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International Journal of Information Systems and Project Management

IJISPM

Mission

The mission of the IJISPM - International Journal of Information Systems and Project Management - is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

The IJISPM publishes leading scholarly and practical research articles that aim to advance the information systems management and project management fields of knowledge, featuring state-of-the-art research, theories, approaches, methodologies, techniques, and applications.

The journal serves academics, practitioners, chief information officers, project managers, consultants, and senior executives of organizations, establishing an effective communication channel between them.

Description

The IJISPM offers wide-ranging and comprehensive coverage of all aspects of information systems management and project management, seeking contributions that build on established lines of work, as well as on new research streams. Particularly pursuing multidisciplinary and interdisciplinary perspectives, and focusing on currently emerging issues, the journal welcomes both pure and applied research that impacts theory and practice.

The journal content provides relevant information to researchers, practitioners, and organizations, and includes original qualitative or qualitative articles, as well as purely conceptual or theoretical articles. Due to the integrative and interdisciplinary nature of information systems and project management, the journal may publish articles from a number of other disciplines, including strategic management, psychology, organizational behavior, sociology, economics, among others. Articles are selected for publication based on their relevance, rigor, clarity, novelty, and contribution to further development and research.

Authors are encouraged to submit articles on information technology governance, information systems planning, information systems design and implementation, information technology outsourcing, project environment, project management life-cycle, project management knowledge areas, criteria and factors for success, social aspects, chief information officer role, chief information officer skills, project manager role, project manager skills, among others.

Topics covered

The journal offers comprehensive coverage of information systems management and project management.

The topics include, but are not limited to:

▪ information technology governance	▪ project environment	▪ project management knowledge areas
▪ information systems planning	▪ project management life-cycle	▪ scope management
▪ information systems design and implementation	▪ project initiation	▪ time management
▪ information technology outsourcing	▪ project planning	▪ cost management
▪ enterprise architecture	▪ project execution	▪ quality management
▪ information systems governance	▪ project control and monitoring	▪ procurement management
▪ information systems department	▪ project closing	▪ risk management
▪ chief information officer role	▪ success criteria and success factors	▪ communication management
▪ information technology leadership role	▪ project manager role	▪ human resources management
▪ chief information officer skills	▪ project manager skills	▪ performance teams
▪ information systems management tools	▪ portfolio management	▪ social aspects
▪ management of complex projects	▪ program management	▪ conflict management
▪ audits	▪ managing organization - structure	▪ managing organization - responsibilities
▪ innovation	▪ tools and techniques	▪ project management office
▪ ethics	▪ project evaluation	▪ contracts
▪ benefits management	▪ success management	▪ success evaluation

Special issues focused on important specific topics will be evaluated for publication.

Submissions

Researchers and practitioners are encouraged to submit their manuscripts to the IJISPM. The guidelines for submission can be found at the journal's home page: ijispm.sciencesphere.org

Correspondence and questions

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IJISPM

Editorial

The mission of the *IJISPM - International Journal of Information Systems and Project Management* is the dissemination of new scientific knowledge on information systems management and project management, encouraging further progress in theory and practice.

It is our great pleasure to bring you the fourth number of the tenth volume of IJISPM. In this issue readers will find important contributions on project management practice and research, robotic process automation, and digital transformation.

The first article, "Reassessing project practices, research, and theory in a post-Covid reality", is a viewpoint authored by Jeffrey K. Pinto. According to the author, the world is slowly emerging from a series of healthcare, financial, and economic disruptions caused by the Covid19 pandemic. While it is still too early to come to a definitive reckoning of the myriad ways in which our world has been forced to make adjustments in how it operates pre-and-post Covid, it is worth considering at least one aspect of the post-Covid reality: its effects on project management practices and theory development. This article offers a perspective on some implications for current and future practice in project management, as well as the ways in which Covid responses have created the potential for a "new normal" in theory and formulating research questions for project studies. Drawing on the Project Management Institute's "Global Megatrends 2022" report, the author examines these six trends and their implications for future practice in project-based work, proposing three topics for future research.

The title of the second article is "Organizational adoption of Robotic Process Automation: managing the performativity of hype", which is authored by Antonios Kaniadakis and Laura Linturn. Robotic process automation (RPA) has recently been subject to colossal hype. Although hype and expectations around technological innovation have been researched at length, there is limited research into the impact of hype at a firm level from an adopter's perspective. Through an inductive multi-case study of five organizations from the banking, financial services and insurance (BFSI) sector that have adopted RPA over the past five years, the authors answer the question: how does RPA technology hype reach the shores of organizations and what adoption behaviour and decision making does it drive? Findings point to the critical role of senior management as instigators of adoption and legitimation, which goes beyond the sponsorship role identified in extant theory. Results also demonstrate that RPA adoption is driven by a 'hunt' for use cases by interdisciplinary teams, which exposes long-standing operational problems while at the same time offers opportunities for organizational learning. The article contributes to a theoretical understanding of the organizational performativity of hype and draw lessons for industry practitioners considering RPA and other hyped technologies for organizational adoption.

The third article, authored by Ján Hunady, Peter Pisár, Dalia Suša Vugec, and Mirjana Pejic Bach, is entitled "Digital Transformation in European Union: North is leading, and South is lagging behind". The transformation of the economy into a digital environment has become a necessary step in recent years. The consequences of the COVID pandemic have accelerated the digital transformation and the growth of the digital economy. Intensive business engagement in the digital economy requires innovative digital solutions and online means of promotion and sale. European Union (EU) countries need to create the conditions for the gradual transformation. The article analyses business readiness for the digital economy in EU countries. It aims to compare and assess the current situation of digital readiness based on the set of selected indicators. The analysis includes a multidimensional comparison of EU countries, classification based on cluster analysis, and ranking based on factor analysis results. Results show significant differences among EU countries.

"Challenges and critical success factors of digital communication, collaboration and knowledge sharing in project management virtual teams: a review" is the fourth article and is authored by Kurt Swart, Taryn Bond-Barnard, and Ritesh Chugh. Technological advancements, globalization, and the COVID-19 pandemic have transformed digital communication into a central tenet of many project management virtual teams (VTs). However, successful VTs are dependent on communication, collaboration and knowledge sharing among team members. Through a systematic literature review, this article investigates the challenges and critical success factors of digital communication, collaboration, and knowledge sharing in project management VTs. As a result, eight key common themes were identified - trust, cultural diversity, collaboration tools and technology, communication and knowledge hoarding, leadership, psychological safety, communication guidelines and training, and resource planning.

We would like to take this opportunity to express our gratitude to the distinguished members of the Editorial Board, for their commitment and for sharing their knowledge and experience in supporting the IJISPM.

Finally, we would like to express our gratitude to all the authors who submitted their work, for their insightful visions and valuable contributions.

We hope that you, the readers, find the International Journal of Information Systems and Project Management an interesting and valuable source of information for your continued work.

The Editor-in-Chief,

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João Varajão is currently a professor of information systems and project management at the *University of Minho*. He is also a researcher at the *ALGORITMI Research Center* at the *University of Minho*. Born and raised in Portugal, he attended the *University of Minho*, earning his Undergraduate (1995), Masters (1997), and Doctorate (2003) degrees in Technologies and Information Systems. In 2012, he received his Habilitation degree from the *University of Trás-os-Montes e Alto Douro*. His current main research interests are related to Information Systems and Information Systems Project Management success. Before joining academia, he worked as an IT/IS consultant, project manager, information systems analyst and software developer, for private companies and public institutions. He has supervised more than 100 Masters and Doctoral dissertations in the Information Systems field. He has published over 300 works, including refereed publications, authored books, edited books, as well as book chapters and communications at international conferences. He serves as editor-in-chief, associate editor and member of the editorial board for international journals and has served on numerous committees of international conferences and workshops. He is the co-founder of CENTERIS – Conference on ENTERprise Information Systems and ProjMAN – International Conference on Project MANagement.

Reassessing project practices, research, and theory in a post-Covid reality

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Viewpoint

Abstract:
The world is slowly emerging from a series of healthcare, financial, and economic disruptions caused by the Covid19 pandemic. While it is still too early to come to a definitive reckoning of the myriad ways in which our world has been forced to make adjustments in how it operates pre-and-post Covid, it is worth considering at least one aspect of the post-Covid reality: its effects on project management practices and theory development. This paper offers my perspective on some implications for current and future practice in project management, as well as the ways in which Covid responses have created the potential for a "new normal" in theory and formulating research questions for project studies. Drawing on the Project Management Institute's "Global Megatrends 2022" report, I will examine these six trends and their implications for future practice in project-based work, proposing three topics for future research.

1. Introduction

By the summer of 2022, in fits and starts, the world's populations started to emerge from a two-year nightmare of Covid, with its societal, economic, and psychological aftermaths still to be considered. While it is still, sadly, too early to make anything like a full accounting of the ways in which Covid has permanently altered our society's thinking on numerous issues, this slow restarting offers us some opportunities to look "through a glass darkly" at the manner in which numerous upheavals are likely to play a role in positing a new normal for project research and practice. It is important to point out that I am addressing "projects" in a general sense with this analysis, based on some preliminary observations. I believe it is far too early to attempt to parse Covid-effects on a discipline-by-discipline, or class-by-project class, basis. Nevertheless, some recent data sampling by professional project organizations, such as the Project Management Institute, is starting to offer a good jumping off point for understanding our post-Covid world and its implications for projects (and grounded theory and research).

