in line with the ones observed by Forcada et al. (2013) in their study of KM in Spanish construction and engineering design firms during pre-COVID-19 pandemic times.

The study unearthed the importance that employees attach to critical aspects of OKMSP namely, KM processes, KM effectiveness, KM culture, and KM tools. These findings are in line with the findings by Jackson et al. (2020) about key factors influencing OKMSP. As the COVID-19 pandemic forced organizations under observation to shift to WFH, the study findings are in line with the observations made by Alavi and Tiwana (2002) about virtual teams showing enhanced acceptance to KM.

The PT time necessitated increased use of information technology and hence the contribution of IT tools was evident. But the perception about KM tools did not show improvements during PT. It could also mean that mere familiarity and increase in IT systems usage is no guarantee of improvements or familiarity of KM tools. Organizations thus need to carefully plan the training efforts necessary to familiarize the employee base about OKMSP on a periodic basic. Meluso et al. (2020) have highlighted shortcomings in terms of the availability of effective collaboration tools at the time of sudden shift from WFO to WFH. The current study also observed that employees found scope for improvements in KM tools during current pandemic times. It is recommended that usage of KM tools should find a specific mention in the employee training calendar to improve the tool adaptability driven by tool familiarity. Survey clearly highlighted the importance employees put on top management involvement besides a role played by reward and recognition system. It is thus recommended that specific efforts by top management need to be devoted to meet these expectations.

COVID-19 pandemic is still raging. Organizations are not yet able to resume the pre-pandemic work normalcy. Although all attention is currently devoted to ensuring business continuity, managers cannot take their eyes off the possibility of eventual revival. As organizations grow and increase geographical spread, the coordination and cooperation amongst various business entities get challenging. It was observed that some of the initiatives like the usage of crowdsourcing platforms and expert systems were initially practiced in one section of the business. As such initiatives were part of the overall framework of OKMSP, subsequent organization-wide adaption was possible. Thus, the learnings from one part of the business can be effectively leveraged by another part of the business, provided the organization has a strong OKMSP. As more and more organizations will try to regroup themselves to get out of pandemic challenges, the OKMSP will increasingly play a crucial role in accelerating such a journey. Lessons learnt during a pandemic can prove handy in devising newer

processes and systems to help organizations handle future catastrophes with better preparation. The study carried out by Cegarra-Navarro et al. (2021) highlights the negative impact of knowledge hiding by the government on citizen engagement. The study can be contextualized to the corporate world to stress the importance of transparent, factual, and timely knowledge sharing during COVID-19 pandemic-like crisis situations.

There are numerous social, economic, and psychological aspects in play with respect to changes in terms of work from the office and WFH. The individual challenges faced by employees at the personal and professional levels are different during PPT and PT periods. More detailed studies are required to understand the impact of these parameters on OKMSP. The current study although provides evidence that the OKMSP was leveraged by the organization during PT, there is a need for more research in this area to enhance the understanding of universal factors responsible for the improvements. When the current pandemic will ebb and the organizations will return to a hybrid model of work from office and WFH scenarios, the OKMSP are likely to undergo further changes.

The process of transformation can take either of the two paths. One is incremental while the other is sudden and rapid. COVID-19 pandemic-induced disruptions were very rapid and across organizations. It provided very little time for any organization to get fully prepared. The organizations thus had no choice but to adapt to sudden changes in the way of working. Van Looy (2021) articulates how the COVID-19 pandemic might stimulate improvements across business process management. Such rapid adaptation requires common understanding across stakeholders in the shortest possible time. Were organizations that could effectively respond to rapid changes had well-established OKMSP? It would need further studies and could be a topic of future research.

The research clearly demonstrated widespread acceptance of OKMSP that helped in navigating through current COVID-19 pandemic-induced disruptions. Could enhanced efforts on OKMSP help organizations prepare to weather work disruptions arising out of future pandemics? This certainly is an important topic for further research and may hold the key to organizations' long-term business continuity during future pandemics. Another possible research area is repeating this study in multiple organizations in the same sector or different sectors. The detailed correlation analysis between organizational performance and employee perception about OKMSP can also be a future research area.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

ORCID

Shantanu Apte https://orcid.org/0000-0002-8006-8747

REFERENCES

Abualqumboz M. (2021). Project-based work in times of COVID-19: A dynamic framework for knowledge exchange. *Knowledge and Process Management*, 1–9. https://doi.org/10.1002/kpm.1698

