

The Role of Digitalization in Project Management, especially in Remote Areas in Saudi Arabia

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The Role of Digitalization in Project Management especially in Remote areas in Saudi Arabia

Graduation Research

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Thanks, Appreciation

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Acknowledgement

The foundation of digitalization in projects, particularly in remote areas, is a virtual team, A Geographically Dispersed Team (GDT) is a group of project workers who use electronic communication technology to meet from ground locations in the construction sector.

For project management, a virtual team (GDT) will accomplish and strategize their projects from different work bases. The virtual team shares a common goal but works from different locations, such as continents or different building areas.

They may never meet in person, but they can avoid feelings of isolation by doing so.

Managers face significant challenges in developing strategically flexible organizations in response to increasingly competitive markets. Fortunately, a new generation of information and communication technology is laying the groundwork for resilient new organizational forms that were not even imaginable a decade ago. One of the most exciting new forms, the virtual team, will allow organizations to become more flexible by delivering the impressive productivity of team-based designs in environments where teamwork was previously impossible. Virtual teams address the challenges associated with today's downsized and lean organizations, as well as the geographical dispersion of essential employees, using advanced computer and telecommunications technologies.

Virtual teams also address new workforce demographics, such as the fact that the best employees can be found anywhere in the world and that workers expect increasing technological sophistication and personal flexibility.

Organizations can use virtual teams to create teams with optimal membership while retaining the benefits of a flat organizational structure. Virtual teams also provide firms with access to previously unavailable expertise, improved cross-functional interaction, and systems that improve the work quality of the virtual team.

1-1 Abstract

Around the world, numerous remote construction projects are taking place in places like the Sahara Desert, the Antarctic region, the Arabian Peninsula Desert, the Australian Desert, the Empty Quarter, etc.

According to Deng et al., managing remote projects presents a challenge. He emphasized that one of the main contributors to management issues is distance, which leads to loss of control.

He offered potential factors, including the lack of need for more structure, human resources, and project management expertise for these remote initiatives.

Remote construction sites in the Kingdom of Saudi Arabia face particular challenges, and it has been noted that some of the project management and Communication issues are brought on by using ineffective tools and systems for coordination, management, and Communication.

For instance, Due to their flaws and inability to carry out project duties and objectives, traditional communications and information management systems cannot satisfy the project team's acute demand for project information and efficient communication.

One of these drawbacks is that traditional systems only offer restricted information access, which is one of the main obstacles to effective project management techniques.

Many of these project failures result from poor construction process organization and management (e.g., poor process coordination and ambiguity surrounding the information now available).

ACMS, such as web-based Project Management Systems (WPMS), mobile, augmented reality, and BIM, can solve these management issues.

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To a certain extent, these systems use wireless, satellite, Internet-based, or mobile tools and networks to help construction industry firms manage the rising complexity of typical building projects.

2-2 Introduction

Communication is critical for information dissemination and the day-to-day operation of any organization. Information and communication technology advancements, particularly the use of Internet-based systems,, have enabled people to learn and work virtually and remotely while retaining or outperforming traditional team performance. Merger and acquisition trends, alliance, hyper-competition, downsizing, and globalization have put pressure on firms to find and group the best talent around the world to serve the best interests of the firm. Lipnack and Stamps, 1997. In the Information Age, the virtual team is still becoming the basic work unit. Virtual team research is still in its early stages. Many research areas, particularly Saudi Arabia, have not been investigated due to the relative newness of virtual teams., which concludes that setting up an infrastructure for a virtual team still requires a significant engineering effort, which represents a major obstacle to the implantation of this new paradigm.

Effective and efficient collaboration across disciplines and distributed teams becomes critical for engineering project success.

As a result, the experiments indicate that more research is needed to investigate ways to improve the performance of virtual teams. Face-to-face teams differ from virtual teams. Virtual teams differ significantly from traditional teams. Members of a traditional team work next to one another, whereas members of virtual teams work in different locations. Task coordination in traditional teams is straightforward and performed by team members together; tasks in virtual teams, on the other hand, must be much more highly structured.

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Also, virtual teams rely on electronic Communication instead of face-to-face Communication in traditional teams.

As the importance of the PM-ASP concept increases, empirical research is needed to identify common factors across the systems and organizations that can lead to the successful implementation of PM-ASPs.

3-3 Background

The research agenda presented here can help identify these success/failure factors and their levels of impact, leading to productive ways of implementing PM-ASP in a construction project and thereby promoting the possibility of successful widespread adoption of PM-ASPs in the construction industry.

Careful planning and strategies are needed to implement PM-ASP successfully in a construction project. Several opinions exist regarding PM-ASP implementation, e.g.

Several attributes or measures might be used to assess the performance of PM-ASP implementation in a construction project.

Several factors can influence the success of PM-ASP implementation in a construction project. However, no single factor can govern this performance.

The interaction of these factors together drives performance.

The success or failure of PM-ASP implementation may or may not directly affect the success of a construction project.

The opinions above would lead one to raise the following questions regarding PM-ASP implementation in a construction project:

1. What attributes or measures should be used to evaluate the performance of PM-ASP implementation in a construction project?

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2. What are the success/failure factors leading to the performance of PM-ASP, and how do they affect its performance?
3. Can these factors, if controlled, ensure the success of PM-ASP implementation in a construction project?
4. What are the relationships, if any, between the success or failure of PM-ASP implementation and construction project success?

This paper is based on research intended to answer all the questions above.

An attempt to answer these questions leads or results to the following objectives:

1. To define a set of measures that can be used to assess the performance of PM-ASP implementation in a construction project.
2. To identify factors leading to the performance of PM-ASP implementation in a construction project.
3. To examine the cause—effect relationships between the identified factors and the performance measures.
4. To use the identified factors and their associated relationships with performance measures for inference, deviation-cause detection, and improvement of PM-ASP implementation in a construction project.
5. To determine if the success or failure of PM-ASP implementation affects the success of a construction project.

4-4 Study Objectives

The goal of this research is to look into Digitalization and remote teams play important roles in project management. It will be a comparison of the two types of teams., evaluating their advantages, disadvantages, and importance, particularly in remote areas and the construction industry.

5-5 Research Questions

- 1- How has adopting digital and remote teams impacted project management practices in Saudi Arabia?**
- 2- What are the main disadvantages and advantages of using digital and remote teams in Saudi Arabia project management?**
- 3- Are there any cultural or societal factors in Saudi Arabia that influence the effectiveness of digital and remote teams in project management?**
- 4- What skills and competencies are required for project managers to effectively lead and manage digital and remote teams in Saudi Arabia?**
- 5- What key factors have led to the increased use of digital and remote teams in project management in Saudi Arabia?**
- 6- What challenges or barriers do organizations face when implementing digital and remote teams for project management in Saudi Arabia?**
- 7- What are the best practices or strategies for effectively managing digital and remote teams in project management in Saudi Arabia?**
- 8- What are the future trends or developments in using digital and remote teams in project management in Saudi Arabia?**

6-6 Importance of the Research

A project management virtual team will complete projects within a specific scope, time frame, and budget. The project management team members have complementary skills and goals. They typically have a budget for high-quality, dependable communication technology tools to help them discuss project plans and

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achievements. E-mail, groupware, video-conferencing, intranet, fax, chat, or phone conversations are examples of technology tools. The virtual team represents the project management team's various locations and departments as they work on their projects.

7-7 Literature review

7-1 Remote construction site problems

Deng et al. (2001) highlight the dilemma of managing remote projects, stating that the extensive physical distance between project participants, which can sometimes span national boundaries, is the primary cause of decision-making delays.

The project team must address both traditional management issues and those that come as a result of the remote locations of these quite often environmentally sensitive sites.

These sites often need more logistic support, materials, and specialized labour.

We are investigating remote project management issues and reporting a need for project pre-planning, certainty, and clarity regarding project process integration. There were also misunderstandings and miscommunications about project outcomes and needs.

A centralized decision-making process and a lack of delegated authority to field personnel frequently affected progress and communications during critical stages of emergency response and recovery. There is a proposal for a framework for remote site design management. The framework prioritizes management functions such as serving, organizing, controlling, and economizing. A survey of construction contractors with experience in remote construction projects must have been conducted. They may discover that contractors have difficulty

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retaining and attracting skilled workers; working in remote areas can be detrimental to an employee's family life.

In remote areas, materials and equipment are difficult to obtain and access, and severe weather conditions reduce productivity. Infrastructure and communication improvements are required. Several potential solutions are proposed by the researchers, including the need for appropriate material management systems and design cost information tailored to remote construction projects. They suggested that during the pre-construction stages, unique costing issues such as mobilization/demobilization, accommodation, site allowances, inclement weather downtime, delivery, and productivity be included in the project's cost estimation. Take, for example, the Saudi Electric Company (SEC)

SEC has several remote projects, and it experiences difficulties running them.

These issues can be summarized as the following:

A. Procurement and Risk Management: More materials are required. Road/highway regulations, as well as the poor condition of some remote roads, impede the delivery of materials and equipment. Projects have significantly higher risk margins than regular projects. This is due to the ad hoc approach, and neither the owner nor the contractor accurately plans projects.

B. Cost, scope, time and quality management: More timely decision-making, loose control, and infrequent visits to the remote site are required, which results in wasted time, high costs, unfocused scope, and poor construction quality.

C. Human Resources: Due to a staff shortage, employees can only make a limited number of required site visits. There should be more security and a scarcity of skilled workers. The impact of harsh working conditions has a negative impact on the productivity of SEC supervisors.

D. Infrastructure and communications: Land ownership is unidentified in some remote areas, and legal disputes are likely. More infrastructure is required. Traditional communication and management tools are still used by contractors and SEC supervisors. Decisions are made unilaterally, and SEC's project managers require assistance in controlling and coordinating the integration of project aspects. The typical management style must be revised to be more cohesive and loose.

7-2 The potentials and barriers to the use of ACMS

7-2-1 The potentials of ACMS

Some remote project management problems can be avoided if ACMS were used.

Knowing how far these systems would be capable of sorting remote construction problems is essential.

Web-based Project Management Systems (WPMS) and mobile systems with mobile tools, personal digital assistants (PDA), wearable computers, wireless tools, four-dimensional augmented reality (4D), virtual reality, and other technologies are examples of these systems.

These systems can improve communication among project team members, allowing them to share information and solve problems more quickly.

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They improve team members' time and cost management skills (ibid). The efficient transfer of information between construction teams can reduce construction costs by 25%; this transfer can be accomplished using ACMS.

Many people believe that adopting Information Communication Technology (ICT) allows for effective communication among dispersed project team members, but that is not the case.

This enables them to effectively grasp the IT benefits as well as the following WPMS benefits: increased project participant productivity, reduced project delays, increased project awareness among all parties, and ease of access to and retrieval of project information.

Other benefits include reduced site visits and travel time to meetings, the avoidance of drawing errors, the saving of time and money on disputes, the sharing and exchanging of project information, the automation of repetitive routine processes, and the elimination of paper reports.

There is a discussion about how WPMS tends to help project managers improve contractor performance and confidence by reducing subjectivity and eliminating the possibility of corrupt practices in the selection process.

This increases competitiveness by raising awareness of competitors' strengths and weaknesses, as well as cultivating mutual trust in exchanging sensitive information such as performance data. Furthermore,

the advantages of using WPMS can be divided into four categories. These categories include cost and time savings, improved communications and collaboration, increased productivity and partnership, and customer and e-commerce support. Several researchers believe that WPMS will eventually replace traditional project management methods, and that these methods will drive WPMS adoption.

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Several factors support this assertion, including increased competitive pressures, revenue growth expectations, global competitiveness, and a desire to re-engineer the business to meet market challenges. It is difficult to determine which mobile systems would directly benefit the construction industry.

Among the most important intangible benefits are improved customer service, gaining a competitive advantage, acquiring more timely management information, supporting core business functions, avoiding competitive disadvantages, improving management information, improving product quality, improving internal communication, implementing changes through innovation, improving external communication, and enhancing employee jobs.

In recent years, laser scanning and video and image-based 3D reconstruction systems have been developed to enable remote and virtual walkthroughs on actual construction sites.

By providing project managers with easily applicable systems, these systems can reduce supervisor travel times and increase the frequency of progress, quality, and safety inspections.

The project team's use of Building Information Modeling (BIM) would result in a more streamlined business process and associated project and site management methodologies, as well as complete facilitation of construction knowledge throughout the entire lifecycle of a building project.