Before developing my theme in detail, it would be useful to set some other limiting criteria, so we understand the degree to which I can or cannot offer firm conclusions. First, as I noted above, it is always dangerous to make too definitive a set of conclusions based on early feedback, as so many aspects of civil, political, and economic society are still coming to terms with the manner in which Covid will affect us. Second, demographics matter; that is, while some societies continue to run at near full employment, others are experiencing higher unemployment, some economies have been shattered by Covid, while others are still relatively robust. Third, while I will be taking a macro-level look at projects in general, we do well to remember that "projects" is a misleading noun, as it subsumes entire, very different classes of activity. We know that the methods and procedures underlying construction projects can be very different from Information Technology (IT) projects. While they certainly share similarities, as our bodies of knowledge attest, they also face serious, disciplines-specific challenges that must be acknowledged. Therefore, generalities need to be taken with a commensurate grain of salt. So, please evaluate my arguments with an eye toward recognizing the provisos that are bound to arise when we think too generally and then apply too specifically.

Finally, we know from research and common observation that all organizations are at different stages in their own project sophistication. As Andersen and Jessen [4] noted some years ago, organizations vary widely in terms of their project maturity, defined by three dimensions: knowledge, attitudes, and actions. Just as we can err by defining projects too broadly, so that in the specific case, they fail the test of authenticity, we can make a similar mistake with project organizations if we assume a relatively similar collection of knowledge and practices. To illustrate this latter point, consider Figure 1, which offers a simple construction in applying Everett Roger's [38] "Diffusion of Innovations" model to some sample project innovations. While it is not intended to offer a precise determination of the relative maturity of each of these project management practices, it illustrates that the practices themselves run the gamut from the basic, ad hoc (what I refer to as "run and gun") that are idiosyncratic to individuals or organizations, all the way to the most cutting-edge practices, currently only be adopted by the "innovator" firms.
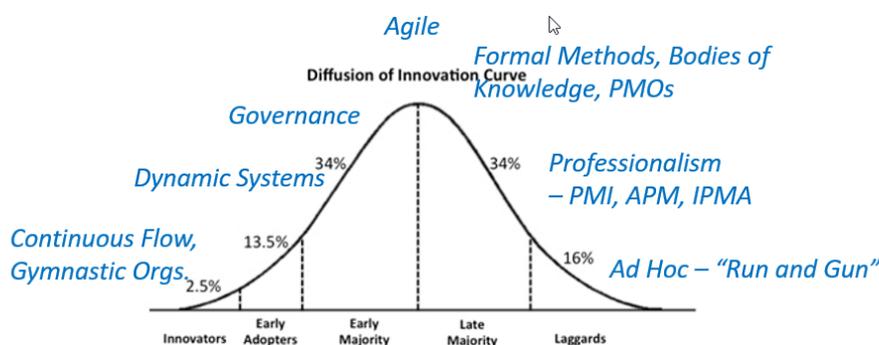
Figure 1. Roger's Diffusion of Innovations and Project Management Applications.

As the Figure illustrates, lumping all project practices (or firms, for that matter) into broad, general categories makes the mistake of assuming some broad level of accepted project management practices are commonly practiced.

With these provisos in mind, I would like us to consider the current state of what has been referred to as "Global Megatrends" [36] with a specific eye toward how these trends are likely to affect and be affected by project behaviours. While speculative, this exercise seems to me a critical opportunity to recalibrate project practices that may seem either inconsequential or outmoded, while reaffirming and exploring the implications of emerging patterns of behaviour post-Covid.

2. Global megatrends

In 2022, the Project Management Institute published a study based on research that they have self-described as the product of consulting "the latest intelligence from industry leaders and conduct[ing] primary and secondary quantitative and qualitative research" as well as interviewing experts and thought leaders on the trends and changes that have created a "new normal" in several global arenas. Their findings comprise six broad categories – from technological implications to societal trends, from environmental concerns to demographic and workforce shifts. Table 1 illustrates each of these identified trends and I would like to use this list as a jumping off point for my own reflections on what these trends suggest for project management practices in our modern, disrupted world.

Table 1: PMI's Global Megatrends

Trend One: Covid and the Impact of Digital Disruption
Trend Two: Climate Crises – Net Zero and Sustainability
Trend Three: Demographic Shifts – Alleviating Worker Shortages and Talent Gaps
Trend Four: Economic Shifts – Supply Chain Disruptions
Trend Five: Labour Shortages and the Changing Workforce
Trend Six: Civil, Civic, and Equality Movements

2.1 Trend one: Covid and the impact of digital disruption

From PMI's [36] report, "a vast majority of innovators, which are defined as high-performing organizations that have a mature digital transformation strategy, indicate the adoption of disruptive technologies has supported significant improvement in meeting or exceeding business objectives." While digital and technological breakthroughs have driven many of the most innovative and game-changing changes in product and process improvements, it was the enforced geographical dispersion of workers that pushed our connectivity innovations to extreme levels. It is true that the trend toward remote work, geographically-dispersed teams, and virtual meetings had been gaining steam in recent years; however, Covid protocols positively demanded that all workers, rather than a select few, embrace and use these disruptive technologies on a regular basis. In effect, what had started as a niche within some firms (virtual teams) became the new normal in very short order.

From a project management perspective, it is interesting to speculate on what digital disruption has led or is leading to. Other than the obvious movement toward virtuality and remote work, larger issues are also visible. For example, does virtual work indicate a flattening of hierarchies, as workers operate under less the standard organizational pyramid structure that restricted information flows and communication patterns in more or less "north/south" directions, than a more communitarian model that emphasizes speed of response and electronic immediacy in place of the traditional model? In short, does the physical disconnect of project team members have implications for the manner in which work is organized and workers controlled? With digital information and connectivity freely available and easy to disseminate,

project managers will need to find ways to encourage communication without snarling these channels or permitting conflicting messaging, gossip, or misunderstandings.

A second fascinating implication of digital disruption lies in the nature of information itself. Bushuyev and colleagues [7] have recently proposed of model that identifies our epidemic era as one that is equally prone to the dangers of "infodemics;" that is, in their words, "[an] Infodemic, ahead of the pandemic, is filled with rumours, conjectures and speculation at the first stage, creating an atmosphere of fear and panic" (page 1). Infodemia has been defined by the World Health Organization as an excessive amount of information about a problem that complicates its solution. Those of us living through the Covid pandemic can readily recall business and societal/health settings in which rumours and misinformation were often immediately accepted as fact, multiple, hard to verify rumours crisscrossed in front of us, and decisions (sometimes momentous) were adopted due to the assumption of veracity, rather than objective confirmation. To put this another way, in a world where information is cheap, easily acquired, and just as easily falsified, it bears considering the manner in which significant project decisions, ranging from the strategic (Which projects should we pursue?", to the tactical, "Which approaches will work best?", to the palliative ("How can we get the project back on track?") are affected by rumours, misuse or selective application of information. In fact, it seems likely that infodemics are in their infancy and without proper administrative vetting, project team members and other key stakeholders may be prone to receiving and passing alone non-verified rumours or inaccurate information.

2.2 Trend two: Climate crises – net zero and sustainability

One of the most important initiatives in the modern developing and developed economies is the push toward the "net zero" consumption of resources. Sustainable project management has been suggested to operate on two levels: sustainable methods applied to the development of projects and projects designed to attain societal goals of sustainability [9]. Thus, an interesting development in project management in recent years has been the introduction of lean principles, originally developed as a means to eliminate waste in operations. Similar goals of eliminating waste are driving a lean project management mentality.

Project management seems to me uniquely positioned to address goals of sustainability, as the purpose of our discipline is to introduce positive change to our world. Whether those changes are monumental and massive, incremental and modest, or purely exploratory in nature, projects remain our most effective vehicle for positive disruptions [44]. As a result, its fit with a sustainable mindset is a logical one. With this idea in mind, current calls are that project managers need to expand their target goals for project outcomes to integrate sustainable metrics (emissions, material usage, reduction of waste/scrap, etc.) into project success assessments. A similar argument has recently been raised by Ika and Pinto [22], in their "re-meaning of project success" arguments. They note that in addition to "project plan" and "business case" success, a comprehensive model of project success must include "green efficacy" as a tripartite element toward which project teams need to work (and be rewarded by their organizations). Modern determinations of project success have moved far from the earliest, "triple constraint" standards by which projects are evaluated.

2.3 Trend three: Demographic shifts – alleviating worker shortages and talent gaps

One unique aspect of our emergence from two years of confusion and redesigned jobs has been labelled the "Great Resignation," to reflect a massive drop-off in employment by senior organizational members. Sociologists and economists will continue to argue about the reasons behind the Great Resignation for years to come, but for our purposes, the practical upshot of a loss of critical institutional memory and tacit knowledge in project organizations has been to force a rethinking of the manner in which projects are staffed, accommodations are made for both remote and co-located team members, knowledge is captured and routinized, and so forth. At a time when human resources continue in a state of upheaval at multiple project organizations, a term has been coined to reflect the recalibration of work rules and employee expectations: "The New Professionalism." Researchers in multiple disciplines, including construction, agriculture, architecture, education, software engineering, and public administration point to this phenomenon, already recognized in the latter part of the past decade and accelerating as a result of Covid [e.g., 14, 34].

The New Professionalism has been defined in various ways, but the underlying characteristics saw professionalism as an occupational value. Traditionally, professionalism was imposed from above; that is, the organizational hierarchy and rules and operating procedures mandated the ways in which project professionals were expected to behave. Increasingly, with the proliferation of external professional project organizations, such as APM, PMI, and IPMA, project professionals have adopted standards of ethics, workplace behaviour, and critical priorities from outside the traditional workplace setting. The consequences of such professionalism include changes in the work itself (i.e., the manner in which projects are conceptualized, scoped, and executed), in practitioner–employer and practitioner–client relations (i.e., the range of stakeholder effects), and in the control of work priorities and processes (e.g., the flourishing of professional certifications like PMP have led to externally-driven standard operating procedures for project management).