Akbari, N., & Ghaffari, A. (2017). Verifying relationship of knowledge management initiatives and the empowerment of human resources. *Journal of Knowledge Management*, *21*(5), 1120–1141. https://doi.org/10.1108/jkm-10-2016-0435

Alavi, M., & Tiwana, A. (2002). Knowledge integration in virtual teams: The potential role of KMS. *Journal of the American Society for Information Science and Technology*, *53*(12), 1029–1037. https://doi.org/10.1002/asi.10107

Ardito, L., Coccia, M., & Messeni Petruzzelli, A. (2021). Technological exaptation and crisis management: Evidence from COVID-19 outbreaks. *R&D Management*, *51*, 381–392. https://doi.org/10.1111/radm.12455

Bangun, Y. R., Ginting, H., & Artini, R. M. O. (2020). Exploring the effect of digital storytelling on employee engagement: An experiment research. *Jurnal Manajemen Teknologi*, *19*(2), 159–176. https://doi.org/10.12695/jmt.2020.19.2.4

Bolisani, E., & Bratianu, C. (2017). Knowledge strategy planning: An integrated approach to manage uncertainty, turbulence, and dynamics. *Journal of Knowledge Management*, *21*(2), 233–253. https://doi.org/10.1108/jkm-02-2016-0071

Bolisani, E., Cegarra Navarro, J. G., & Garcia-Perez, A. (2021). Managing counter-knowledge in the context of a pandemic: Challenges for scientific institutions and policymakers. *Knowledge Management Research and Practice*, *19*(4), 517–524. https://doi.org/10.1080/14778238.2021.1911606

Bolisani, E., & Cegarra-Navarro, J. G. (2021). Bad counter knowledge: Case studies and countermeasures. In *Business revolution in a digital era* (pp. 1–13). Springer. https://doi.org/10.1007/978-3-030-59972-0_1

Bratianu, C., & Bejinaru, R. (2021). COVID -19 induced emergent knowledge strategies. *Knowledge and Process Management*, *28*(1), 11–17. https://doi.org/10.1002/kpm.1656

Carrillo, P., & Chinowsky, P. (2006). Exploiting knowledge management: The engineering and construction perspective. *Journal of Management in Engineering*, *22*(1), 2–10. https://doi.org/10.1061/(asce)0742-597x(2006)22:1(2)

Cegarra-Navarro, J., Soto-Acosta, P., & Wensley, A. K. (2016). Structured knowledge processes and firm performance: The role of organizational agility. *Journal of Business Research*, *69*(5), 1544–1549. https://doi.org/10.1016/j.jbusres.2015.10.014

Cegarra-Navarro, J. G., Vătămănescu, E. M., & Martínez-Martínez, A. (2021). A context-driven approach on coping with COVID-19: From hiding knowledge toward citizen engagement. *Knowledge and Process Management*, *28*(2), 134–140. https://doi.org/10.1002/kpm.1662

Cook, S. D., & Brown, J. S. (1999). Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organization Science*, *10*(4), 381–400. https://doi.org/10.1287/orsc.10.4.381

Forcada, N., Fuertes, A., Gangolells, M., Casals, M., & Macarulla, M. (2013). Knowledge management perceptions in construction and design companies. *Automation in Construction*, *29*, 83–91. https://doi.org/10.1016/j.autcon.2012.09.001

Girard, J., & Girard, J. (2015). Defining knowledge management: Toward an applied compendium. *Online Journal of Applied Knowledge Management*, *3*(1), 1–20.

Gustafsson, J. (2017). Single case studies vs. multiple case studies: A comparative study. Academy of business. Engineering and Science, Halmstad University, Halmstad, Sweden. 12(1).