This led to the argument that BIM implementation is a valuable alternative to addressing key construction sector issues and offers solutions to these by increasing productivity, efficiency, and quality, reducing costs, lead times, and duplications, and reducing costs, lead times, and duplications through effective collaboration and communication of stakeholders in remote construction projects.

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These key findings also support the classification of the critical challenges for construction project management in remote construction projects, such as human resources, cost, time, scope, and quality management; procurement and risk management; infrastructure and Communication.

There is a study on the potentiality of Communications and Project Management Systems (CPMS) and whether they would help SEC avoid construction problems, sort out efficient site queries, and improve the management of these projects.

They pointed out that the CPMS would support SEC's management activities, particularly during the construction stages that witness long delays in providing feedback to the construction inquiries.

CPMS can provide fast feedback to the site personnel regarding the most problematic construction problems, such as those related to the monitoring of the construction process, quality of work, procurement of materials, and productivity levels.

The section above highlighted the problems and capabilities of ACMS regarding each project management aspect.

The previous research indicated that remote construction sites have unique problems that need customized IT solutions.

It also indicated that remote construction sites have some common problems, such as time, potential Risk, pre-planning, cost, and logistic support, despite being in different locations.

7-2-2 Barriers to the Use of ACMS

Despite fast developments in IT and the creation of many IT applications for the construction industry, some issues still need to be improved for the applicability of these systems to construction project management.

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There needs to be a solution to the diffusion of IT in the construction industry and the absorption of IT into work practices.

This includes the level of strategic IT investment by construction industry firms.

Other barriers include IT technical shortages, deployment of the system on an ad hoc basis, isolated project management practices, and costly systems.

To minimize such barriers and enable ICT adoption, the following issues should be investigated (Margherita & Petti, 2010):

- **Strategy:** the action plan deriving from an integrated view of the organization's goals and priorities, **people's expectations, and potential benefits;**
- **People:** the single individuals' attitude and the overall organizational context that impact the level of willingness and readiness to change;
- **Process:** the fundamental unit of analysis and trigger of change in terms of alternative redesign scenarios and associated impact; and
- **Enablers:** The potential facilitators of implementation at the technological and organizational levels investigated the impact of project success/ failure factors on the performance of WPMS.

This is regarding the following aspects: project characteristics, project team characteristics, service provider characteristics, and system characteristics.

Concerning the project and project team characteristics, they found that strategic, time, cost, quality, Risk, and communication improvement are significantly linked: owner type, project type, project cost, project duration,

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and starting stage of PM-ASP development. Regarding project team characteristics, the above factors are significantly linked with the project Parties deciding to use PM-ASP.

The following structural and social impediments to **the integration of ICT systems**: commitment from top management, continuing support for users, highly reliable systems, involvement of users, we-use systems, effective project management, clear cost justification, well-proven systems, complete training, precisely defined objectives, facilities to meet specific needs, use of pilots or prototypes and organizational change.

7-2-3Control mechanisms.

Recent work in the tradition of control theory has investigated the effect of control mechanisms on small groups such as information systems design and development teams (Guinan et al., 1998; Henderson & Lee, 1992; Kirsch, 1997) and retail outlet crews (Eisenhardt, 1985).

In this tradition, control is defined as "the mechanisms through which an organization can be managed so that it moves toward its objectives" (Ouchi, 1979, p. 833). It is conceptualized as ensuring that individuals working on team projects conform to predefined strategies (Kirsch, 1997).

One form of control that has received attention in the traditional team literature is behaviour control – a type of formal control designed to structure the transformation process of work instead of the results (i.e. outputs) of work activities (Ouchi, 1977; Snell, 1992).

When enforcing behavior control, "specific rules and procedures are articulated, which, if followed, will lead to desired outcomes" (Kirsch, 1997, p. 217).

Thus, behavior control mechanisms call for structuring the work by employing procedures and rewarding individuals for complying with them (Kirsch, 1997; Snell, 1992).

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In traditional co-located teams, behavior controls are frequently used to stimulate team performance, foster cooperation, and increase individual satisfaction (Henderson & Lee, 1992; Pinto et al., 1993).

Typical behavior control mechanisms include defining explicit work assignments, specifying rules and procedures, and filing project plans and reports (Henderson & Lee, 1992; Kirsch, 1997; Pinto et al., 1993).

Early virtual team research has endorsed behavior control as a managerial control method in virtual teams, indicating that "Clear schedules must be established of when the team will provide reports, interim deliverables and the final product" (Townsend et al., 1998, p. 25).

However, most virtual team research has focused on self-directed teams with no behavior control (Powell et al., 2004).

A second form of control in team management is self-direction.

While the concept of self-directed teams is familiar (Guzzo & Dickson, 1996), more work has focused on teams of knowledge workers (Janz et al., 1997).

Team self-direction is a type of informal control that develops over time from the socialization processes occurring within the team.

Initially, there are no formal procedures or processes the team must follow. Virtual Teams 361 Downloaded by ABE, Miss Claire Siegel at 08:39 27 September 2017 (PT) follow. Instead, the socialization process identifies and reinforces the norms, values, and goals important to the team (Kirsch, 1997). While Kirsch defines this approach to control as clan control, the critical characteristics of clan control and our term of self-direction are the same.

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Even when formal controls (i.e., deadlines) are imposed on a virtual team, team members will still create informal control mechanisms to ensure desired behaviours and attitudes in team members (Crisp & Jarvenpaa, 2002).

The socio-technical tradition and previous traditional team research suggest that, at the individual level, knowledge workers greatly value autonomy (Cheney, 1984; Goldstein & Rockart, 1984).

Some studies examining co-located teams have found that autonomy appears to have positive implications at the team level for member satisfaction but no relationship with performance (e.g. Janz et al., 1997; Cohen & Ledford, 1994), while other studies have found that the highest performing co-located teams were those with behavioural controls (Henderson & Lee, 1992; Kim & Lee, 1995).

Work processes: coordination and communication effectiveness.

Two aspects of work processes commonly investigated concerning virtual teams are coordination effectiveness and communication effectiveness.

Measurements of work processes often include aspects of coordination and Communication (e.g. Lurey and Raisinhgani, 2001; Taylor & Bowers, 1972).

In addition, coordination and Communication are two of the most common dimensions of work processes studied in virtual teams (Powell et al., 2004). For this study, we examine coordination effectiveness and communication effectiveness as two dimensions of work processes.

The product development research tradition has investigated the processes of product development teams that draw members from diverse functional areas. This literature indicates that "Effective group processes,

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particularly those related to communication, increase information and are essential for high-performing development processes" (Brown & Eisenhardt, 1995, p. 368).

These and related findings highlight the central role of frequent and effective internal Communication for team success (Allen, 1977; Ancona & Caldwell, 1992; Dougherty, 1992; Ebadi & Utterback, 1984).

A high level of coordination among team members is also a mark of effective product development teams (Ancona & Caldwell, 1992; Kraut & Streeter, 1995; Pinto et al., 1993). Communication and coordination breakdowns are significant hurdles preventing project teams from reaching their objectives (Curtis et al., 1988).

Coordination problems in teams arise from the dependencies between members, and they are often engendered by the structure of the problem, particularly in complex projects (Crowston & Kammerer, 1998).

Rules and procedures are often introduced to mitigate such coordination problems (Pinto et al., 1993). Outcomes. The team literature defines effectiveness regarding group-produced outputs and the consequences a group has for its members (Cohen & Bailey, 1997; Guzzo & Dickson, 1996; Hackman, 1987; Sundstrom et al., 1990).

Effective teams should be able to produce high-quality output (i.e. products and services) and reward team members in terms of gratification and satisfaction with the working experience (Jarvenpaa & Ives, 1994).

Thus, we define team effectiveness in terms of team performance: effective teams can deliver a timely, high-quality product; and ITP 17,4 362 Downloaded by ABE, Miss Claire Siegel at 08:39 27 September 2017 (PT).

Individual satisfaction: Effective teams can satisfy individual team members' needs rather than frustrate them as a byproduct of team interaction.

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Team performance and individual satisfaction are the two most common variables when examining virtual team outcomes (Powell et al., 2004).

Most research examining performance and satisfaction has compared the outcomes of virtual teams with traditional co-located teams (Burke & Chidambaram, 1996; Gallagher & Kraut, 1994; McDonough et al., 2001; Warkentin et al., 1997).

There has also been a substantial amount of research done to determine what antecedents are necessary for successful performance (Kaiser et al., 2000; Majchrzak et al., 2000; Malhotra et al., 2001; Maznevski & Chudoba, 2000; Suchan & Hayzak, 2001) and satisfied team members (Kayworth & Leidner, 2000; Tan et al., 2000). However, none of this research has examined the impact of control mechanisms on virtual team performance or individual satisfaction.

Theoretical development In this section, we build on the above discussion of traditional and virtual team literature by examining research involving virtual teams, specifically how technology impacts the virtual team. Our theoretical model guides our hypotheses development team control structure to work processes. Virtual teams face significant contextual and environmental challenges due to using technology as their primary means of Communication. Visual, tactile, and verbal Communication is reduced, while technology problems that impede work processes increase. Because of virtual teams' challenges, they encounter significant obstacles to effective work processes.

When the team is allowed to self-direct, rather than being required to comply with predefined behaviours, it can appropriate the available technology that best fits its idiosyncratic skills, limitations, and needs (DeSanctis & Poole, 1994).

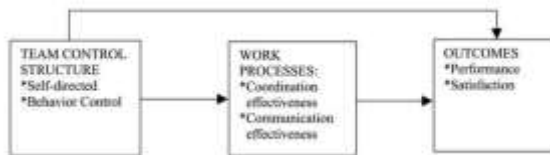
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Similarly, the team can decide to appropriate the technology as expected but adapt the team structure and the organizational environment to correct misalignments (Majchrzak et al., 2000). Alternatively, when behaviour controls are enforced, they force the team to comply with externally, apriori imposed schedules.

These schedules may not match the communication and coordination requirements the team faces once it begins its work and may

readdisrupt its idiosyncratic rhythm, hampering Communication and coordination and ultimately hindering team effectiveness (Majchrzak et al., 2000; Maznevski & Chudoba, 2000):

H1a. Members of self-directed virtual teams achieve greater coordination effectiveness than members of virtual teams under behaviour control.



Coordination.

In general, coordination represents the degree of functional articulation and unity of effort between different entities in an organization (Georgopoulos & Mann, 1962) and "the extent to which the work activities of organizational members are logically consistent and coherent" (Cheng, 1983, p. 156).

Thus, in a well-coordinated organization, work activities are complementary and are directed toward a common goal without duplication of effort or fragmentation (Cheng, 1984). In a team environment, internal coordination refers to how organized the team is in carrying out its mission (Janz et al., 1997). Early work on virtual teams has highlighted the difficulties virtual teams face as they attempt to coordinate work across time

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zones, cultural divides, and divergent mental models (Gallagher & Kraut, 1994; Kayworth and Leidcause—effect02; Sarker & Sahay, 2002; Warkentin et al., 1997). Using technology as the primary means of communicating with team members can impede the ability of team members to coordinate their work. More excellent geographical dispersion among team members is now possible through technology, and virtual team members must adapt their work style to coordinate with team members whose working style is different from their own. These differences require greater information exchange to coordinate and integrate the contributions of technology-mediated team members (Qureshi & Vogel, 2001; Robey et al., 2000).

The lack of communication richness in technology-supported Communication also affects the ability to coordinate work (Gallagher & Kraut, 1994), as do time delays that occur when communicating solely through technology (Robey et al., 2000). Thus, virtual team members are more likely to report difficulty coordinating work activities due to communication constraints (Chidambaram, 1996; Gallagher & Kraut, 1994; Hollingshead et al., 1993).

Virtual teams that can overcome coordination difficulties will likely be more effective and satisfied (Johansson et al., 1999; Lurey & Raisinhgani, 2001; Maznevski & Chudoba, 2000).

Overcoming coordination obstacles such as power considerations, cultural/work process differences, and lack of Communication is necessary for the performance and satisfaction of the team (Johansson et al., 1999): H2a. Virtual team performance improves as coordination effectiveness increases. H2b. Satisfaction increases as coordination effectiveness increases. Communication. Effective communication processes are central to the effectiveness of traditional, co-located teams. In virtual teams, the inability to frequently meet face-to-face, the temporal and geographical dispersion, and the significant reliance on communication technologies create additional obstacles to effective Communication, potentially damaging team effectiveness (Gallagher & Kraut,

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1994; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999). While there are many advantages to communicating via technology, this mode of interaction also introduces a new set of communication problems that do not exist in traditional team environments.