Additional to externally-centred project management standards, the New Professionalism is affecting organizations through their willingness to consider greater flexibility in work rules, no-longer-mandatory office attendance, job crafting, hiring, learning, mentoring, and greater workplace sensitivity. Combined with a large, mixed-generational cohort of project team members (Baby Boomers, Gen X, Gen Y, Millennials, and Gen Z), as well as international employees and contractors, the modern workplace is highly heterogeneous and increasingly complicated from a managerial perspective. To address these concerns, Project Management Institute's [36] report identifies five activities firms must embrace to narrow the talent gap they are facing: 1) embrace technologies such as AI and automation to take some of the burden off project managers, 2) use creative methods to find and retain talent, 3) look for talent abroad, 4) harness the power of all changemakers, and 5) preserve the knowledge from departing workers. Recognizing the New Professionalism and making proactive administrative policies for finding and retaining project management talent and embedded, institutional knowledge will be critical initiatives in the coming years.

2.4 Trend four: Economic shifts – supply chain disruptions

One of the most critical after-effects of the Covid pandemic has been its disruption of critical supply chains worldwide, with 75% of companies studied in a recent Accenture survey indicating that these disruptions have had a negative or strongly negative effect on their business operations [2]. While it is clear that in many ways, the full ramifications of Covid disruptions to project supply chains are still being realized, there is little question that shortages or all kinds are impacting project delivery schedules, cost estimates, and even quality specifications, as project organizations scramble to find suitable substitutes for critical materials. A key term in supply chain research these days is "resilient," suggesting that effective firms are those that may not have anticipated the full magnification of effects from shortages, but have at least been able to respond with a degree of agility where their rivals remained locked into more traditional operating procedures. Remko [37] noted that future research on resilient supply chains needs to avoid overfocusing on costs only, and consider the value of flexibility, short response times and multiple sources as well as expanding their supplier networks to include evaluating alternatives that seek to offer more options that a simple reductive focus on savings and payment terms only.

From a project management perspective, the key to effectively managing supply chains to minimize the impact of future disruptions is to develop plans that anticipate such interruptions. Nikolopoulos et al. [33], for example, cite the opportunities that artificial intelligence (AI) as well as machine learning offers us in constructing forecasting models. Butt [8] studied four countries that are major manufacturing centres to determine how they are adjusting their operations post-Covid. His results suggested that supply chain partners are acting differentially, depending on where they operate within long-legged chains. For example, while manufacturers continue to refine their production schedules to meet these challenges, distributors are working with secondary suppliers to minimize "bullwhip effects" and smooth inventory shortages. Finally, supplying firms continue to evaluate the impact of demand from various project organizations, are focused on short-term demand strategies, including shifting supply channels, communicating with key customers, and trying to prioritize shipments among competing project firms, all seeking to secure predictable supplies (which allow them to support their completion schedules and budgets). The past 18 months has demonstrated some salient truths, including: 1) no matter how much we assume that we can rationalize and secure project supply chains, the nature of "Black Swan" events [39] demonstrates that we continue to operate within statistical probabilities, rather than certainties; and 2) project organizations need to find the optimal balance between locking in suppliers on a

strict low-cost basis and building deeper relationships that allow for flexibility and agile adjustments. In short, simply applying cost as the key criteria for supply chain partnerships is no substitute for long-term relationships, particularly during time of upheaval.

2.5 Trend five: Labour shortages and the changing workforce

Writing on the impact of economic trends of any sort is a dangerous undertaking simply due to the transitory nature of such observations; that is, time makes a habit of fooling all of us and mocking our prognostications. Just as we observe one phenomenon, events conspire to immediately reduce the value of such prescriptions, at best, and at worst, render them immediately moot. Thus, it is important to couch any observations about pressures on the current labour force with a rather large grain of salt. Having stated this point, and in conjunction with Trend Three (discussed above), it is useful to observe a host of human resource (HR) challenges that are affecting project organizations. First, however, let us establish the proximate cause for concern about labour shortages and generational and cultural shifts within the workforce: demand for trained professionals continues to grow at very high rates. The Project Management Institute [36] recently reported that the global economy will need 25 million *new* project professionals by 2030. That is, these are not replacement positions, but new careers in anticipation of the continued growth of project-based work worldwide. Thus, as countries are emerging from Covid restrictions and economic slowdowns, there are significant backlogs of pent-up demands for projects in industrial settings of all types.

With this backdrop, the critical issue of supply becomes apparent; specifically, the steady supply of project management professionals. The HR challenge in the coming decade will be enormous: finding, recruiting, training, and rewarding talent has always been a critical need for successful firms. Set against the backdrop of increasingly diverse workforces, globalization, and university educational priorities, harnessing useful and loyal talent quickly becomes a sine qua non for competitive firms. Some important work on this topic has appeared in recent years and offers a timely look at the current state of education and the training up of a new generation of project management professionals. For example, Greer and Carden [19] have examined the challenges of finding, retaining and rewarding talent when these skills sets are in high demand and short supply. An intriguing line of work has been developed by Borg and Scott-Young [5] who are looking at project management training and the perceptions of employers, trying to determine what specific skill sets are needed. They also address the sometimes-awkward question of asking whether or not university education is providing new project management staff with the skill sets required in their positions. This research is highly valuable as a sounding board for both educators and employers alike, as we work to align our education programs with pressing needs in the commercial environment.

A final implication of the changing workforce must be to consider the manner in which project leadership skills are best applied; that is, where they can attain the greatest leverage in managing, influencing, controlling, and championing new projects. The question currently being asked regarding this potentially "new" project manager relates to the most effective role they can take on. For example, recent work has begun to explore new perspective on project leadership, including examining it from an agency perspective [3, 24], stewardship theory [11, 12], and so forth. What exactly will describe the role of future project managers, especially under the flattened hierarchies we noted above, remains to be seen but it seems clear that leadership itself will undergo significant reconsideration. So, while it is beyond the purview of this essay to delve too deeply into the richness of project leadership, it bears considering the manner in which the changing workforce trend is likely to have a significant effect on leadership styles and modes of project team management.

2.6 Trend six: Civil, civic, and equality movements

The final trend identified in the PMI study relates to the movement toward diversity, equity and inclusion in the workplace. The "movement-oriented" workplace requires organizations to expand their thinking outside of normal, business-as-usual mindsets to recognize the value in a diverse workforce, as well as encouraging a more embracing corporate culture. As the PMI [36] report notes, "a culture that embraces different perspectives will enable creative thinking and adaptability and result in improved business outcomes." Thus, the goal of the civil, civic, and equality

movement is to find ways to make the workplace mirror more closely the broader societal state in which organizations find themselves operating.

Moreover, we can expand the notion of making the organization as inclusive as possible in the interest of ethical treatment of employees to examining how these same ethical patterns can benefit project management as a professional discipline. That is, it is helpful to take beneficial, internal movements and reflect on how they can be expanded to the wider commercial and social milieu. When we think, for example, of ethics in project management, we can employ PMI's Code of Ethical Conduct, which argues that ethics, "is about making the best possible decisions concerning people, resources and the environment. Ethical choices diminish risk, advance positive results, increase trust, determine long term success and build reputations." In practical terms, project ethics implies the idea of "right" projects done "right;" that is, projects that are ethically sourced, ethically developed, and ethically funded.

A focus on ethics offers some important windows into current challenges for project development worldwide. For example, if we examine the current state of development projects in Africa, not only can we view them through a utilitarian viewpoint (do they work as intended, in the long term?) [31], but ethics plays a role in establishing the implications of various project funding models and their longer-term implications. Two competing models that are currently under the public policy microscope are World Bank vs. Chinese "Belt and Road" financing alternatives. Gil, et al. [18] have examined several cases of "debt traps" due to public mega-projects in sub-Saharan Africa in which leaders of countries have opted for one funding source or the other, and the societal disruptions that poor choices can lead to, none more immediately obvious than Sri Lanka's loss of a key port and 15,000 acres of land, deeded on a 99-year lease to Chinese companies due to default on loan interest payments [1]. Without faulting one side or the other in this controversy, it is fair to observe that ethical decision-making is not simply the province of project managers within their projects, but also key stakeholders in initiating such projects in the first place. The failure of Sri Lanka's government to adequately evaluate the riskiness of this venture has led to a diminishing of their countrymen's overall standard of living.

Cases of mega-project ethical malfeasance have given rise to interest in a relatively new idea: megaproject social responsibility (MSR) [27, 29]. The keys to MSR include four important ideas:

1. Public participation in project planning. One way to prevent "shadow deals" from occurring is to encourage transparency in all aspects of project planning.
2. Anticorruption in project bidding. Committees or teams of evaluators should be designated to openly disclose and discuss project bids to ensure that they are clearly identified and linked to bidding organizations.
3. Environmental protection during construction. Projects should be completed in a manner that follows local laws regarding environmental protection, as well as adhering to international inspection bodies.
4. Occupational health and safety during field work. Worker protection from accidents and abusive governance is absolutely essential for ethical megaprojects. With numerous cases of "guest worker" abuse and poor safety protocols for major construction projects, it is highly important to provide and enforce guarantees of worker wellbeing.

In summary, today's projects are subject to a new set of management expectations: both internal to the organization (equality and diversity movements) and externally, as projects are expected to be developed in an ethics-driven manner. Adherence to these various movements represents the sixth megatrend in current project professionalism.