Jackson, T., Shen, J., Nikolic, S., & Xia, G. (2020). Managerial factors that influence the success of knowledge management systems: A systematic literature review. *Knowledge and Process Management*, *27*(2), 77–92. https://doi.org/10.1002/kpm.1622

Jennex, M. E., & Raman, M. (2011). Knowledge Management in Support of Crisis Response. In M. Jennex (Ed.), Crisis Response and Management and Emerging Information Systems: Critical Applications (pp. 201-213). IGI Global. https://doi.org/10.4018/978-1-60960-609-1.ch013

Joe, C., Yoong, P., & Patel, K. (2013). Knowledge loss when older experts leave knowledge-intensive organisations. *Journal of Knowledge Management*, *17*(6), 913–927. https://doi.org/10.1108/jkm-04-2013-0137

Klein, V. B., & Todesco, J. L. (2021). COVID-19 crisis and SMEs responses: The role of digital transformation. *Knowledge and Process Management*, *28*(2), 117–133. https://doi.org/10.1002/kpm.1660

Kristanti, M. M. (2020). The influence of tacit & explicit knowledge, learning organization, service innovation, employee performance, towards competitive advantage: A customer-based approach during the pandemic COVID-19 in Indonesia. *Information and Knowledge Management*, *10*(4), 14–27. https://doi.org/10.7176/ikm/10-4-02

Li, Y., Zhou, Y., Stafford, T., & Wang, X. (2021). Significant stakeholders: Toward an agile knowledge management system in the time of coronavirus crisis. *IEEE Engineering Management Review*, *49*(1), 38–49. https://doi.org/10.1109/emr.2020.3036816

McMahon, C., Lowe, A., & Culley, S. (2004). Knowledge management in engineering design: Personalization and codification. *Journal of Engineering Design*, *15*(4), 307–325. https://doi.org/10.1080/09544820410001697154

Meluso, J., Johnson, S. & Bagrow, J. (2020). Making virtual teams work: Redesigning virtual collaboration for the future.

Meso, P., & Smith, R. (2000). A resource-based view of organizational knowledge management systems. *Journal of Knowledge Management*, *4*(3), 224–234. https://doi.org/10.1108/13673270010350020

Mohajan, H. K. (2017). Two criteria for good measurements in research: Validity and reliability. Annals of Spiru Haret university. *Economic Series*, *17*(4), 59–82. https://doi.org/10.26458/1746

Pinto, C. A. (2020). Knowledge management as a support for supply chain logistics planning in pandemic cases. *Brazilian Journal of Operations & Production Management*, *17*(3), 1–11. https://doi.org/10.14488/bjopm.2020.033

Sharma, P., Leung, T., Kingshott, R. P., Davcik, N. S., & Cardinali, S. (2020). Managing uncertainty during a global pandemic: An international business perspective. *Journal of Business Research*, *116*, 188–192. https://doi.org/10.1016/j.jbusres.2020.05.026

Singh, M. D. & Kant, R. (2007). Knowledge management barriers: An interpretive structural modeling approach. 2007 IEEE International Conference on Industrial Engineering and Engineering Management.

Smuttrasen, K., & Heo, D. (2020). The impact of leader roles on cross-border knowledge management and the development of boundaryless business models: A case study of Thai construction companies. *Knowledge and Process Management*, *27*(1), 53–62. https://doi.org/10.1002/kpm.1620

Soto-Acosta, P. (2020). COVID-19 pandemic: Shifting digital transformation to a high-speed gear. *Information Systems Management*, *37*(4), 260–266. https://doi.org/10.1080/10580530.2020.1814461

Van Looy, A. (2021). How the COVID-19 pandemic can stimulate more radical business process improvements: Using the metaphor of a tree. *Knowledge and Process Management*, *28*(2), 107–116. https://doi.org/10.1002/kpm.1659

Vermicelli, S., Cricelli, L., & Grimaldi, M. (2020). How can crowdsourcing help tackle the COVID-19 pandemic? An explorative overview of innovative collaborative practices. *R&D Management*, *51*(2), 183–194. https://doi.org/10.1111/radm.12443

Wang, W.-T., & Wu, S.-Y. (2021). Knowledge management based on information technology in response to COVID-19 crisis. *Knowledge Management Research and Practice*, *19*(4), 468–474. https://doi.org/10.1080/14778238.2020.1860665

Wei, X., Guo, D. & Li, Z. (2019). Application of knowledge management platform in digital media art courses. 2019 Eighth International Conference on Educational Innovation through Technology (EITT). https://doi.org/10.1109/eitt.2019.00050

How to cite this article: Apte, S., Lele, A., & Choudhari, A. (2022). COVID-19 pandemic influence on organizational knowledge management systems and practices: Insights from an Indian engineering services organization. *Knowledge and Process Management*, 1–13. https://doi.org/10.1002/kpm.1711