Computer-mediated Communication reduces the visual, tactile, and verbal Communication in traditional team communication (Robey et al., 2000). Electronic media are intrinsically leaner than face-to-face Communication and convey limited communication cues (Sproull & Kiesler, 1986). With the leaner media, ITP 17,4 364 Downloaded by ABE, Miss Claire Siegel at 08:39 27 September 2017 (PT), team members find it challenging to convey the same rich information that they can convey during face-to-face meetings and, with less wealthy Communication, social relationships are more difficult to develop (Walther & Burgoon, 1992).

Individuals who interact through information and communication technologies tend to be less attentive and receptive to contextual cues (Lea & Spears, 1992; Sproull & Kiesler, 1986).

Their interaction appears impersonal, task-oriented, and businesslike (Bordia, 1997; Connolly et al.; Cause et al., 1987).

Technology limitations lead to other common communication problems in technology-mediated teams. Servers crashing, incorrect e-mail addresses, or overloaded phone lines delaying textual information to team members impact virtual teams much more than co-located teams. These technology problems can significantly delay a project when team members have technology as their primary means of Communication (Cramton, 2001; Kayworth and Leidner, 2001/2002; Suchan & Hayzak, 2001; Van Ryssen & Hayes Godar, 2000).

The ability of individuals to effectively communicate without face-to-face interaction varies as a function of their experience with the medium, the available time to complete the task, and social norms within the team (Carlson & Zmud, 1999; Chidambaram, 1996; Fulk & DeSanctis, 1993; Walther, 1995).

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While contextual variables such as experience and time on task help mitigate some of the virtual teams' communication difficulties, the barriers to effective communication remain significant in the virtual environment. Using technology as a primary means of Communication has been found to reduce team effectiveness because of increased communication problems associated with lags and delays of Communication, inability to assess understanding of fellow team members, and team members' differing frames of reference, language, culture, and motivation to participate (Cramton, 2001; Gallagher & Kraut, 1994; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999; Robey et al., 2000; Walther & Burgoon, 1992; Warkentin & Beranek, 1999; Warkentin et al., 1997).

These difficulties are magnified for short-term virtual teams that work under significant time pressure.

Virtual teams that succeed in coping with these communication challenges will be more effective: H3a. Virtual team performance improves as communication effectiveness increases.

H3b. Satisfaction increases as communication effectiveness increases.

Team control structure to outcomes. Most virtual team research to date has focused on self-directed (i.e., autonomous) teams (Gallagher & Kraut, 1994; Iacono & Weisband, 1997; Jarvenpaa et al., 1998; Jarvenpaa & Leidner, 1999), but there has been no explicit test of the benefits that such organizational structure offers in the virtual environment.

Traditional teams extensively use behaviour control mechanisms (Kirsch, 1997), and their extension to the virtual environment has been advocated (Townsend et al., 1998).

Virtual teams face more significant project management challenges, including keeping on schedule and ensuring that project goals remain stable (McDonough et al., 2001).

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For teams with assigned leaders, team members regarded poor leaders as those who needed to provide more detail on what needed to be done and needed to provide a clear separation of tasks among members (Kayworth and Leidner, 2001/2002).

Proponents suggest that by providing appropriate schedules and assignments for the Virtual Teams 365 Downloaded by ABE, Miss Claire Siegel At 08:39 27 September 2017 (PT), completion of work tasks and requiring the team to report on its progress, Communication and coordination challenges periodically can be minimized (Townsend et al., 1998).

However, a chief advantage of virtual teams is their flexibility, enabling them to draw the most appropriate set of individuals required to complete a specific task (Jarvenpaa & Leidner, 1999; Townsend et al., 1996).

For this reason, virtual teams are frequently employed for atypical and highly specialized projects involving unique information and changing requirements (Jarvenpaa & Ives, 1994; Robey et al., 2000).

Virtual teams are continually shifting and adapting to changes in technology and the social structures of the organization and team (Qureshi & Vogel, 2001).

Thus, virtual team members must be willing to work in a dynamic environment, embrace change, and adapt as needed.

Organizations with successful virtual teams have recognized the need for team members who "work comfortably without constant supervision, require minimal formal structure, enjoy autonomy ..." and can solve problems independently rather than turning to managers (Robey et al., 2000).

In virtual teams where leadership was designated, "leaders as mentors" was more closely associated with leadership effectiveness than "leaders as directors" (Kayworth and Leidner, 2001/2002).

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Socio-technical theory (Passmore, 1988; Pearce & Ravlin, 1987) suggests that because—effects may increase team performance and individual satisfaction by harnessing the team's self-regulatory capacity.

This perspective suggests that autonomy “enables group members to effectively deal with task and environmental demand by making decisions in the process of doing work” (Cohen et al., 1996, p. 647).

Thus, the team can allocate its resources efficiently and cope with changes in working conditions and demands (Cohen et al., 1996). Virtual team members must adapt to contextual and environmental changes such as cultural diversity, differences in work practices, and variations in time zones and schedules (Robey et al., 2000); most importantly, they must learn to effectively use information and communication technologies as the backbone of their operations (Maznevski & Chudoba, 2000).

Doing so requires significant adaptation of the various technologies available to the team and an innovative and proactive stance on the part of individual team members (Robey et al., 2000).

When substantial adjustment on the part of team members is needed, behaviour controls that limit the team's autonomy may prove detrimental to team effectiveness; here, reporting requirements routinely used in traditional co-located teams may stifle the improvisation and adaptation required for virtual team effectiveness: H4a. Self-directed virtual teams achieve higher performance than virtual teams under behaviour control. H4b. Members of self-directed virtual teams express greater satisfaction with their experience than members of virtual teams under behaviour control. Mediation effects. We hypothesize that team self-direction increases virtual team effectiveness because it improves the work processes of communication and coordination effectiveness within the team. In other words, the positive effect of self-direction on team performance and team members' satisfaction is due to self-direction's positive effect on work processes (i.e., coordination and communication effectiveness).

Formally, we argue that coordination and communication effectiveness mediate the relationship between the team control structure and team effectiveness (Furst et al., 1999): ITP 17,4 366 Downloaded by ABE, Miss Claire Siegel at 08:39 27 September 2017 (PT)

H5a. When the effects of coordination and communication effectiveness are controlled, there is no performance difference between self-directed virtual teams and virtual teams under behaviour control. H5b.

When the effects of coordination and communication effectiveness are controlled, there is no difference between the level of satisfaction reported by members of self-directed virtual teams and those of virtual teams under behaviour control.

8.8 Theoretical Implications

Collaborating in teams using various digital information and communication technologies (ICTs) to perform interdependent tasks and achieve common goals relevant to one's organization is increasingly the new normal. Such more or less virtual teams—which can be all human or human-agent teams (HATs) (i.e., including autonomous software agents with artificial intelligence)—are complex, dynamic, open socio-digital systems embedded in an organizational, economic, and societal context. How and to what degree team members use ICTs to perform their tasks and to manage situational demands influence team processes and emergent states, such as transactive memory systems and team mental models, and thus team effectiveness.

Virtual teams exist in an environment that precludes or severely limits the ability of team members to meet face-to-face. Still, virtual teams share some similarities with traditional co-located teams.

For this reason, and because of the lack of a cogent theory of virtual team effectiveness, we draw on the traditional team literature to develop our research hypotheses. Specifically, we focus on theoretical models of

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managerial control (Ouchi, 1979), product development (Brown & Eisenhardt, 1995), and socio-technical ITP systems (Bostrom and Heinen, 1977a, b; Mumford & Weir, 1979; Passmore, 1988; Pearce & Ravlin, 1987).

The literature on managerial control supports the investigation of different control mechanisms.

The product development literature helps illuminate the internal processes underlying cross-functional development teams' effectiveness, and socio-technical theory sheds light on the Role of team autonomy and its relationship to team effectiveness.

Our approach is consistent with previous research advocating the transfer of existing theory to new environments and contexts with appropriate modifications to account for the unique characteristics of the new setting (Rice & Williams, 1984).

Thus, mindful of the dissimilar context in which virtual teams interact (e.g., lean communication channels, time dispersion, organizational and geographical dispersion), we draw on the computer-mediated communication literature, as well as the early findings of virtual team research, to extend our understanding of traditional, co-located teams to the virtual context.

We develop a theoretical model for our investigation based on our literature review.

Saudi Arabia has steadily emphasised digital transformation as part of its ambition to transform and innovate the infrastructure, encouraging using technologies like BIM. **What is connected construction technology, and how is it helping construction stakeholders to have more successful projects?**

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Connected Construction, in its broadest sense, refers to a network of machinery, vehicles, devices, people, and locations connected by wireless or digital technology and controlled by a single firm or organization.

This is particularly crucial as a construction project involves numerous teams for various tasks, including contractors, subcontractors, engineers, field personnel, project owners, architects, designers, and other stakeholders.

One of the most significant challenges is when most project participants use multiple independent tools for various coding and work processes, which prevents an integrated view of a project's workflow.

This structure makes it difficult to manage various tools, leads to repetitive data entry, and prevents compartmentalized data from establishing a better view of the project's status.

Connected Construction makes it possible to roundtrip data from the field to the office to the store and back again, ensuring that everyone has access to the latest information, which also allows for data-based decision-making, interoperability, real-time data, optimized project costs, and schedules, better collaboration and Communication, and fewer risks.

Construction landscape through technology.

BIM can be used to digitize and connect, eliminating errors and streamlining workflows, regardless of the kind or technique of Construction, such as precast, cast-in-place, steel, commercial and retail, or infrastructure. Simply put, the BIM process is a crucial technology workflow that enables numerous preferred models and data to transmit information from the initial planning stage to the finer points of the design while controlling schedule and cost. Data collection and flow of data are crucial elements in the construction industry. Installing

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Technology-supported functions (Anderson et al., 2007). Gassmann and Von Zedtwitz (2003b) defined a "virtual team as a group of people and sub-teams which interact through interdependent tasks guided by a common purpose and work across links strengthened by information, communication, and transport technologies". Another definition of virtual teams, "... distributed work teams whose members are geographically dispersed but coordinate their work, predominantly with electronic information and communication technologies (E-mail, video-conferencing, telephone, etc.) (Hertel et al., 2005)". However, among different definitions of a virtual team, the following is the most widely accepted (Powell et al., 2004), "virtual teams as groups of geographically, organizationally and/or time dispersed people brought together by information technologies to accomplish one or more organization tasks".

It is generally accepted that virtual teams form socio-technical systems (Curseu et al., 2008).

From these are other definitions, the key terms in virtual teams are: A group of people (who may belong to different companies (Dafoulas & Macaulay, 2002) who interact through interdependent tasks to achieve common goals (Gassmann & Von Zedtwitz, 2003b), while geographically, organizationally and/or time dispersed (Leenders et al., 2003), work mainly using communication technologies (Hertel et al., 2005), for short-term and perpetual (Baskerville & Nandhakumar, 2007).

Benefits of virtual teams

Virtual teams reduce time-to-market (Lipnack & Stamps, 2000; May & Carter, 2001; Sorli et al., 2006; Kankanhalli et al., 2006; Chen, 2008; Shachaf, 2008; Kusar et al., 2004; Ge & Hu, 2008; Mulebeke & Zheng, 2006; Guniš et al., 2007; Prasad & Akhilesh, 2002; Zhang et al., 2004; Sridhar et al., 2007).

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Lead time or time-to-market has been generally admitted to being one of the most important keys to success in manufacturing (Sorli et al., 2006).

Time also has an almost 1:1 correlation with cost, so the cost will be proportionally reduced if the time-to-market is quicker (Rabelo & Jr., 2005).

Virtual teams can overcome the limitations of time, space and organizational affiliation that traditional teams face (Piccoli et al., 2004) and reduce transfer time and costs and travel costs (McDonough et al., 2001; Rice et al., 2007; Bergiel et al., 2008; Cascio, 2000; Fuller et al., 2006; Kankanhalli et al., 2006; Prasad & Akhilesh, 2002; Olson-Buchanan et al., 2007; Boudreau et al., 1998; Biuk-Aghai, 2003; Liu & Liu, 2007; Lipnack & Stamps, 2000).

Virtual teams overcome traditional teams' limitations of time, space, and organizational affiliation (Piccoli et al., 2004).