3. Project challenges in the new world order

After briefly reflecting on these megatrends, as identified by the Project Management Institute, it seems useful to at least offer some thoughts on current or potentially looming challenges that shadow our professional field. Please note that this is a personal list; it is not intended to be a distillation of our wide and diverse literature, nor is it comprehensive to cover all possible threat vectors. Readers may reasonably react to these ideas with the thought: "Fine, but what about …?" and I would most likely agree with them. It could also be reasonably argued that some of these themes were already coming into focus prior to the pandemic; in other words, it would be wrong to argue their importance arose as a

result of Covid. Nevertheless, with our emergence from the Covid experience, I propose these challenges merely as a jumping off point, for researchers and practitioners alike, in considering how current megatrends can influence and shape our research initiatives. With these anchors firmly in place, let us examine what I consider to be some of the current challenges for which we need to devote more attention.

3.1 Project pathologies.

By "pathologies," I am referring to the potential for abusive or predatory practices in how we run our projects. These behaviours may either be the result of inappropriate actions taken on a project, or in some cases, the development of a project itself for the sole purpose of pursuing illegal or unethical ends (a well-known car manufacturer's development of a "cheat" system for defeating diesel emissions tests comes to mind!). Of course, the potential for some misbehaviours have always been present, as compelling research on strategic misrepresentation or planning fallacy demonstrates [15, 16]. However, as we recognize the prevalence of project-based work and the lack of universal standards for its organization and development, there are still a number of pathologies that are becoming apparent. To list just two that are increasingly evident from our studies: the lingering problems with corruption, usually within construction projects, and normalization of deviance behaviours. Corruption has been defined as "the abuse of entrusted power for private gain" [40] and involves personal enrichment at the expense of larger, corporate goals. While not a "natural" response to the huge increase in project-based work, corruption occurs as a result of the failure of oversight, inadequate governance, the huge sums that are being funnelled to a variety of massive projects, and a diverse set of management levers that create an opaque accounting environment. The work of Lehtinen et al. [26] on corruption in project practices is highly illuminating of the manner in which corruption occurs, how it is recognized, and the mitigation actions that can most effectively frustrate these behaviours. While a good start, the authors note that the actual work on corruption in projects is still in its infancy and needs both deeper and broader analysis to understand the challenges.

The practices underlying Normalization of Deviance (NoD) have been variously defined in the literature, but I am going to adopt an amalgam of definitions that suggest it is best understood as a corruption of project governance [12, 35] through a gradual weakening of control systems, a willingness to look the other way in the face of poor practices, and the creation of perverse reward systems that implicitly encourage misbehaviour [20]. These mindsets become institutionalized over time to the point where members of the organization are aware that they occur, realize they are not optimal, but have become inured to their potential dangers and continue practicing them. Normalization of Deviance starts out as erroneous or poor/dangerous actions that, because they do not show immediate negative consequences, are gradually accepted as normal operating behaviour. As Pinto [35] suggested, "The unexpected becomes the expected, which becomes the accepted." Among the common NoD behaviours are the willingness to ignore workplace safety guidelines or standard project bidding because "everybody does it." More importantly, research suggests that these practices continue to proliferate in projects and when the inevitable negative effects finally occur, the results are often tragic, life-threatening, or result in punitive damages that can destroy the project organization [c.f., 20, 41].

3.2 Success/Benefits realization

Some 50 years after the original representations of project success, it is ironic that our field continues to grapple with clear and inclusive definitions of what exactly "success" consists. This conceptual confusion is partly natural; as we learn more about the distinct properties of various classes of project, we have managed to modify our expected goals to accommodate more accurate success determinants. So, the earliest metrics (time, cost, and quality; aka, the "iron triangle") have given way to broader and more descriptively accurate assessments that consider both "project success" and "project management success." In other words, we seek to realize project success both as an external, "effectiveness" measure that addresses the business case for the project, as well as internal, "efficiency" metrics that focus on getting the project done correctly, from cost and schedule perspectives.

The challenge of identifying success is further complicated by the classes of project themselves. For example, the determinants of success of IS/IT projects are very different than those that help us assess construction or R&D projects [c.f., 13, 23]. What *is* our dependent variable? Does our research make sufficient justification for the factors it selects? These issues are fundamental because, as I and colleagues have noted elsewhere, a number of problems arise from

sending out false or ambiguous signals as to what the organization is rewarding in terms of project success. Poor communication can lead to putting emphases on metrics that are less important (e.g., rewarding schedule performance rather than client acceptance and use of an IT system), while also affecting our reward systems for project managers. Thus, getting "success" right; that is, making sure that all relevant internal and external project stakeholders are on the same page for evaluating success, is a critical precondition for subsequent management of our projects.

Project benefits management is a new move within the field to put forth the goal of assessing projects first in terms of the benefits they seek versus those they actually deliver. Project benefits, as opposed to project success, are "the flows of value that arise from a project" [45: p.11]. "Value" means the sum of economic and wider social benefits to be accrued minus the costs incurred and point to an important consideration with value management and benefits realization: it forces project organizations to remain externally-focused and concentrate on what is considered "valuable" or "beneficial" by the end user and the larger environment, rather than settling for iron triangle concerns of efficiency. Benefits management is a recent idea with big implications that will continue to shape the future of projects by relating directly to larger, societal goals.

3.3 Mega-Project Underperformance

We currently live in a pivotal time when it comes to projects and project management. Arguably, at no point in economic history have we seen the growth and proliferation of project-based work, to address a myriad of needs – social infrastructure, continental development, information technology, environmental concerns, sustainability, …, the list goes on and on. With examples commonplace, an awkward corollary to our investment of trillions USD in large projects world-wide has been the undeniable history of poor (or, at least, "under") performance. Thus, while interest in projects is at an all-time high, their actual beneficial outcomes (both in terms of project management success *and* project success) remains questionable. Mega-projects (generally accepted to have budgets in excessive of $1 billion USD) have a chequered history, with many examples of success stories leading to improved societal well-being, while others are notorious as white elephants. This observation is not intended as an indictment of our field or the value it has contributed to society as a whole, so much as it raises the awkward questions of value: are we getting the greatest possible value for the investments that governments, corporations, and private organizations continue to make in projects and in not, what are the reasons for this under-performance?

Another potential source for uncovering some of the dynamics of mega-project underperformance is to consider the broader topic of system integration challenges, as proposed by Davies and colleagues [10, 32]. Davies' work has addressed the challenge in complex projects of not simply completing the wide set of sub-projects and programs necessary to support the mega-project, but the need to integrate these various elements. For example, Simon Wright was replaced in 2018 as head of London's Crossrail metro system development, as the project had been falling increasingly behind schedule and required a large, supplemental cash injection from the British government. His successor, Mark Wild, noted that his most important duty upon taking over the project was not to complete any of the individual elements that constituted work outstanding; in fact, the actual work had been (or was nearly) done. The problem was an inability to link (integrate) these sub-components together in order to create a working system of the whole mega-project [6]. If, in fact, research suggests that our biggest challenges with mega-projects are due to complex systems integration, it should cause us to rethink and broaden our perspectives on the causes of recent multiple cases of serious under-performance.

Research on the topic of causes and remedies of underperformance continues to be produced at a gratifyingly rapid pace (see, for example, 16, 17, 28]. Interestingly, behavioural economics tends to be a favoured lens through which to examine many causes of under-performance, as the work of Flyvbjerg and colleagues has promoted the prospect theory work of Kahneman and Tversky [25]. So, concepts such as "strategic misrepresentation" and "planning fallacy" have entered our lexicon as potential causes of under-performance, where key project stakeholders essentially set up their projects to fail, by promoting them excessively or lying about their potential benefits while minimizing their challenges. Counter-perspectives, championed by scholars such as Peter Love and Gerd Gigerenzer, have challenged the behavioural economist perspective, leading to a continued failure of consensus around the causes of mega-project underperformance (perhaps, "failed consensus" is the wrong choice of words, and a better descriptor would suggest that

their causes are more diverse, complicated, and more complex than can be concluded from focusing on only a few key causes).

Implications of project under-performance resonate across the developing world, as well, as a number of poor countries in Latin America, Asia, and Africa are currently experiencing the hangover effect of these "debt traps," discussed earlier in this essay. For example, the central governments of Sri Lanka and Zambia took on large loans from Chinese banks under their "Belt-and-Road" development initiative, only to be saddled with unpayable debt loads when expected revenues did not materialize and/or corruption doomed these projects to expensive failure. The Chinese government, embarrassed by the international backlash this situation has generated, has been seriously reconsidering the easy terms once offered in favour of more rigorous evaluations. For example, nearly 60% of China's overseas loans are now held by countries considered to be in financial distress, compared with 5% in 2010 [42]. While it is not my purpose to identify the culpable parties – either the funding organizations or their clients – it is clear that lofty goals for many of these projects often fail to live up to their original promise. Thus, the more we can understand about the causes of mega-project under-performance, the greater the promise of genuine societal development.

3.4   Anticipating more "grand challenges"

We live in a time of big opportunities coupled with daunting challenges. Societal advancement, environmental remediation and sustainability, health and human development, economic growth initiatives, …, the list goes on. These "grand challenges," require a new way of thinking about project-based work to address opportunities that are "…wicked, complex and messy, and require more trial and error, and agility or flexibility" [21; p. 602]. The ambiguity and changing goals that often define grand challenges are particularly interesting for project management because most of us have been taught over the years the importance of "processes" and standardized approaches to project development. By their sheer "murkiness," many grand challenges require a different mindset: one that combines flexibility with vision, or creativity with disciplined methods. We have seen (and continue to see) the variety of grand challenges for which project management is critical, including climate change and its implications [30], virology and epidemiology [43], emergencies and natural catastrophes of all types, and so forth. The question we must ask ourselves, both as a scholarly discipline and as a professional calling, is how we are preparing future generations of project managers to undertake grand challenges. Does our knowledge base provide sufficient training? Do we encourage creative problem-solving, resiliency, and flexibility? In short, does our discipline remain competent to undertake the complexity of grand challenges in the years ahead?

4. Conclusions

Projects remain uniquely positioned to address the challenges we face in all aspects of our existence: economic, societal, and environmental. Put another way, as a force for change, projects are equally a force for good. We, in the project scholarly community, need to be willing to take the time to pause on occasion, to ask the important questions regarding our own productivity and the value we add to the practice of project management. While our efforts are, of necessity, on-going and continuous, when historical events offer an opportunity to turn a corner, or conclude a chapter, reflecting on what we just witnessed and where the new chapter is likely to take us, it is incumbent on each of us to seize these opportunities. This essay has been my attempt at briefly reflecting on (looking backwards) an epochal event in the midst of turbulent times – economically, socially, politically, and environmentally. My thoughts and suggestions are merely for us to generally consider and if they spark insights or prompt deeper reflection and investigation by any in our community, my efforts will have been well-rewarded.

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Organizational adoption of Robotic Process Automation: managing the performativity of hype

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Abstract:
Robotic process automation (RPA) has recently been subject to colossal hype. Although hype and expectations around technological innovation have been researched at length, there is limited research into the impact of hype at a firm level from an adopter's perspective. Through an inductive multi-case study of five organizations from the banking, financial services and insurance (BFSI) sector that have adopted RPA over the past five years, we attempted to answer the question: how does RPA technology hype reach the shores of organizations and what adoption behaviour and decision making does it drive? Findings point to the critical role of senior management as instigators of adoption and legitimation, which goes beyond the sponsorship role identified in extant theory. Results also demonstrate that RPA adoption is driven by a 'hunt' for use cases by interdisciplinary teams, which exposes long-standing operational problems while at the same time offers opportunities for organizational learning. We contribute to a theoretical understanding of the organizational performativity of hype and draw lessons for industry practitioners considering RPA and other hyped technologies for organizational adoption.

1. Introduction

Robotic process automation (RPA)is the use of software to automate organizational processes in order to eliminate repetitive and mundane tasks previously carried out by humans [1], [2]. More specifically, a software program interacts with the presentation layer of applications by mimicking human behaviour (click mouse, open file etc.), allowing human tasks to be automated [3]. Each bot is an instance of the software program [4]. According to Gartner [5], in 2018 RPA was the fastest growing segment in the enterprise software market. The RPA market was projected to grow to $2.9 billion last year from $250 million in 2016 [1]. This extraordinary growth is reflected in the growth of the industry's biggest players and the eye watering investments and valuations they have been attracting. UiPath, a RPA company, went from 700 customers in early 2018 [6] to over 6000 in 2019 [7], and doubled their annual recurring revenue from $100 million to over $400 million in the 24 months to July 2020 [7]. UiPath raised $225 million in their series E funding round in mid 2020, at a valuation of 10.2 billion [7]. Their main rival Automation Anywhere raised $290 million in late 2019 at a valuation of $6.8 billion [8].

Existing academic research on RPA generally consists of single case studies focused on the practicalities of implementation [3], [9], [10], [11], [12], information technology (IT) and business governance [3], [9], [13], [14], and business process selection [3], [15], [16]. References to the RPA adoption decision-making process and dynamics are limited.

The notion of hype is centred on exaggerated expectations [17]. The effect of hype and expectations on technological innovation and the formation of markets has been well researched over the past few decades. There is interesting work on the dynamics of hype in relation to the development of specific markets such as graphene [18] and digital health [19]; and a comparison of hype across voice over internet protocol, gene therapy and high-temperature superconductivity [20]. Hype dynamics are powerful and performative forces that bring about technological developments that give rise to new markets [18], [19], [20], [21]. There is less research, however, into the impact of hype at the firm level from the adopter's perspective. Existing work on RPA does little to illuminate how hype permeates organizations and the decision-making behaviour it drives. In this study we therefore ask: how does RPA technology hype reach the shores of organizations and what adoption behaviour and decision-making does it drive? We will seek to answer this question through an inductive multi-case study. This research methodology is particularly suitable for understanding processes and 'how' based questions [22]. Our analysis contributes to (a) the understanding of hype from an adopter's perspective, (b) technology adoption decision-making and processes, and importantly how these two themes intersect. Our research has several implications for practitioners trying to navigate this world.

The paper is structured as follows: we present a review of existing literature on hype and expectations and RPA adoption. This is followed by the methodology, which leads to the presentation of empirical findings and discussion of them. We conclude with an outline of our contributions, limitations and future work.

2. Literature review

2.1 Hype and expectations

The definition of 'hype', both as a noun and a verb, includes the public promotion of a product or an idea but in an extravagant and often exaggerated way. Oxford Learner's Dictionaries, for example, define the verb hype as "to advertise something a lot and make its good qualities seem better than they actually are, in order to get a lot of public attention for it" [23]. This suggests that with hype come inflated expectations that may create promises that go beyond the capabilities of a certain technology [24]. Despite the enthusiasm, therefore, that those inflated expectations might cause, there is also hyperbole and uncertainty about how new technologies for information systems are actually going to be applied and diffused among organizations [25]. Indeed, many technologies have gone through a hype and a subsequent disappointment phase [17] where the enthusiasm that comes with initial passionate bandwagons of adoption subsequently fades away [24]. This phenomenon is often referred to as a hype cycle [18], [20], although some suggest that it is more useful to view hype as a wave, rather than a cycle [18]. Indeed, as the wave passes through space and time, different actor groups experience different levels of hype at a given time. Hype is also said to be increasing in

comparison to previous years, with expectations becoming ever more unrealistic [21]. Expectations and hype are widely thought to be performative, in the sense that they do not only create an enthusiastic atmosphere around a new innovation by attracting attention, but also help mobilise resources, seek and achieve organizational support from key stakeholders and secure funding [18], [19], [20], [21]. This way, hype and expectations motivate organizations and communities to achieve those expectations and shape technological futures [19] through legitimizing decisions of technical functions [18] and enabling agenda-setting by innovation actors [20]. This notion of performativity is not equal to a self-fulfilling prophecy for every technological vision or claim [21]. However, it has been suggested that once a technology is underwritten by coordinating practises and market investments, its course may be very difficult to change and once investment reaches a certain level, expectations 'become too big to fail' [19]. Such commitment in certain innovations enable their assimilation into everyday work practice even after initial enthusiasm has faded away [24].

During the course of a hype wave, different actor groups are involved in the governance and coordination of expectations about an innovation [17] through journals, conferences, articles, market reports. Some of them, such as industry analysts like Gartner emerge as particularly influential in shaping new markets by pushing technology providers towards conforming to their market construct [21]. At the organizational level, a powerful actor group for innovation is senior management in the adopting organization. Their support is very important for technology innovation to succeed in organizations [26], [27], [28], [29]. More specifically, they provide legitimation [30], a key feature of successful information systems projects [31]. Also, in cases of resource scarcity, senior managers may be involved in securing access to resources and funding [32]. Specifically, in relation to RPA, c-suite support has been found to lead to greater programme success [3], [33]. This study will look at the chain of events and decision-making relating to adoption in the context of hype, including the relevant key actors; rather than looking at the ultimate success or acceptance of RPA.

We intend to look at the RPA hype wave from an adopter's perspective, including how hype penetrates organizations, the role of certain key actors, and what behaviour it drives within the adopting organization.

2.2 RPA adoption

Technology adoption has received attention in a variety of contexts, such as, cloud computing [34], enterprise collaboration systems [35], decision support systems [36] and so on, whereby scholars tend to focus on benefits and motivations of adoption. Similarly, research in the area of RPA has tended to focus on benefits, suitable use cases and implementation methods. Much of the work has espoused its benefits including: easy and fast set up [3], [37], increased productivity and efficiency [9], [15], [16], growing the digital workplace [16], increased accuracy [9], [15], [16], lower reliance on IT workforce [10], rapid scale up and easing IT workloads [3], allowing people to do more interesting work [16], [33], and facilitating system integrations that were not previously possible [37].

In line with the apparent benefits, existing studies frequently position the decision to adopt RPA as being a response to a need to cut costs [1], [14], increase efficiency of business processes [12], [13], renew processes [13], or as part of process innovation [3]. However, research does not tend to go beyond these very high-level goals, or into the details of how and why such goals become linked to RPA. We learn a limited amount about the source of these expectations, how they are internalised by the adopter organization and the early adoption processes, including how organizations choose particular use cases, an important and often challenging step in the adoption process [3], [15]. There is also a limited amount of research on how alternative solutions are appraised. Penttinen et al. [10] looked at how organizations should choose between RPA or more heavyweight automation solutions that rely on application programming interfaces (APIs). The study resulted in some interesting factors that may influence the decision, most of which hinge on whether backend or presentation layers are stable enough to cope with heavyweight or lightweight integration respectively. However, the actual cases did not appear to have undergone a serious assessment of heavyweight alternatives.

As with any technology implementation, RPA should be considered in the context of an organization's goals, challenges and process management capabilities [15]. Research suggests taking a broader view of RPA from the very start by seeing it as complimentary to other Artificial Intelligence (AI) technologies [37]. Similarly, RPA could be seen in the wider context of cognitive capabilities which can be delivered through a range of different technologies [38]. This

includes learning about cognitive technologies, identifying opportunities based on business need, then assessing use cases in terms of their contribution to business strategy [38]. Davenport and Ronanki [38] warn against injected projects from senior management and companies that simply 'pave the cowpath' (p. 9), by automating processes with RPA and foregoing value by taking this narrow approach. Moreover, organizations adopting RPA are often overly focused on the technology and its features as a potential technological solution, something that prompts them to build organizational teams, such as robotics labs, whose purpose is to hunt for solutions [39]. Another perspective is to embed RPA in an organization as one of many approaches to automating or optimising business processes [40]. Empirical evidence to support or oppose these recommended adoption approaches is, however, in short supply.