One of the most important of employing a virtual R&D team is to tap selectively into a centre of excellence, using the best talent regardless of location (Criscuolo, 2005; Cascio, 2000; Samarah et al., 2007; Fuller et al., 2006; Furst et al., 2004; Badrinarayanan & Arnett, 2008; Prasad & Akhilesh, 2002; Boudreau et al., 1998; Boutellier et al., 1998).

Also, virtual teams respond quickly to changing business environments (Bergiel et al., 2008; Mulebeke & Zheng, 2006), able to digitally or electronically unite experts in highly specialized fields working at great distances from each other (Rosen et al., 2007), make R&D continuation decisions more effective (Cummings & Teng, 2003; Schmidt et al., 2001), provide a greater degree of freedom to individuals involved with the development project (Ojasalo, 2008; Badrinarayanan & Arnett, 2008; Prasad & Akhilesh, 2002).

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Creating greater productivity, shorter development times (McDonough et al., 2001; Mulebeke & Zheng, 2006), producing better outcomes, and attracting better employees are other benefits of virtual teams. Further, such teams can generate a tremendous competitive advantage from limited resources (Martins et al., 2004; Rice et al., 2007; Chen et al., 2008c), useful for projects that require cross-functional or cross-boundary skilled inputs (LeeKelley & Sankey, 2008), less resistant to change (Precup et al., 2006), helping transnational innovation processes (Gassmann & Von Zedtwitz, 2003b; Prasad & Akhilesh, 2002) and a higher degree of cohesion (teams can be organized whether or not members are in proximity to one another) (Kratzer et al., 2005; Cascio, 2000; Gaudes et al., 2007), evolving organizations from production-oriented to service/information-oriented (Johnson et al., 2001; Precup et al., 2006) and providing organizations with an unprecedented level of flexibility and responsiveness (Powell et al., 2004; Hunsaker & Hunsaker, 2008; Chen, 2008; Guniš et al., 2007; Prasad & Akhilesh, 2002; Pihkala et al., 1999; Piccoli et al., 2004; Liu & Liu, 2007).

Besides, virtual teams are self-assessed and high performance teams (Chudoba et al., 2005; Poehler and Schumacher, 2007), employees can more easily accommodate both personal and professional lives (Cascio, 2000), employees perform their work without concern of space or time constraints (Lurey and Raisinghani, 2001), optimize the contributions of individual members towards the completion of business tasks and organizational goals (Samarah et al., 2007), reduce the pollution (Johnson et al., 2001), manage the development and commercialization tasks quite well (Chesbrough and Teece, 2002), improve Communication and coordination and encourage the mutual sharing of inter-organizational resources and competencies (Chen et al., 2008a), cultivating and managing creativity (Leenders et al., 2003; Prasad and Akhilesh, 2002; Atuahene-Gima, 2003; Badrinarayanan and Arnett, 2008), facilitate knowledge capturing and sharing and experiences (Rosen et al., 2007; Zakaria et al., 2004; Furst et al., 2004; Merali and Davies, 2001; Sridhar et al., 2007; Lipnack and Stamps, 2000), improve the detail and precision of design activities (Vaccaro et al., 2008), provide a vehicle

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for global collaboration and coordination of R&D-related activities (Paul et al., 2005), allow organizations to access the most qualified individuals for a particular job regardless of their location (Hunsaker and Hunsaker, 2008) and enable organizations to respond faster to increased competition (Hunsaker and Hunsaker, 2008; Pauleen, 2003).

The ratio of publications from virtual R&D members is exceeded from co-located publications (Ahuja et al., 2003), and the extent of the informal exchange of information is minimal (Pawar & Sharifi, 1997; Schmidt et al., 2001). Virtual teams have better team outcomes (quality, productivity, and satisfaction) (Gaudet et al., 2007; Ortiz de Guinea et al., 2005; Piccoli et al., 2004), reduce training expenses, faster learning (Pena-Mora et al., 2000; Atuahene-Gima, 2003; Badrinarayanan & Arnett, 2008) and finally greater client satisfaction (Jain & Sobek, 2006).

These benefits have been introduced previously. The key advantages of virtual teams are that they can reduce time-to-market and increase flexibility and team formation.

Pitfall of virtual teams

Virtual R&D teams in which members work at different times or places often face tight schedules and a need to start quickly and perform instantly (Munkvold & Ziguers, 2007).

The virtual team may allow people to collaborate with more productivity at a distance. However, the trip to a coffee corner or across the hallway to a trusted colleague is still the most reliable and effective way to review and revise a new idea (Gassmann & Von Zedtwitz, 2003a).

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As a drawback, virtual teams are vulnerable to mistrust, communication breakdowns, conflicts, and power struggles (Rosen et al., 2007; Cascio, 2000; Kirkman et al., 2002; Taifi, 2007; Baskerville & Nandhakumar, 2007).

It sometimes requires complex technological applications (Bergiel et al., 2008; Badrinarayanan & Arnett, 2008) and has a lack of physical interaction (Cascio, 2000; Hossain & Wigand, 2004; Kankanhalli et al., 2006; Rice et al., 2007).

In virtual teams, everything is reinforced in a much more structured, formal process (Lurey & Raisinghani, 2001) but decreased monitoring and control of activities (Pawar & Sharifi, 1997).

Virtual teams comprise challenges of project management (Wong & Burton, 2000; MartinezSanchez et al., 2006; Badrinarayanan & Arnett, 2008; Jacobs et al., 2005), finding out the suitable task technology fit (Qureshi & Vogel, 2001; Ocker & Fjermestad, 2008; Griffith et al., 2003; Badrinarayanan & Arnett, 2008; Bell & Kozlowski, 2002), managing conflict (Hinds & Mortensen, 2005; Ocker & Fjermestad, 2008; Kayworth & Leidner, 2002; Piccoli et al., 2004; Wong & Burton, 2000; Ramayah et al., 2003) and technophobia (employees who are uncomfortable with computer and other telecommunications technologies) (Johnson et al., 2001).

Cultural diversity in virtual teams leads to differences in the members' thought processes. Therefore, developing trust among the members is challenging (Bell & Kozlowski, 2002; Griffith et al., 2003; Shachaf, 2005; Jacobs et al., 2005; Paul et al., 2005; Poehler & Schumacher, 2007; Kankanhalli et al., 2006; Badrinarayanan & Arnett, 2008; Munkvold & Zigurs, 2007; Boutellier et al., 1998).

Various practices (cultural and work diversity) and employee mobility negatively impacted performance in virtual teams (Chudoba et al., 2005). Team members need special training and encouragement (Rysen & Godar, 2000) to gain more responsibilities and competencies besides the still-existing traditional mode of

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product developed and adapted in the home country and technical support for production abroad (Reger, 2004).

Trends in the last decade have shown that China and India emerged as attractive R&D destinations for the USA (Hegde & Hicks, 2008).

Changes in telecommunications and data processing abilities make it possible to coordinate research, marketing, and production operations worldwide (Acs & Preston, 1997).

Hegde and Hicks (2008) noted that overseas R&D sites are auxiliary outposts, subservient to home R&D laboratories. "Corporate growth and positioning" and "knowledge sourcing" are two forces that result in companies with a more global R&D nature (Richtne'r & Rognes, 2008). Technological change is a highly dynamic process that may quickly move to take advantage of ideal conditions for growth (Hegde & Hicks, 2008).

For most R&D teams, being virtual is a matter of degree (Leenders et al., 2003).

They define global virtual teams as those whose members work and live in different countries.

Similarly, Jarvenpaa and Leidner [21] describe global teams as culturally diverse and geographically dispersed.

The terms distributed and virtual have sometimes been used interchangeably [32].

Both refer to the notion that the team's members are geographically dispersed, but unlike global teams, they comprise culturally similar team members [42]. Co-located teams are located in close physical proximity. While these teams may comprise culturally diverse members, few studies have focused on this possibility [32].

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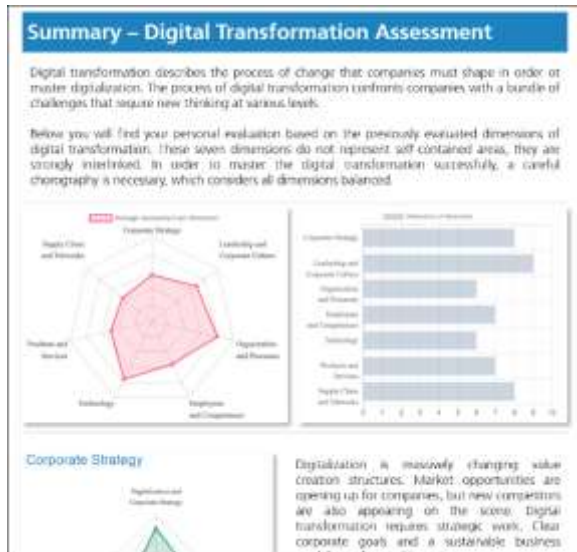
In our research, we define collocated, virtual, and global NPD teams as follows: Y Co-located NPD teams are comprised of individuals who work together in the exact physical location and are culturally similar.

Y Virtual NPD teams are comprised of individuals with moderate physical proximity and are culturally similar.

One example of a virtual team is where team members are located in different parts of the same country.

Another example is when team members are in the same building but on different floors.

Y Global NPD teams are comprised of individuals who work and live in different countries and are culturally diverse.



Companies. Hence, a broader spectrum of literature has been considered to discover the field's structures, dynamics, and management intervention.

This review covered works of literature in the areas of virtual R&D in general and its relevance with SMEs. The current understanding and thinking about SMEs and virtual R & D teams are found at the intersection of these separate fields, as the list of references contains approximately 194 items out of 537 selected items extracted from 1,425 pre-investigated items.

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To find relevant academic publications, some multidisciplinary databases were used. A set of keywords from a general model shown in Figure 1 were used to find relevancy.

The general model for SMEs and virtual R & D teams enables systematically integrating the fragmented literature on the topic.

There needs to be more consensus in the literature on whether virtual teams are superior for SMEs or not.

We argue that virtual teams will shelter the lack of SMEs.

The trend of publications shows that virtual R & D team in SMEs is an exciting topic in recent years. As an example, the distribution of published/cited articles per year extracted from the Web of Science® database

Advantages and disadvantages of virtual teams

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Disadvantages	Advantages
Sometimes requires complex technological applications	Reducing relocation time and costs, reduced travel costs (Virtual teams overcome the limitations of time, space and organizational affiliation that traditional teams face (Piccoli, Powell and Ives, 2004))
Decrease monitoring and control of activities	Reducing time-to-market (Time also has an almost 1:1 correlation with cost, so cost will likewise be reduced if the time-to market is quicker (Rabelo and Jr., 2005))
Weak at mistrust, communication break downs, conflicts and power struggles	More effective R & D continuation decisions Most effective and rapid in making decisions
Challenges of project management are more related to the distance between team members than to their cultural or language differences	Able to tap selectively into the center of excellence, using the best talent regardless of location Greater degree of freedom to individuals involved with the development project Greater productivity, shorter development times
Challenges of determining the appropriate task technology fit	Producing better outcomes and attract better employees. Generate the greatest competitive advantage from limited resources. Useful for projects that require cross-functional or cross boundary skilled inputs
Challenges of managing conflict	Higher degree of cohesion (Teams can be organized whether or not members are in proximity to one another) Provide organizations with the unprecedented level of flexibility and responsiveness Self-assessed performance and high performance.
Cultural and functional diversity in virtual teams leads to differences in the members' thought processes. Develop trust among the members are challenging	The extent of informal exchange of information is minimal (virtual teams tend to be the more task oriented and exchange less socio emotional information) Respond quickly to changing business environments Improve communication and coordination and encourage the mutual sharing of inter-organizational resources and competencies Sharing knowledge, experiences; Facilitate knowledge capture

Small and medium enterprises (SMEs)

SMEs are a significant part of the industrial economies (Eikebrokk & Olsen, 2007; Robles-Estrada & Gomez-Suarez, 2007).

Their survival and growth have, therefore, been a prominent issue. Becket et al. (2005) found a strong and positive association between the growth of SMEs and GDP per capita growth.

Their survival depended on their capability to market response, meet performance, and produce goods that could meet international standards (Gomez & Simpson, 2007).

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Organizations face unprecedented challenges in an ever-dynamic, constantly changing, and complex environment (Rezgui, 2007).

SMEs must construct a network service platform to speed up the research and development process (Lan et al., 2004).

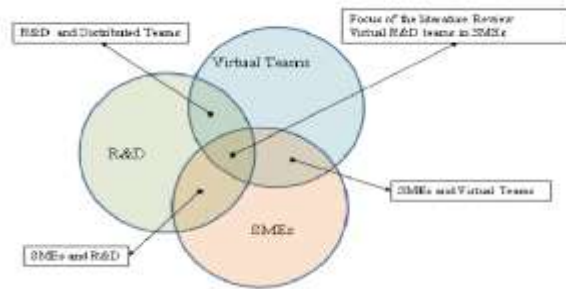
ICTs are indispensable for SMEs to innovate (Redoli et al., 2008). Web resource services can help enterprises get external service resources and implement collaborative design and manufacturing (Dong & Liu, 2006). Responding to the increasing de-centralization and globalization of work processes, many organizations have responded to their dynamic environments by introducing virtual teams. Virtual teams are growing in popularity (Wayne et al., 2000).

Additionally, the rapid development of new communication technologies, such as the Internet, has accelerated this trend, so today, most large organizations employ virtual teams to some degree (Hertel et al., 2005).

Research on virtual teams is still in its nascent stages (Badrinarayanan & Arnett, 2008; Prasad & Akhilesh, 2002), and because of the relative newness of virtual teams, many areas of research have not been examined (Badrinarayanan & Arnett, 2008).

Camarinha-Matos and Afsarmanesh (2003) conclude that setting up an infrastructure for the virtual team still requires a significant engineering effort, which represents a major obstacle to the implantation of this new paradigm.

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Effective and efficient cooperation across disciplines and distributed teams becomes essential for the success of engineering projects (Zhang et al., 2008).

Therefore, the experiments suggest that more research is needed to explore ways to enhance the performance of virtual teams (El-Tayeh et al., 2008).

A small number of studies exclusively focused on the virtual R & D teams (Gassmann and von Zedtwitz, 1999, 2003b; Kratzer et al., 2005; Tribe & Allen, 2003), and few of them concentrated on the virtual R & D teams in SMEs.

This paper summarizes the critical finding of precedent works on different aspects of virtual R & D teams in SMEs.

It highlights the gaps and weaknesses in the existing literature on virtual R & D teams in SMEs.

Finally, it identifies the future research directions in the area of concern.

More specific research needs to be conducted because there is no single definition of a virtual R&D team in SMEs.

A few studies have been done on virtual R & D teams in multinational

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The importance of small and medium-sized enterprises (SMEs) Small and Medium Enterprises (SMEs) plays a vital role in promoting economic development.

Acs et al. (1997) concluded that small firms are the engines of global economic growth. In most countries, SMEs dominate the industrial and commercial infrastructure (Deros et al., 2006).

More importantly, SMEs play an essential role in the flows of foreign direct investment (FDI) (Kuo & Li, 2003).

Economists believe that the wealth of nations and the growth of their economies strongly depend upon their SMEs' performance (Schroder, 2006).

In many developed and developing countries, SMEs are the unsung heroes that stabilize the national economy.

They help buffer the shocks that come with the boom and bust of economic cycles.

SMEs also serve as the vital engine behind equalizing worker income disparity (Choi, 2003).

China's recent rapid growth is also linked to the emergence of many new small firms in village townships and coastal areas, often named new industries (Acs et al., 1997).

To survive in the global economy, SMEs must improve their products and processes, exploiting their intellectual capital in a dynamic network of knowledge-intensive relations inside and outside their borders (Corso et al., 2003).

Hanna and Walsh (2002) observed that if small firms want to make a step-change in their technological and innovation base, they have to rethink their approach to cooperation.

SMEs need appropriate and up-to-date knowledge to compete, and there is a strong need to create, share and disseminate knowledge within SMEs (Nunes et al., 2006).

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Especially in emerging and dynamic markets, shared knowledge creation and innovation may speed up the market.

development (Blomqvist et al., 2004).

The critical elements in knowledge-sharing are not only the hardware and software but also the ability and willingness of team members to actively participate in the knowledge-sharing processes (Rosen et al., 2007).

Dickson and HadjiManolis (Dickson & Hadjimanolis, 1998) examined innovation and networking among small manufacturing companies.

They found some tentative evidence that companies operating in terms of “the local strategic network” are more innovative than those operating in terms of “the local self-sufficiency”.

At the beginning of R&D activities, SMEs face capital shortages and need technological assistance.

Most firms today do not operate alone; they are networked vertically with many value-chain partners (Miles et al., 2000).

The typical Taiwanese production system has a cooperative network of SMEs that are incredibly flexible and quickly responsive, although under-capitalized, sensitive to market demand, and highly integrated into the global economy (Low, 2006).

The strategic alliance formation mechanism has been touted as one of the most critical strategic actions SMEs must undertake for survival and success (Dickson et al., 2006).

Gassmann and Keupp (2007) found that managers of SMEs should invest less in tangible assets but more in those areas such as R & D that will directly generate their future competitive advantage.

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The significant characteristics of SMEs to have a better understanding of SMEs behavior, a brief knowledge of the characteristics of SMEs is a must; therefore, the significant characteristics of SMEs are listed in Tables 5 and 6 (these are for all types of SMEs and not all may hold for every SME).

SMEs are not scaled-down versions of large companies. Different characteristics distinguish them from large corporations, and that can, of course, change across different countries and cultures.

SMEs are generally independent, multi-tasking, cash-limited, and actively managed by the owners, highly personalized and informal structured, predominantly localized enterprises in their area of operations that are mainly dependent on internal sources for the growth of finance (Perrini et al., 2007).

VIRTUAL R & D TEAMS IN SMES Most SMEs heavily rely on external sources, including customers and suppliers, to generate new knowledge (Jones & Macpherson, 2006).

SMEs of all sizes must reach out into their external environment for necessary resources (P. H. Dickson et al., 2006).

In the present era of globalization, it is evident that the survival of SMEs will be determined first and foremost by their ability to manufacture and supply more at a competitive cost, in less delivery time, with minimum defects, and using fewer resources (Sharma & Bhagwat, 2006).

To face this challenge, SMEs can reinforce knowledge to create synergies that allow firms to overcome difficulties and succeed.

This may lead to new relationships between agents to overcome scarcity and/or difficulties in gaining access to resources (Gomez & Simpson, 2007).

Explosive knowledge growth and inexpensive information

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transfer create fertile soil for unlimited virtual invention (Miles et al., 2000).

Web resource services can help enterprises get external service resources and implement collaborative design and manufacturing (Dong & Liu, 2006).

SMEs must construct a service platform or network to speed product development (Lan et al., 2004).

Sharma and Bhagwat's (2006) study revealed that information technology (IT) in SMEs is still in the backseat even though the use of computers is continuously increasing.

Table 7. Compensate lack of SMEs by virtual teams.

Disadvantage of SMEs	Can be compensated with advantage of virtual teams
Scarce resources and manpower	Able to tap selectively into the center of excellence, using the best talent regardless of location Reducing relocation time and costs, reduced travel costs Reducing time-to-market (Time has an 1:1 correlation with cost)
Lacking some of the essential resources for innovation, severe resource limitations in R & D Not having formal R & D activities limited degree of information technology (IT) implementation	More effective R & D continuation decisions Can manage the development and commercialization tasks quite well Sharing knowledge, experiences
Weak at converting research and development into effective innovation	Facilitating transnational innovation processes Higher team effectiveness and efficiency
Rely on outdated technology, labor intensive and traditional management practices	Respond quickly to changing business environments Most effective in making decisions Provide organizations with the unprecedented level of flexibility and responsiveness
Lagging in the export	Provide a vehicle for global collaboration and coordination of R & D-related activities

STRATEGIES FOR EFFECTIVE VIRTUAL TEAM MANAGEMENT

Managing remote teams effectively requires a different approach than managing traditional, co-located teams.

This section will discuss five critical strategies for effective virtual team management: establishing clear objectives and expectations, implementing remote work policies and guidelines, utilizing appropriate

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communication tools and platforms, providing regular feedback and performance evaluations, and encouraging team-building activities and social interactions.

A. Establishing Clear Objectives and Expectations

Setting clear objectives and expectations is crucial for the success of virtual teams. Managers should define the team's goals, roles, and responsibilities, ensuring all team members understand their tasks and expected outcomes (Allen et al., 2021).

This clarity helps to reduce confusion, enhance collaboration, and foster a sense of accountability among remote team members (Marlow et al., 2018).

B. Implementing Remote Work Policies and Guidelines

Organizations should develop comprehensive remote work policies and guidelines to provide a framework for remote team management.

These policies may include guidelines on Communication, work hours, data security, and the provision of remote work resources (Harris et al., 2018).

Implementing clear and consistent remote work policies can help to establish a supportive and productive remote work environment, ensuring the success of virtual teams (Espinosa et al., 2021).

C. Utilizing Appropriate Communication Tools and Platforms

Effective Communication is essential for virtual team collaboration, and selecting appropriate communication tools and platforms can significantly enhance team performance.

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Managers should choose tools that support synchronous and asynchronous Communication, such as video conferencing software, instant messaging, and project management platforms (Kurland & Bailey, 2020).

The choice of communication tools should be based on the team's specific needs and work processes, ensuring that Communication is efficient and seamless (Liao, 2017).

D. Providing Regular Feedback and Performance Evaluations

Regular feedback and performance evaluations are essential for maintaining accountability and fostering continuous improvement in remote teams. Managers should schedule frequent check-ins with individual team members and conduct performance reviews to provide constructive feedback and recognize accomplishments (Choudhury et al., 2021). This ongoing feedback loop can help identify improvement areas, enhance employee engagement, and promote a culture of continuous learning and development (Jang, 2020).

E. Encouraging Team-Building Activities and Social Interactions

Building trust and rapport among virtual team members is essential for effective collaboration. Managers should encourage team-building activities and social interactions to foster strong interpersonal relationships and create a sense of belonging among remote employees (Gibson et al., 2019).

Virtual team-building activities may include online games, video conference social events, or collaborative problem-solving exercises (Stanko & Beckman, 2021).

These activities bridge communication gaps, enhance team cohesion, and promote a positive remote work culture.

COLLABORATION IN VIRTUAL TEAMS

Successful virtual teams rely on effective collaboration to achieve their goals.

This section will discuss the importance of effective collaboration, techniques for fostering collaboration in virtual teams and overcoming common collaboration challenges.

A. Importance of Effective Collaboration: Effective collaboration

is crucial for the success of virtual teams, as it enables team members to leverage their collective knowledge, skills, and resources to achieve shared objectives (Espinosa et al., 2021).

Collaborative teams are better equipped to solve complex problems, enhance innovation, and adapt to changing circumstances (Marlow et al., 2018). Therefore, fostering effective collaboration should be a priority for managers and organizations implementing remote work arrangements.

B. Techniques for Fostering Collaboration

1. Virtual Brainstorming Sessions can help to generate

new ideas, facilitate problem-solving, and enhance team cohesion.

Managers can use video conferencing platforms or online collaboration tools to host brainstorming sessions, allowing team members to contribute ideas, ask questions, and provide real-time feedback (Liao, 2017).

These sessions encourage open Communication and the sharing of diverse perspectives, fostering a collaborative work environment.

2. Collaborative Project Management Tools

Collaborative project management tools like Trello, Asana, and Basecamp can enhance coordination and collaboration among remote team members.

These platforms enable teams to track project progress, assign tasks, and share updates, ensuring all team members are aligned and working towards a common goal (Kurland & Bailey, 2020). To ensure seamless collaboration, managers should select project management tools that best suit their team's needs and working styles.

3. Scheduled Check-ins and Progress Updates Regular

Check-ins and progress updates can maintain open communication and facilitate collaboration among virtual team members.

Managers should schedule periodic team meetings and one-on-one check-ins to discuss project progress, address concerns, and share feedback (Jang, 2020). These structured interactions allow team members to collaborate, learn from one another, and stay aligned on project objectives.

C. Overcoming Common Collaboration Challenges

Collaboration challenges in virtual teams may include communication barriers, lack of trust, and difficulty coordinating tasks across time zones (Gibson et al., 2019).

To overcome these challenges, managers should prioritize clear Communication, invest in appropriate collaboration tools, and establish processes that support effective teamwork (Stanko & Beckman, 2021).

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Additionally, fostering a positive team culture and promoting team-building activities can build trust and rapport, enhancing collaboration in virtual teams.

Challenges of Remote Work and Virtual Team Management

Despite its numerous benefits, remote work presents various challenges for employees and managers. This section will discuss five common challenges associated with remote work and virtual team management: communication barriers, building trust and rapport, time zone differences, ensuring accountability and productivity, and employee engagement and well-being.