A lot of RPA research has focused on the mechanics and governance of implementation. RPA is seen firmly in the domain of lightweight IT [9], [10], [37], meaning IT that is more business and user-driven, and often side steps the IT function [10]. This has a bearing on how organizations should and do implement RPA. It is often the case that specific RPA teams [3] or centres of excellence (central shared resources) [33] are assembled to implement and govern RPA. There is much debate on how to set up the team: whether it is centralised or decentralised [13], [14], whether it should be in the business or aligned to IT [3], [9]. As part of implementation, organizations often conduct proof of concepts (POC) before beginning in earnest [12], [13]. However, what is not clear from existing research is the series of events leading up to the implementation activities, and who the key internal and external actors are.

This study is intended to fill in some of current research gaps in relation to RPA adoption, including inter and intra organizational interactions, decision-making processes and the influence of hype. Ultimately, it is the intention of this paper to illuminate the impact of hyped technologies like RPA on organizational behaviour, as it is adopted by companies in the banking, financial services and insurance (BFSI) sector.

3. Methodology

We conducted our research as a multi-case inductive study [41]. This approach enabled building theory on the relationship between hype and the process of adoption in organizations. This study is exploratory in nature and using multiple cases should enable better generalisability of the theoretical outcomes [41], [42].

3.1 Sampling of case-study organizations

Five organizations, which have all implemented RPA were selected. A high-level summary of the cases is set out in Table 1.

Table 1. Case study organizations (anonymised)

Case Ref.	Overview	No. employees	Informants
LargeIns	UK subsidiary of large multinational insurance company.	7,000	1A – IT strategy/Operational Excellence 1B – IT Operational Excellence, RPA lead 1C – IT architect
InsServ_1	UK based company. Provides solutions to insurance industry.	1,800	2A – IT Director 2B – Operations Director
LargeBank	Large multinational bank.	200,000+	3A – Operational Excellence, Automation lead
MedBank	Medium sized multinational bank.	8,5000	4A – IT Automation lead 4B – IT Product Manager 4C – Operational change manager/process owner
InsServ_2	Insurance division of multinational services company.	1,200	5A – Operational Excellence 5B – Operational Excellence, RPA modeller 5C – Operations Director

In order to strike a balance between building theory that is generalisable, but also controls for extraneous variation [22], [43], all cases were selected from within the BFSI sector. We understand the BFSI sector as a community of different actor groups, which may be at different stages of the RPA hype wave than other sectors [18]. By no means do we claim to produce an exhaustive, sector-level analysis. Our sampling strategy, however, was driven by the variation in levels of

RPA adoption in different industry sectors and the different points they are at in the hype wave. In 2019, for example, BFSI was the largest industry vertical within the RPA market with 29%, whereas in the retail and consumer goods sector, RPA revenue was less than half that of the BFSI sector [44].

3.2 Data Collection

The primary data source was interview data, which provided in-depth and rich descriptions of events, the roles of key individuals and processes involved. Although Eisenhardt & Graebner [42] recommend multiple data sources, they acknowledge that interview data often becomes the primary data source and recommend limiting bias by using multiple well-informed interviewees. For all cases but **LargeBank**, multiple informants were interviewed to triangulate information and get a more robust understanding of various situational factors and relationships between them. The informants were a range of individuals, all of which had been closely involved in the adoption and implementation of RPA within their organizations. Some interviewees were more oriented towards business operations, others were more aligned with technology functions. Interaction with participants consisted of an initial introductory meeting, followed by semi-structured, recorded then transcribed 60-minute interview via video conference. Follow ups by email and phone were used to fill in missing pieces of information or clarify statements where required. Figure 1 below shows the data collection process.

Fig. 1. Data collection

Interviews were structured as informant interviews [45]. All informants had in-depth experience of RPA adoption and could explain the events and history of what had occurred. We followed a generic interview guide with the following sections: (1) how was external hype internalised in the first instance and who were the key actors in the early stages; (2) how did things move from an idea/expectations to implementation; (3) how were internal expectations crafted; and (4) to what extent have expectations been met. Many of the questions were generative in order to elicit rich responses (see Appendix A). We used tour, timeline and experience questions [45]. For example, in relation to how RPA first came about, we asked informants, 'can you talk me through how this came about, including who the key people were?'. As informants toured us through past events and processes, we would interject as appropriate for more specific details with directive questions such as, 'when was that' or 'what was their role'. We also used some compare and contrast questions to get informants to think about how RPA outcomes compared with their earlier statements on expectations. Informants often spoke about the roles of others, and where appropriate we probed their potential motives, but generally stayed away from this type of question to limit guessing or philosophising.

3.3 Data Analysis

Our analysis was conducted as follows for all cases and a clear timeline of adoption for each case was established: We worked through each case in turn, undertaking a primary cycle of coding of the transcripts [45]. This consisted of assigning descriptive words or phrases to sections of transcript without any references to previous theory or research questions. This gave us a list of topics and sub-topics. As we added data sources, the list of codes expanded and new topics arose [46]. For example, 'the beginning' was the code used for all data pertaining to how the RPA initiative first started including early activities, key actions and decisions. Once we had completed the initial coding for each set of case transcripts, we then fractured the data into smaller pieces. For example, when we were fracturing data for **LargeIns**, 'the beginning' had sub-topics including 'role of group company' and 'role of senior management' added to it. For each case, we then undertook a second cycle of coding [45]. By looking at each primary cycle code we were able to see certain themes emerge. We used memos to detail analytical coding, generate ideas and questions [46] together

with pertinent quotes. We completed all these steps before moving onto the next case. This process allowed us to pick out key themes for each case. Each case expanded the list of topics and themes, although minimally by the time we had reached the third, fourth and fifth case.

Cross-case patterns [41] emerged as we revisited our finer grained topics and analytical coding memos for each new case comparing to the prior ones. By analysing the data that coalesced around a certain theme, we were able to compare cases, noting similarities and differences. Initially between two cases, then three, etc. The key to developing cross-case patterns was ensuring that where themes emerged, each case acted as an appropriate replication [42], confirming or not prior findings from other cases [47]. We encountered some situations where one source from a case seemed to confirm the presence of a cross-case pattern, but another source suggested a different interpretation of events. In such cases, we revisited the divergent sources by probing the transcripts more deeply and where possible revisited with the informant. Understanding why certain themes emerged between cases, involved reviewing of extant literature, both confirming and contradictory [41]. In order to generate possible explanations [43] and extend theory where appropriate, the outcomes of this process will be set out in the following sections of this paper. Figure 2 below summarises the data analysis process.
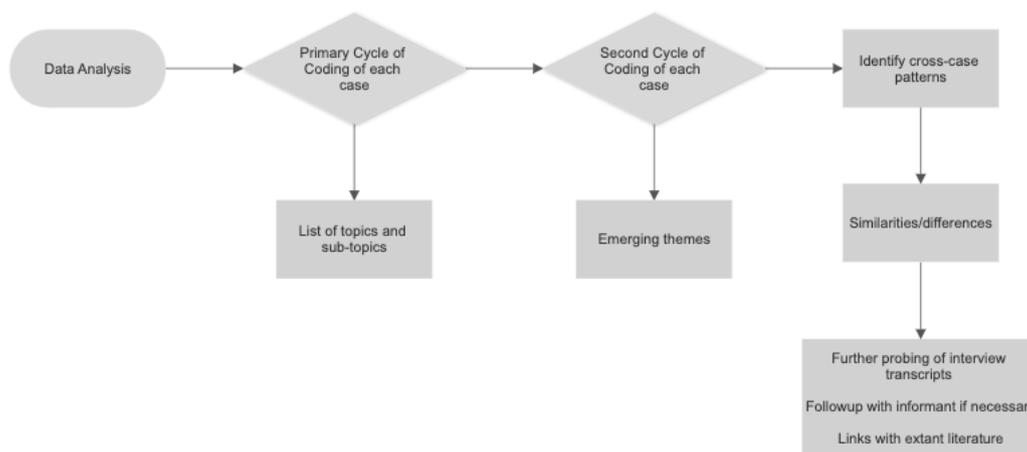
Fig. 2. Data analysis

4. Empirical Findings

4.1 Role of senior management

All but one case that we looked at began their forays with RPA between 2016-2018. This was the time when RPA was attracting a lot of attention and a steep growth in interest. As shown in Figure 3, publications (Primary docs) that were retrieved using "robotic process automation" from Scopus started rapidly increasing right around that period and after.