A. Communication Barriers Effective Communication

is crucial for the success of any team, and remote work can exacerbate communication challenges. Virtual teams often rely on technology-mediated Communication, leading to misunderstandings, delays, and a lack of nonverbal cues essential for interpreting messages (Allen et al., 2021).

To overcome these barriers, organizations must invest in appropriate communication tools and establish clear communication protocols (Marlow et al., 2018).

B. Building Trust and Rapport Trust and rapport

are critical for successful teamwork and collaboration, yet they can be challenging to establish in remote work settings.

The absence of face-to-face interactions and informal socializing may hinder the development of strong interpersonal relationships among team members (Espinosa et al., 2021).

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Managers must prioritize team-building activities, such as virtual social events and icebreakers, to foster trust and rapport in virtual teams (Liao, 2017).

C. Time Zone Differences Remote teams

often comprise members working across different time zones, which can complicate scheduling and impede real-time Communication (Gibson et al., 2019).

Managers must be mindful of time zone differences when scheduling meetings and establish guidelines for asynchronous Communication to ensure all team members have the opportunity to contribute to discussions and decision-making (Jang, 2020).

D. Ensuring Accountability and Productivity Monitoring

employee performance and accountability can be challenging in remote work settings. Managers may need help to assess productivity and provide timely feedback to remote employees (Choudhury et al., 2021).

To address these concerns, managers should establish clear performance metrics and objectives, encourage regular check-ins, and provide ongoing feedback to remote employees (Kurland & Bailey, 2020).

E. Employee Engagement and Well-being Maintaining employee engagement and well-being

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is essential for the success of remote work arrangements. Isolation, lack of social support, and blurred boundaries between work and personal life can contribute to stress and burnout among remote employees (Kompier et al., 2021).

Managers should promote work-life balance, encourage regular breaks, and provide resources to support employees' mental and physical well-being (Eurofound and the International Labour Office, 2017).

9-9 Research design and methods

research exhibit the characteristics the research generated deal with solving practical problems.

This has been the case regarding the Role of digitalization in Project Management, especially in remote areas, as much of the past research has addressed project success or failure.

The evidence that digitalization in project management works better than physical project management in achieving project success is largely anecdotal. This study focused solely on agile and traditional methodologies, including moderators' industry and experience, as to the influence of project management methodology on reported project success.

The study was limited to the Role of Digitalis in Project Management, especially in remote areas in Saudi Arabia, as these categories encompass most specific approaches.

Project management methodology was the independent variable in this research. Reported project success is the dependent variable in this study. Industry and experience are moderating variables.

10-10 Conclusion

This paper aims to identify the application and impact of using Digitalization in Saudi Arabia. The literature and various studies concluded that virtual teams and digitization are still nascent because both virtual teams and digitalization are relatively new, and many research areas still need to be examined, especially in Saudi Arabia.

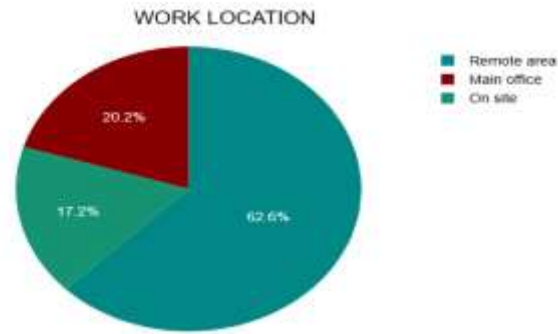
Studies like these are rare or do not exist in our region. This paper is an endeavour to facilitate the use of virtual teams in Saudi Arabia, mainly Neom projects, the types of virtual teams, the challenges, and the benefits.

In the end, we can summarise the result that the majority of the answers were strongly agreed that Digitalization in remote areas is something essential to be applied in the project, but unfortunately, lack of technology and connection one of the most considerable Risks may the project have also the surveyors think that the government should support and fill the lack of technology knowledge with proper education to the future employees to match with the vision 2030.

11-11 Results

The surveyors work on Neom Projects (Red Sea Spine Trojana and the line, which is known as remote areas; the result of the research survey was surprising: the majority of the Surveyors 62.6 % were working in areas a's 20.2 % work in the principal office of the company which can be a part of via sensualism and digitization who contact the employees in a remote area.

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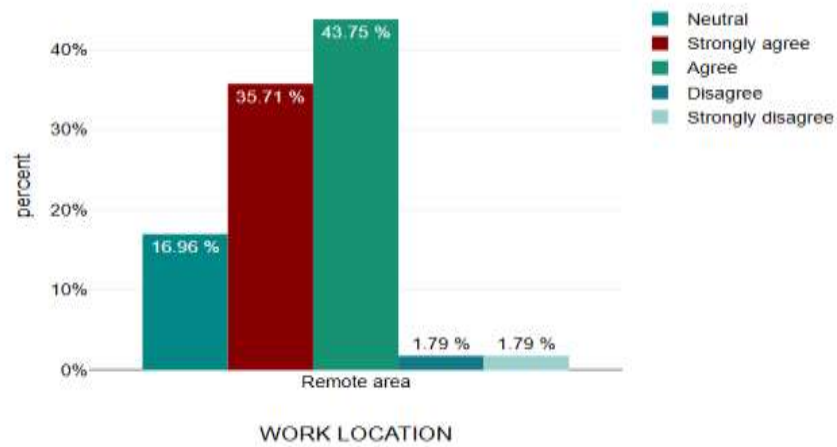
The majority of surveyors 62.5 % are Project managers or working on project management positions and are divided as per the chart below:



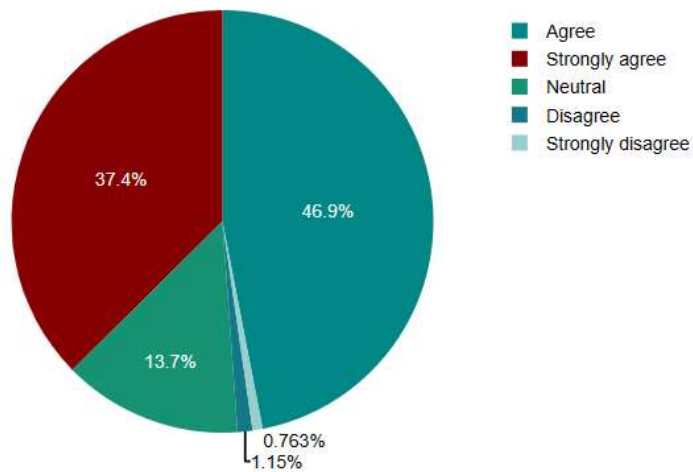
Now, we will focus our results on surveyors who work in remote areas only

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43,75 % agree that Digitalization has better Communication between members.

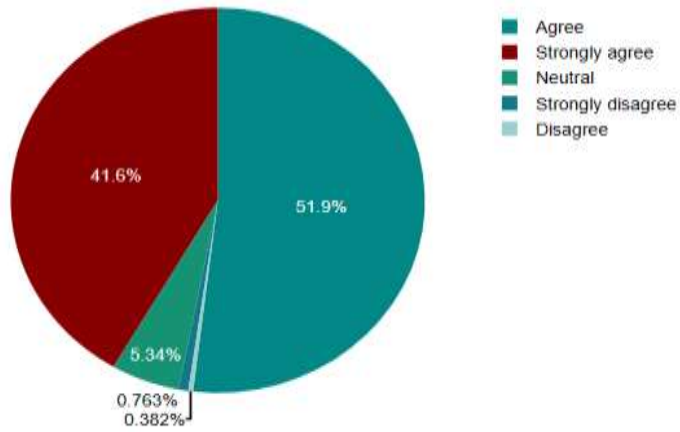


46.9 % agreed that Digitalization has better Communication between members.

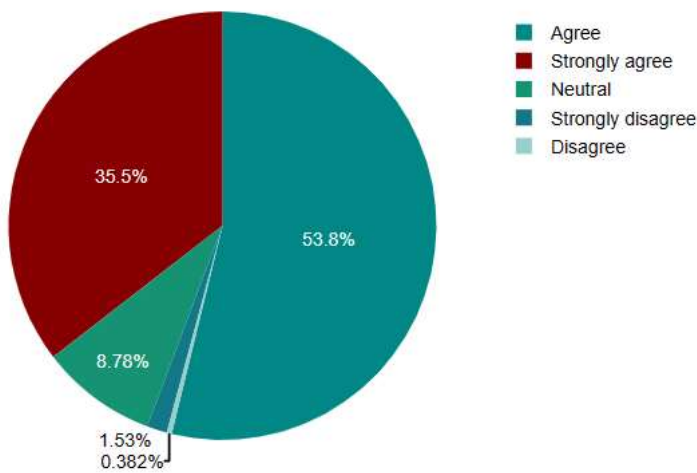


51.9 % agree that the use of digital tools increases the effectiveness of planning and scheduling

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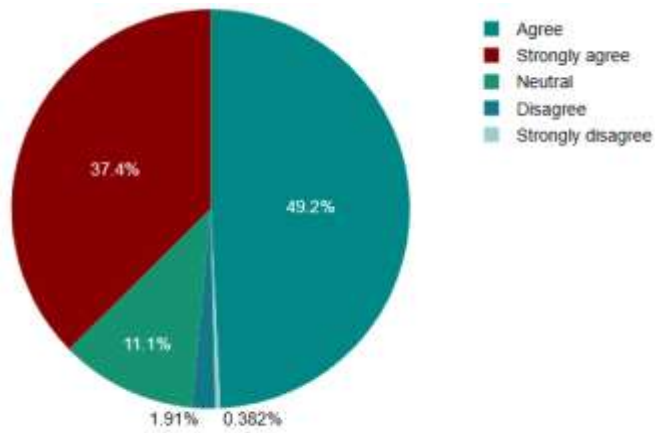


53.8% agree that Digitalization has eased real-time monitoring and shadowing of design progress.

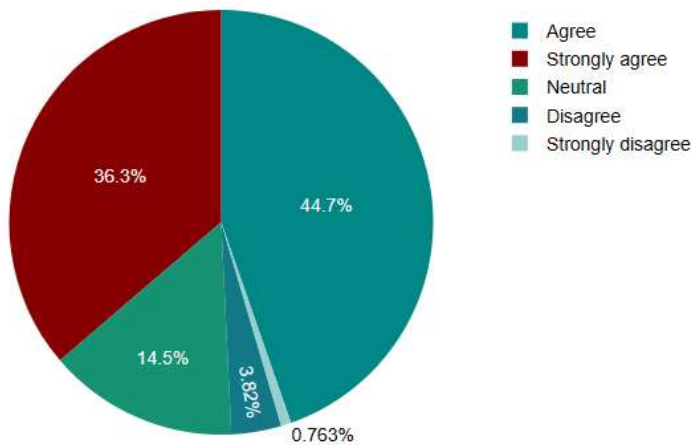


49.2% agree that the use of digital tools helps to improve their decision-making

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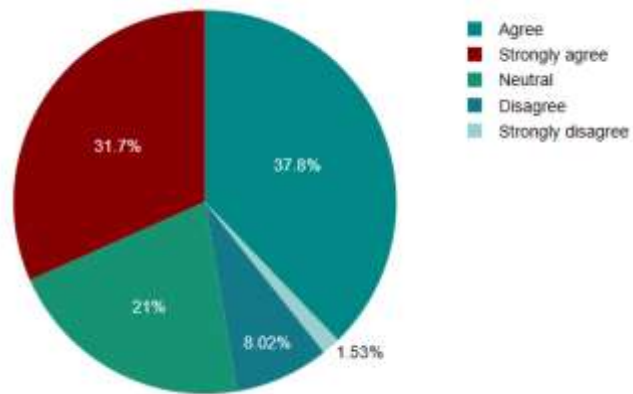


44.7% agreed that Digitalization helps to improve risk management practices

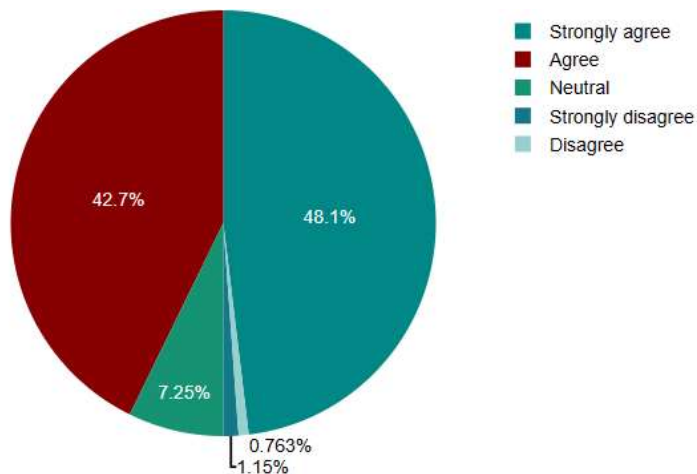


37.8% agreed that developing remote areas in Saudi Arabia have lakes and lack basic infrastructure and services,

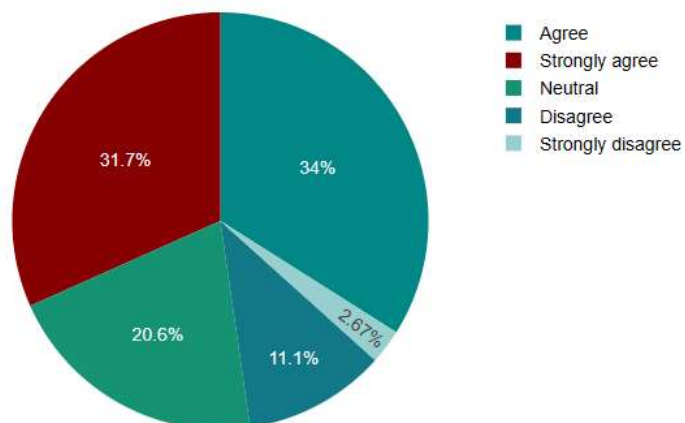
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48.1 % agreed that developing remote areas in Saudi Arabia is essential for achieving balanced indigenous growth.