In this context, in all our case firms, except **MedBank**, it was a senior manager who was engaged with this rise in RPA interest and became the spark that ignited the implementation of RPA. In **LargeIns**, it was the CEO who provided the spark by directing her IT team to establish a business case for it. She was, however, heavily influenced by external management consultancy firms and vendors whom she was interacting with. The promise, upon adoption, was framed around cost-cutting and operational efficiency. A senior IT strategist in **LargeIns** explains: "You can automate a lot of your mundane, repetitive tasks and processes and thereby reduce headcount. That was pretty much the hypothesis that they were sold, and that I was given to try and prove or disprove". Similarly, in **InsServ_1**, the spark was generated by members of the board who pushed the IT team to explore RPA. The **InsServ_1** IT director explains: "The beginning of the journey was sitting at a board meeting and combination of the CFO and CEO saying words to the effects of, there's a lot of people doing stuff with RPA, shouldn't we be doing stuff?". With respect to **LargeBank**, one of the senior general managers of the bank was credited as having launched the initiative. The Automation Lead at **LargeBank**

confirms: "It would have been [Senior Manager] … who wanted to look at automation". ***InsServ_2*** commenced their activities in 2014, a fair bit earlier than the other four cases. The division's Operational Excellence lead explained that the initiative had begun as a result of the actions of a senior executive (SE): "The spark was [SE]…. He used to work at [X]… and in that role he'd come across robotics. That started a conversation that started a cascade…which landed to me… to start something called robotics".
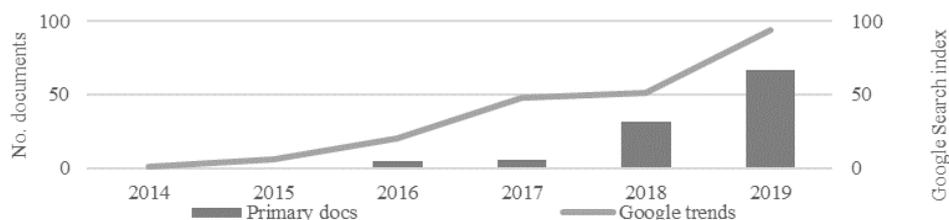
Fig. 3. Google trends index base period is January 2020 = 100. Annual index figure is based on annual maximum. Source: Graph generated by the authors.

In ***MedBank***, the situation was slightly different in that an analyst in the IT team at the time, together with his manager both came to learn about RPA at a similar time. They then put their RPA idea forward to be part of a hackathon. The company's Chief Operations Officer (COO) had a critical role in pushing the initiative, something that became apparent when he left the company. The Automation Lead at ***MedBank*** explains: "When [the COO] disappeared, all the stakeholders disappeared … And my boss … wasn't sure what was going on. And he didn't want to push it anymore".

Table 2 summarizes the sources of hype at the point adoption together with the expectations of senior management. In all cases but ***InsServ_2*** (explained by their earlier adoption), prior to adoption, several colleagues were beginning to learn about and discuss RPA at around the same time.

Table 2. Source of adoption/hype and senior management expectations

Case	Source of adoption/hype	Senior management expectations
LargeIns	- Group parent company - Conferences - Management consultancies	- Cost savings - Employee reduction - Improve quality - Improve Service Level Agreements (SLA)
InsServ_1	- Competitors - Clients - Industry talk - Email adverts	- Do more with less - Redeploy staff - Data accuracy
LargeBank	- Management consultancies - RPA vendors	- Cost savings - Customer experience - Risk reduction
MedBank	- Investment news (on RPA vendors) - RPA vendor was customer of bank	- Cost savings / reduce headcount - Remove menial work - Improve SLA
InsServ_2	- Previous employer	- Cost savings - Redeploy headcount

4.2 A solution looking for a problem

In relation to the process of implementing RPA, there was a clear pattern between the cases. Following a decision or clear expression of intent to adopt RPA, each of the cases undertook an almost identical process. This involved looking for processes and sub-processes which could potentially be automated.

After receiving direction from their CEO, **LargeIns** brought in an external consultancy to help them identify a list of potential processes to apply RPA to. The internal team worked alongside the consultancy analysing processes, tasks, the effort involved and problem areas. A senior IT strategist explains the approach, "It was a combination of looking within tasks, listening to people [hearing] their frustrations… looking at data around time and motion… put all that together, and it created that first list that had around 14 opportunities". **InsServ_1** also brought in an external party to look for potential processes. They decided to start their effort in a part of the business with known problems around re-keying data, something they understood to be a good use case for RPA. The consultancy spoke to operations staff in this area to understand which processes could be automated. The IT Director summarised: "We had a proposal from [Consultancy] having done an initial assessment, where they'd worked with people like [X] to identify what processes… they worked with them to create a proposal on what processes could be automated, and what the supporting implementation plan etc., would look like". After the initial activity of identifying processes was complete, board approval was sought to implement RPA for these processes. After **MedBank** completed their initial POC in early 2018, they too engaged a third party to begin looking for activities which RPA could automate. The Consultancy worked with operations staff across the division about their processes and divided potential opportunities into different categories i.e. easy, hard. The Automation Lead confirmed, "In the beginning [Consultancy] came in … They spoke to all the people in the business, they talked about all the tasks and the processes that they were doing. And they came up with a sort of…quadrant type analysis [of automations]". The Automation Lead also implied that the COO was pivotal to this approach. He explained that when the COO left, the approach to finding RPA opportunities changed, he said, "I think if he'd [COO] hung around, we would have carried on doing it like that".

InsServ_2 did not use a consultancy to assist their RPA efforts, instead the Operational Excellence team learnt about the potential of RPA and shared this insight with their operations colleagues to "Try to produce a list of opportunities where we felt the business could gain by using that automation tool". In **LargeBank**, the business operations team started with a POC. After this they established a large multi-year programme and set about systematically looking for activities, they could apply RPA to. All areas of the bank were encouraged to work through their operations areas to build a pipeline of potential processes to automate. Regarding his own area of the bank, the Automation Lead summarised "We then got asked to look at opportunities for the RPA program. We identified about 40 or 50 different processes". Significant effort was spent on workshops, communication, knowledge sharing and analysis to complete this activity. The Automation Lead describes what his team did: "discovery workshops, robotics awareness sessions at the major operational centres, …pull[ing] the relevant ops leads in". Finding activities appropriate for RPA and calculating the potential savings was replicated around the bank, and also supported by a consultancy partner.

4.3 Internal promotion of RPA

After their initial tranche of activity, most of the cases, continually added to their lists or pipelines of potential activities to automate with RPA. The technology itself and characteristics of activities it could automate were at the heart of the search. In many cases they did this through advertising their achievements internally amongst their operations colleagues. **LargeIns**, **LargeBank** and **MedBank** all took this approach. In all these cases RPA lead individuals for the organization or division were established. The Automation Lead at **LargeBank**'s team did a number of things to spread the word about RPA and to identify additional opportunities, for example, his team launched a SharePoint site for people to submit automation ideas and do Public Relations (PR) around it. Likewise, in **LargeIns**, the automation team did a lot of internal PR and communication to encourage colleagues to consider RPA and identify new opportunities. The Automation Lead explains what they did, "A lot of PR, a lot of communication. We've done huge numbers of roadshows, we publish a lot of articles".

InsServ_2 took a more systematic approach and went through every process in their organization with their operations colleagues. In order for a process to be considered for RPA, once automated it had to generate savings equivalent to the work of one full time member of staff. A Process Modeller explains, "Myself and the other process modellers…then sit with the business and then go through all of their processes, and identify if that process was within the criteria for working in robotics". This activity was led by the Process Modeller and her colleagues: individuals whose sole job it was to implement RPA. Finally, *InsServ_1* is at an earlier stage, having not implemented RPA for any new processes beyond their initial implementation. They have however, recently appointed someone to look for more RPA opportunities as well as process design work. The IT Director explains, "[The individual] is working with the business on processes, to identify where we can do more of this stuff [RPA]".

4.4 Criteria for selecting processes

Our case organizations embarked upon a process of selecting organizational processes that would be considered for RPA. Some of them pursued this through their IT function, others through their Operations team; while some also followed a combination of the two.

The teams leading on RPA in *LargeIns* and *InsServ_2* focused on operational excellence and lean techniques. As a result, they seemed to emphasize the importance of combining process improvement with RPA, or sometimes even as an alternative to implementing RPA. For example, in *LargeIns*, they have developed a decision tree to evaluate how appropriate something is for RPA, or whether it requires process improvement. The tool also helps estimate costs and potential savings. A senior IT Strategist explains the output of the decision tree, "You can get to: yes, automation's the end result or you need to improve it, but it's just Operational Excellence". In *InsServ_2*, the team only considered RPA as a potential solution when appraising processes. A Process Modeller confirms, "Our main tool is just robotics. So, if it's come to us, then we're looking at it from a robotics point of view". Blackbelt lean qualified colleagues in the business improvement team do however work with the RPA team to perform process assessments alongside RPA work. Similarly, in *LargeBank*, the Automation Lead and his team sit in the wider process engineering team, and before beginning any RPA initiative they always look at it through a wider Operational Excellence lens and assess whether the process itself has been properly designed and implemented. He explains, "I shouldn't really automate anything that hasn't been through a standard OPEX type review as well. To say, is this process standard, is it consistent, should it exist at all, why are we doing it?".

Although these organizations utilised their operations experts to search for suitable processes, there were also experts with a technical background that would look at processes from a more technical point of view. In *LargeIns*, an IT Solution Architect who is an integral part of the RPA delivery mechanism seemed to use his personal technical expertise to determine when RPA might not be appropriate and something else should be considered. He explains, "If I think there's a better way of doing it, I will tell [X] and suggest that it's not done as a robotic process".

In *LargeBank*, the Automation Lead has a business architecture and IT background, using his range of expertise he attempted to consider a range of possible technology solutions alongside RPA. Although he acknowledged, that currently he was only able to implement RPA. Such technical perspectives also bring into the discussion questions around whether heavyweight integration is more appropriate. In *LargeBank*, for instance, the Automation Lead adopted an IT lens to consider more heavy weight integration at the business logic or data layer. He explains "We should always, where possible, automate through API to API between systems. Often the answer will be - we don't have the resource to do that it's going to take us too long… So, every automation opportunity, one of the first things that we do is talk to the IT system owners, etc. and the architects and say, right, is there a better way to do this?". This account was consistent with what was happening across all cases. Where system-to-system interaction was required (a very common RPA use case), more heavyweight integrations such as APIs were not possible or desirable due to cost and time. As an example, in *InsServ_2*, the Operations Director explains, "I think because our legacy system's so complex, trying to get the API's to work was virtually impossible". There was however, very little evidence of rigorous debate around API versus RPA or serious assessments having been undertaken.