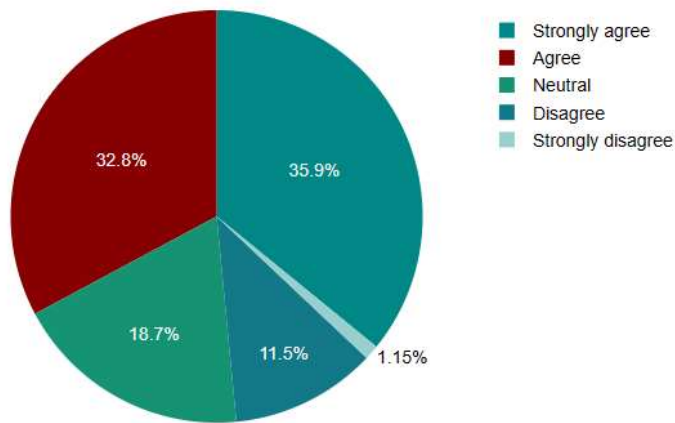


34% agreed that the Remote areas in Saudi Arabia need better quality education.

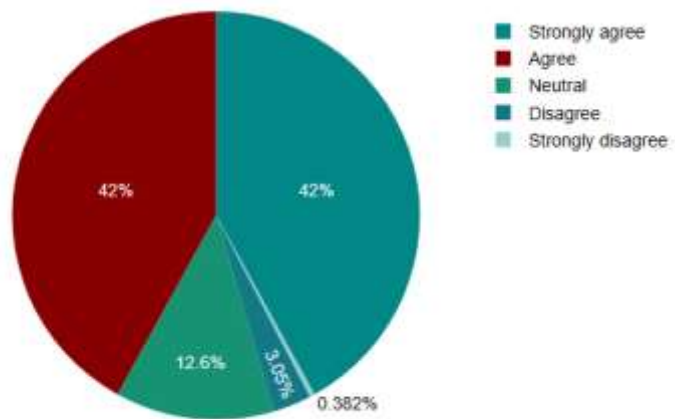


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35.9 % think that the Remote areas in Saudi Arabia lack digital technologies and internet connectivity.

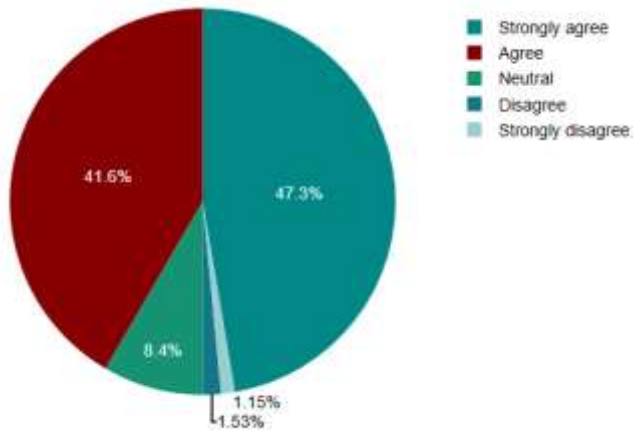


42% agree that the Remote areas in Saudi Arabia have unique natural resources that can be used for sustainable development.



47.3% think that The government should invest further in structure development in remote areas in Saudi Arabia. Also, they should support original entrepreneurship and small.

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In the end, we can summarise the result that the majority of the answers were strongly agreed that Digitalization in remote areas is something essential to be applied in the project, but unfortunately, lack of technology and connection one of the most considerable Risks may the project have also the surveyors thinks that the government should support and fell the lake of technology knowledge with proper education to the future employees to match with the vision 2030.

12-12 Methodology

The methodology influences reported project success. The present study extends their work by attempting to repeat their findings and introducing experience and industry as moderating variables.

The participants were recruited through an intermediary using a simple, random sample obtained from a double opt-in access panel to reduce same-source bias.

13-13 Population and Sample

The target population for this study was Saudi Arabia's remote area project managers.

The research examined project management methodology, Reported Process Success, industry, and experience. The sampling frame consisted of individuals who chose to opt in for the online survey.

The population met the inclusion criteria of 25 years or older, five years of experience, and experience with multiple PMMs.

The following criteria eliminated participants from the study: the respondent did not have experience with multiple PMMs or did not agree to the informed consent. The research utilized an intermediary to deliver the surveys.

The intermediary selected participants using a simple, random sample from the sample frame. Simple random selection allows researchers to determine the appropriate sample size of participants, which can be generalized to a larger population. The intermediary conducted Communication with respondents with no direct contact with the researcher.

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The researcher will provide the intermediary survey and the informed consent form for the research, including the study's objectives and associated risks.

Using SAP programs to calculate the recommended sample size, a target of 176 completed surveys, all participants self-identified as holding a PMP® certification.

14-14 Instrument

This research utilized Google Surveys, an Internet survey website, to deliver the questionnaire.

15- 15 Data Collection

A single electronic survey instrument served as the primary measure for this study.

A simple random sampling technique has the mode of data collection. Potential respondents review the informed consent form for the study at the onset of the online survey.

Participants must accept all terms of the informed consent before proceeding to the survey.

Participants who do not accept the terms of consent will not be allowed to continue with the survey and instead will be presented with a statement of gratitude and exit the questionnaire.

Participants who met the inclusion criteria and accepted the consent terms proceeded to the survey.

A copy of the consent form will be available to all participants.

Data collection occurred using Google Surveys, as facilitated through an intermediary. Such usage of an Internet survey is a popular data collection method due to its speed, efficiency, and cost.

However, such surveys also carry validity risks regarding the accuracy and reliability of responses.

16-16 Data Analysis

The collected survey responses were analyzed using Statistical Package for the Social Sciences (SPSS).

The data will confirm all the data, which would prevent accurate analysis. Performance and analysis of summary statistics and data normality will be used to establish the data quality.

The first and second sets of hypotheses use descriptive statistics and Pearson's correlation coefficient to identify and measure differences in reported success between the PMM.

The third hypothesis will be tested using multiple linear regression. Multiple linear regression helps identify the strength of relationships between multiple predictor variables to a single outcome variable, significantly when moderated by another set of variables.

17-17 Validity and Reliability

The instrument utilized 25 questions to measure methodology, including the percentage of planning effort in either the initiation or the initiation and execution phases, and report project success. The instrument will be published and establish validity and reliability as measured.

18- 18 Summary

A growing number of Projects are in a race to adopt the Vision 2030 of Crown Prince Mohammad bin Salman, such as Neom, Trojena (Neom mountain), Red Sea and more.

The site preparation and the site itself is a remote area. Those mega-projects need to be finished quickly, so to reach that vision, we need to have an easy way to communicate without travelling more than 5,000 miles for 30 30-minute meetings with the contractor or delivering a document for our employee info at the site.

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That is why we highlight virtually as one of the best mythology can project management.

Digitalization and virtual teams are essential for projects nowadays, especially in remote areas, because they can Enhance employee engagement and productivity and Increase diversity and collaboration, as well as Reduce travel costs and environmental impact.

However, they also face some challenges, like Communication barriers and disconnection, Technology issues, and security risks. Let us not forget Cultural differences and conflicts.

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20-20 Appendixes

. Digitization has come an integral part of the ultramodern world and is revolutionizing numerous diligence and sectors, including design operations. In Saudi Arabia, digitization has played an important part in bridging the gap between remote areas and civic centers. This technological advance has not only changed the way systems are managed but has greatly bettered effectiveness, availability, and connectivity across the country.

Remote areas in Saudi Arabia have traditionally faced communication and connectivity challenges. Due to limited internet access and structure, design operation in these areas is frequently hampered by a lack of real-time data, communication detainments, and difficulties in collaboration. still, with the arrival of digitization, these conditions have bettered significantly and brought about a host of positive changes.

One of the most notable benefits of digitization in design operations is the capability to pierce and partake in real-time data, anyhow of geographic position. Through digital platforms and pall- grounded technologies, design directors in remote areas can now efficiently cover, track, and dissect design progress. This enables them to identify and address issues instantly, icing smooth perpetration and timely completion.

-معلومات المحكم -

الاسم	المهنة
بدر حامد علي	عضو هيئة تدريس
محمد محمد عبد العظيم محمد	دكتوراه في إدارة الأعمال – كلية التجارة – جامعة المنصورة
السيد عبدالرازق محمد	دكتوراة الدراسات السياحية

The Role of Digitalization in Project Management, especially in Remote Areas in Saudi Arabia

The following statements deal with the perceptions of The Role of Digitalization in Project Management especially in remote areas in Saudi Arabia Please, show the extent to which these statements reflect your perception of The Role of Digitalization in Project Management especially in remote areas in Saudi Arabia.

العبارات التالية تتعامل مع تصورات دور التحول الرقمي في إدارة المشاريع، وخاصة في المناطق النائية في المملكة العربية السعودية. يرجى تقييم درجة مطابقة هذه العبارات لتصورك لدور التحول الرقمي في إدارة المشاريع، وخاصة في المناطق النائية في المملكة العربية السعودية.

الأسئلة الديموغرافية DEMOGRAPHIC QUESTIONS

GENDER النوع: ☐ ذكر MALE ☐ أنثى FEMALE
LEVEL OF EDUCATION مستوى التعليم: ☐ UNDERGRADUATE طالب جامعي ☐ MASTERS ماجستير ☐ Ph.D. دكتوراه

First variable: The Role of Digitalization in Project Management: refers to the integration and application of digital technologies, tools, and platforms to enhance colorful aspects of design operation processes. Digitalization play a significant part in transubstantiating traditional design operation practices by using technology to ameliorate effectiveness, collaboration, decision- timber, and overall design issues.

المتغير الأول: الدور الذي يلعبه التحول الرقمي في إدارة المشاريع: يشير إلى الدمج والتطبيق الفعال للتقنيات والأدوات والمنصات الرقمية لتحسين جوانب مختلفة من عمليات إدارة المشاريع. يلعب التحول الرقمي دورًا هامًا في تحويل الممارسات التقليدية لإدارة المشاريع من خلال استخدام التكنولوجيا لتحسين الفعالية والتعاون واتخاذ القرارات وحل المشكلات بشكل عام.

الاسئلة Questions	Agreed موافق	Don't agree غير موافق	Natural محايد
1. Digitalization has better communication and collaboration among design platoon members. 1. تتمتع الرقمنة بتواصل وتعاون أفضل بين أعضاء فصيلة التصميم.	العبارة غير واضحة تحتاج إعادة صياغة		
2. The use of digital tools has increased the effectiveness of design planning and scheduling. 2. أدى استخدام الأدوات الرقمية إلى زيادة فعالية تخطيط التصميم والجدولة.	مناسبة		
3. Digitalization has eased real-time monitoring and shadowing of design progress. 3. التحول الرقمي سهل مراقبة وتتبع التقدم في التصميم بشكل فوري.	يفترض ان العبارة تقيس جانب واحد (monitoring or shadowing(		
4. The vacuity of digital platforms has enhanced the availability of design information for stakeholders. 4 فراغ منصات التحول الرقمي قد زاد من توفر معلومات التصميم لأصحاب المصلحة.	غير واضحة		
5. The use of digital design operation tools has bettered decision-making processes. استخدام أدوات التصميم الرقمية قد تحسن عمليات صنع القرار.	صنع القرار ... في إدارة المشاريع		
6. Digitalization has enabled design brigades to overcome geographical walls and work seamlessly. التحول الرقمي قد مكن فرق التصميم من التغلب على الجواجز الجغرافية والعمل بسلاسة.			
7. The use of digital tools has bettered threat operation practices. استخدام الأدوات الرقمية قد تحسن ممارسات إدارة المخاطر.			
8. Digitalization has bettered the quality of design deliverables. التحول الرقمي أدى الى تحسن جودة مخرجات التصميم.			

Second variable: remote areas in Saudi Arabia: The identification of remote areas is pivotal for policymakers and government authorities to understand the specific requirements and challenges faced by these regions. It helps in formulating targeted development plans, allocating coffers, and enforcing enterprise to ameliorate the quality of life

المتغير الثاني: المناطق النائية في المملكة العربية السعودية: تعدّ تحديد المناطق النائية أمرًا حيويًا لصانعي السياسات والسلطات الحكومية لفهم المتطلبات والتحديات الخاصة التي تواجه هذه المناطق. فهذا يساعد في صياغة خطط التنمية المستهدفة وتخصيص الاموال وتنفيذ المشاريع لتحسين جودة الحياة.

The Role of Digitalization in Project Management, especially in Remote Areas in Saudi Arabia

الاسئلةQuestions	Agreed موافق	Don't agree غير موافق	Natural محايد
1. Remote areas in Saudi Arabia have limited access to introductory structures and services. 1. المناطق النائية في المملكة العربية السعودية لديها وصول محدود إلى البنية التحتية والخدمات التمهيدية.	مركبة		
2. The development of remote areas in Saudi Arabia is essential for achieving balanced indigenous growth. 2. يعد تطوير المناطق النائية في المملكة العربية السعودية أمراً أساسياً لتحقيق نمو محلي متوازن.			
3. The vacuity of quality education in remote areas of Saudi Arabia is limited. 3. فراغ التعليم الجيد في المناطق النائية في المملكة العربية السعودية محدود.	صياغة		
4. The government should invest further in structure development in remote areas of Saudi Arabia. 4. يجب على الحكومة أن تستثمر بشكل أكبر في تطوير البنية التحتية في المناطق النائية في المملكة العربية السعودية.	صياغة من الضروري الابتعاد عن الوجوبيات واللزوميات		
5. Access to clean water and sanitation installations is a major challenge in remote areas of Saudi Arabia. 5. الوصول إلى المياه النظيفة والمرافق الصحية يشكل تحدياً كبيراً في المناطق النائية في المملكة العربية السعودية.	مركبة تتضمن: المياه النظيفة المرافق الصحية		
6. Remote areas in Saudi Arabia have limited access to digital technologies and internet connectivity. 6. المناطق النائية في المملكة العربية السعودية لديها وصول محدود إلى التقنيات الرقمية واتصال الإنترنت.	هل تغني عنها العبارة الأولى؟		
7. Remote areas in Saudi Arabia have unique natural coffers that can be employed for sustainable development. 7. المناطق النائية في المملكة العربية السعودية لديها موارد طبيعية فريدة يمكن استخدامها لتحقيق التنمية المستدامة.			
8. The government should support original entrepreneurship and small businesses in remote areas of Saudi Arabia. 8. يجب على الحكومة دعم ريادة الأعمال الأصلية والشركات الصغيرة في المناطق النائية في المملكة العربية السعودية.	صياغة		

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الأسئلة الديموغرافيةDEMOGRAPHIC QUESTIONS

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الاسئلةQuestions	Agreed موافق	Don't agree غير موافق	Natural محايد
4. Digitalization has better communication and collaboration among design platoon members. 1. تتمتع الرقمنة بتواصل وتعاون أفضل بين أعضاء فصيلة التصميم.			
5. The use of digital tools has increased the effectiveness of design planning and scheduling.			

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2.	أدى استخدام الأدوات الرقمية إلى زيادة فعالية تخطيط التصميم والجدولة.			
6.	Digitalization has eased real-time monitoring and shadowing of design progress.			
9.	التحول الرقمي سهل مراقبة وتتبع التقدم في التصميم بشكل فوري.			
10.	The vacuity of digital platforms has enhanced the availability of design information for stakeholders.			
4	فراغ منصات التحول الرقمي قد زاد من توفر معلومات التصميم لأصحاب المصلحة.			
11.	The use of digital design operation tools has bettered decision-making processes.			
	استخدام أدوات التصميم الرقمية قد تحسن عمليات صنع القرار.			
12.	Digitalization has enabled design brigades to overcome geographical walls and work seamlessly.			
	التحول الرقمي قد مكن فرق التصميم من التغلب على الحواجز الجغرافية والعمل بسلاسة.			
13.	The use of digital tools has bettered threat operation practices.			
	استخدام الأدوات الرقمية قد تحسن ممارسات إدارة المخاطر.			
14.	Digitalization has bettered the quality of design deliverables.			
	التحول الرقمي أدى الى تحسن جودة مخرجات التصميم.			

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الاسئلةQuestions	Agreed موافق	Don't agree غير موافق	Natural محايد
9. Remote areas in Saudi Arabia have limited access to introductory structures and services.			
1. المناطق النائية في المملكة العربية السعودية لديها وصول محدود إلى البنية التحتية والخدمات التمهيديّة.			
10. The development of remote areas in Saudi Arabia is essential for achieving balanced indigenous growth.			
2. يعد تطوير المناطق النائية في المملكة العربية السعودية أمراً أساسياً لتحقيق نمو محلي متوازن.			
11. The government should invest further in structure development in remote areas of Saudi Arabia.			
4. يجب على الحكومة أن تستثمر بشكل أكبر في تطوير البنية التحتية في المناطق النائية في المملكة العربية السعودية.			
12. Access to clean water and sanitation installations is a major challenge in remote areas of Saudi Arabia.			
5. الوصول إلى المياه النظيفة والمرافق الصحية يشكل تحدياً كبيراً في المناطق النائية في المملكة العربية السعودية.			
13. Remote areas in Saudi Arabia have limited access to digital technologies and internet connectivity.			
6. المناطق النائية في المملكة العربية السعودية لديها وصول محدود إلى التقنيات الرقمية واتصال الإنترنت.			
14. Remote areas in Saudi Arabia have unique natural coffers that can be employed for sustainable development.			
7. المناطق النائية في المملكة العربية السعودية لديها موارد طبيعية فريدة يمكن استخدامها لتحقيق التنمية المستدامة.			
15. The government should support original entrepreneurship and small businesses in remote areas of Saudi Arabia.			
8. يجب على الحكومة دعم ريادة الأعمال الأصلية والشركات الصغيرة في المناطق النائية في المملكة العربية السعودية.			

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21-21 Research schedule

Research phase	Objectives	Deadline
Scientific Research	The concept of scientific research <u>- Formation and approval of graduation project team</u>	Jun 3 rd ,2023
Research Proposal	Research Proposal components: 1. Research Title 2. Introduction 3. Research problem 4. The importance of the research <u>-Choose and update the project title and variables</u>	Jun 10 th ,2023
	5. Research Hypotheses 6. Literature Review 7. Research Methodology 8. Research Structure 9. Research limits 10. Initial reference list <u>-Evaluate the project title and variables</u>	Jun 17 th ,2023
Research Methods	- Research method concept - Types of research methods <u>- Project plans Discussion.</u>	July 1 st ,2023
Population and Sampling	- An Introduction - The concept of population and research sample - Reasons for using the sampling method - Sample types <u>-Receiving and Approval of all project plans</u>	July 8 th ,2023

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Population and Sampling	- Sample selection steps - Specify the sample size - <u>follow up theoretical content writing tasks with research groups.</u>	July 15 th , 2023
Data Collection	- Data Collection Introduction - Primary data and secondary data - Methods for collecting primary data - <u>Follow up on the practical application of research</u>	July 22 nd , 2023
Validity and Reliability	- Validity and Reliability Introduction - <u>Follow up on the practical application of research</u>	July 29 th , 2023
Data Types (Quantitative & Qualitative)	- The first stage: Presentation and analysis of data using the SPSS program - The second stage: Describing the data using statistical measures. - The third stage: Data analysis using SPSS software - <u>Follow up on the practical application of research</u>	August 5 th , 2023
Research Conclusion	- Research Findings - Research Recommendations - Research Reference	August 12 th , 2023
Final submission	<u>Graduation research final submission</u>	August 19 th , 2023

Abstract

Around the world, numerous remote construction projects are taking place in places like the Sahara Desert, the Antarctic region, the Arabian Peninsula Desert, the Australian Desert, the Empty Quarter, etc.

According to Deng et al., managing remote projects presents a challenge. He emphasized that one of the main contributors to management issues is distance, which leads to loss of control.

He offered potential factors, including a lack of need for more structure, human resources, and project management expertise for these remote initiatives.

Remote construction sites in the Kingdom of Saudi Arabia face particular challenges, and it has been noted that some of the project management and communication issues are brought on by the use of ineffective tools and systems for coordination, management, and communication.

For instance, Due to their flaws and inability to carry out project duties and objectives, traditional communications and information management systems cannot satisfy the project team's acute demand for project information and efficient communication.

One of these drawbacks is that traditional systems only offer restricted information access, which is regarded as one of the main obstacles to effective project management techniques.

many of these project failures result from poor construction process organization and management (e.g., poor process coordination and ambiguity surrounding the information that is now available).

The utilization of ACMS, such as mobile, web-based Project Management Systems (WPMS), augmented reality, and BIM, can solve these management issues.

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To a certain extent, these systems use wireless, satellite, Internet-based, or mobile tools and networks to help construction industry firms manage the rising complexity of typical building project

يُنفذ العديد من مشاريع البناء عن بعد في جميع أنحاء العالم في أماكن مثل الصحراء الكبرى ومنطقة أنتاركتيكا وصحراء شبه الجزيرة العربية والصحراء الأسترالية والربع الخالي وما إلى ذلك.

وفقًا لـ Deng et al. ، فإن إدارة المشاريع البعيدة تمثل تحديًا. وأكد أن أحد أهم العوامل المساهمة في مشكلات الإدارة هو المسافة ، مما يؤدي إلى فقدان السيطرة.

وقدم عوامل محتملة ، بما في ذلك عدم وجود حاجة إلى مزيد من الهيكل والموارد البشرية وخبرات إدارة المشاريع لهذه المبادرات البعيدة.

تواجه مواقع البناء البعيدة في المملكة العربية السعودية تحديات خاصة ، وقد لوحظ أن بعض مشكلات إدارة المشروع والاتصالات ناجمة عن استخدام أدوات وأنظمة غير فعالة لتنسيق وإدارة وتواصل.

على سبيل المثال ، لا يمكن للأنظمة التقليدية لاتصالات وإدارة المعلومات أن تلبي الطلب الحاد لأعضاء الفريق على معلومات المشروع والتواصل الفعال بسبب عيوبها وعدم قدرتها على تنفيذ مهام وأهداف المشروع.

أحد هذه العيوب هو أن الأنظمة التقليدية توفر فقط وصولاً محدودًا إلى المعلومات ، والذي يُعتبر أحد أهم العوائق أمام أساليب إدارة المشاريع الفعالة.

ينتج العديد من إخفاقات هذه المشاريع عن سوء تنظيم وإدارة عملية البناء (مثل سوء تنسيق العملية وعدم الوضوح المحيط بالمعلومات المتاحة حاليًا).

يمكن أن تحل أنظمة ACMS ، مثل أنظمة إدارة المشاريع المحمولة و Web-based (WPMS) و Web-based و BIM ، هذه المشكلات الإداري إلى حد ما ، تستخدم هذه الأنظمة أدوات وشبكات لاسلكية وإدارية و internet-based أو متنقلة لمساعدة شركات قطاع البناء في إدارة التعقيد المتزايد لمشاريع البناء العادية

جامعة ميدأوشن

كلية الإدارة

قسم / تخصص ماجستير إدارة مشاريع



دور الدجتللة في إدارة المشاريع خاصة بالمناطق النائية في المملكة

إعداد الطالب /

	الاسم	ID	
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إشراف /

Dr. Walid Abdelgawwad

العام الدراسي:

2023