We have also observed some tensions between the RPA IT team and operations people. The reason is that operations people are trying to shift volumes of process automation cases away from other IT teams towards the RPA team. In *MedBank*, for example, operations people gravitated towards the RPA project because they thought that any operational

problems would be easier to solve than through alternative IT teams. The RPA Automation Lead explains, "I've become a lot pickier about what I automate now as well. Because in the beginning, I realized we were getting used by some of the business areas to solve all the stuff that none of the other IT teams wanted to solve". He cited time, money and resources as reasons why IT had not been able to resolve some of these things.

4.5 Revealing hidden problems and organizational learning

Across the case-firms, many use cases that were identified represented long-standing problems. For example, in **MedBank**, in relation to one prominent RPA project the process issue being tackled by RPA had existed for many years. A Change Manager confirms, "The issue was not a new issue in terms of operations it's been in there for years". In many cases, there was also genuine surprise at the problems unearthed. This was observed in **LargeIns**, **InsServ_1** and **MedBank**. The Automation Lead in **LargeIns** explains: "I started to get quite shocked on, firstly how bad it had got on the front line for people". In **InsServ_1**, there was similar surprise at the problems uncovered during the process analysis work. This led to more questions being asked around the business. The IT director describes the questions prompted amongst team members, "I didn't know you didn't do it that way. Why are you doing it that way? Why does that take too long?". More broadly he described the effect this had amongst management: "These things start bubbling to the surface which creates conversations further up the chain. So why don't we know about this stuff etc?... where else is this happening?". On one prominent project in **MedBank**, the analysis work and data generated by the RPA project team led to uncovering issues around very poor data entry and associated re-work, something which was unexpected and of which there was no visibility previously. The Automation Lead explains: "It's created so much management information around how bad incoming data is… And a lot of the time the work's being created by the fact that people couldn't be bothered to input dialling codes correctly". Regarding a separate process, the RPA team also surprisingly uncovered that updates were being made to systems by operations staff that were never accessed or used. A Change Manager confirms, "Systems being updated, that were never used and didn't go anywhere".

In **LargeBank**, during the RPA programme, there was significant learning activity around process complexity and variation. This learning reflects the gap between people working in operations and those people tasked with implementing RPA. The original assumptions the team had made about processes were wrong as they had not appreciated the level of variation between regions, products and system landscape. As a result, the savings were significantly over estimated. An Automation Lead explains, "The business case pretty much evaporated or became so complex that it was going to take way longer for [consultancy] to build it than initially planned".

Given that all informants in **InsServ_2** were from the operations team, they would have been familiar with operational issues and not surprised by them. They were coming at it from the opposite angle; knowing their operational environment but not knowing the potential of technology to resolve issues. RPA gave people a new way to look at the way they were working. A Process Modeller explains, "It was more about giving them [operations] a new way of thinking about things, because we think until this [RPA] came along, nobody considered or thought about another way of doing things".

Overall, tangible quantified results varied across the different organizations with some showing more progress than others in relation to the number of hours saved and the number of processes automated. **LargeIns**, for example, saved over 30,000 hours and automated 114 processes, whereas **MedBank** automated about 35. Across some cases, there was sensitivity in relation to the communication of such specific numbers due to fear of job cuts. Savings achieved were generally recorded as hours saved, with the time saved being redeployed as opposed to roles being made redundant.

5. Discussion

The research question for this study was: how does RPA technology hype reach the shores of organizations and what adoption behaviour and decision-making does it drive? Our findings point to three different dimensions of introduction of RPA and subsequent adoption behaviour: a) the role of senior management; b) the processes and practices that organizations set up in order to 'hunt for use cases'; and c) the effects these have on the adopting organization. We discuss these below.

5.1 Senior management as key instigator of adoption

Extant theory does provide some possible explanations for the actions of senior management reported. The presence of hype is likely to place adoption pressure on senior management. As more and more organizations adopt a technology, they are likely to be increasingly concerned about being left behind [26], and felt the need to join the bandwagon [20]. All but one case began their first forays with the technology between 2016-2018 and this aligns with the steep increases in publications and web activity set out in Figure 1. The varied and numerous sources set out show how noisy the market hype had become and exemplifies the activities of a diverse group of actors during a hype wave. This diversity is likely to have increased the sense that everyone else was doing it. This kind of external pressure pushes senior managers to assume roles of sponsors and key agents of RPA adoption and make them engage with formal and informal networks of experts in the broader technical field [48]. Although bottom-up movements within the adopting organizations might have eventually taken off, these required senior management direction and legitimation [30], a key feature of successful information systems projects [31]. This legitimation is also useful in overcoming internal barriers to change such as resource scarcity, lack of budget and governance processes. These barriers slow or inhibit bottom-up innovation and in many situations a senior champion is required to remove obstacles [32].

Although senior managers are important as key instigators for RPA adoption, we showed that in some cases, while trying to overcome those internal barriers, they shifted a large amount of resources to focus on RPA. Consequently they might have neglected other alternatives or trying to consider RPA alongside similar or complementary technologies. A one-sided focus on RPA increases the levels of commitment to the technology as the only option which 'has to work'. This leads to a 'hunt for use cases' within the adopting organizations.

5.2 The 'hunt for use cases'

The pressures of making RPA fit within the adopting organization created a rush for use cases that organizations could apply RPA to. To do this, our case organizations set up structures and started surveying their landscapes in search of processes that aligned to what is suitable for RPA. In a technology hype context, this situation is more likely to prompt organizations to follow a technology-push approach, whereby decision-making on technology adoption is not necessarily driven by a need to resolve existing problems [48]. Instead, adoption is driven by technological capabilities and the efforts of organizational actors to locate problems which can be served by them [49]. Huff and Munroe [49] found that technology-led approaches are facilitated by technical experts lower in the organizational hierarchy, in the case of this research, the hype surrounding RPA and the involvement of senior management made it more of a top-down approach.

Nevertheless, adopting organizations assemble specialist RPA automation teams utilising internal expertise or outsource to a third party, with the aim to hunt for use cases. We observe that those teams adopt an operational processes lens to identify use cases. This means that they will have to start collaborating with "Operations" in order to identify use cases. There was however a disconnect between experts in Operations and the RPA automation team. More specifically, this chasm did not allow bottom-up initiatives to develop and at the same time, tensions were created between experts in the two organizational groups. For example, RPA experts would create additional criteria to filter out use cases that were pushed to them by the Operations team. On the one hand, Operations who did not understand RPA were considering as a suitable use case every operational problem they could not solve, whereas RPA experts would filter a number of cases out as unsuitable. This disconnect is a source of tension that can pose additional barriers and delay adoption. Specifically, it does not allow teams to meaningfully merge their expertise but instead any solutions that emerge from such a collaboration mirror the structure and the skills composition of separate organizational groups [50].

5.3 Organizational gaps

The gap between RPA automation teams and Operations and the effects it had while adopting organizations were scanning for use cases, allowed long-standing operational problems to surface. Indeed, the distance and the siloes between the IT experts and Operations revealed long-standing operational issues which became obvious when experts from the two teams had to interact during the use cases hunt. In this sense, the RPA adoption process generated

organizational learning between previously disconnected experts which overall benefitted the RPA adoption projects [51].

This relates to the issue of how to organize and assemble teams during a use case hunt in the context of a changing scope of the IT function from being a support and maintenance activity to becoming a digitalization and new business development function [13]. Our research suggests that it is more beneficial having new hyped technologies explored by an organization more broadly rather than just by the IT function. This will increase the proximity of the technology to use cases and instigate organizational learning that can reveal long-standing hidden operational problems. This is more important in cases of lightweight digitalization, as in the case of RPA, where it may be unrealistic to expect IT experts alone to be in charge of maintaining legacy infrastructures and at the same time navigating the techno-hype for and creating business value through digital innovation [3]. In this sense, heavyweight IT (core systems maintained by the IT function) should be separated from lightweight IT as they constitute different knowledge regimes [52].

6. Conclusion

In this paper we explore mechanisms and processes followed by adopting organizations in the BFSI industry when adopting a hyped technology such as RPA. We found that the role of senior management plays an important role driving the initial stages of adoption. They do so by legitimizing a digitalization vision for the organization and also by attracting internal resources and support. Subsequently, usually with the help of external consultants, organizations set up mechanisms and organizational structures directed towards a 'hunt for use cases'. In this process, criteria for selection are being established and we observed tensions amongst different expert teams trying to determine and define suitable use cases. Overall, RPA adoption projects allow organizations to unearth existing but hidden problems and also provide opportunities for interdisciplinary collaborations between different expert organizational groups.

6.1 Contributions to theory

The paper contributes to a theoretical understanding of the organizational performativity of hype in cases of technology adoption. More specifically, our analysis adds to approaches which understand the performativity of hype not simply as a rhetorical enthusiasm stemming from exaggerated expectations, but as an organizational process aiming to mobilise resources, situate the technology in question as a viable option alongside complementary and even competing technologies and finally achieve organizational legitimation. We argue therefore that considering a hyped technology, requires a specific kind of adoption practice which we discuss below.

6.2 Contributions to practice

Adopting a hyped technology such as RPA requires senior management approval and support. This will help legitimize the technology and secure resources. Moreover, it requires engaging the whole organization more broadly and not just IT expertise. As hyped technologies are usually not well-established yet, use cases need to be constructed so that problems will be formulated and linked to associated RPA-related solutions. This requires assembling interdisciplinary teams from different parts of the organization. However, practitioners should be warned that this will most likely generate tensions between different knowledge regimes. Such tensions should be embraced as they are essential to learning and identifying 'hidden' gaps and problems. Organizations that are geared to learning, we suggest, are the ones who would be in a position to adopt RPA in a more meaningful way.

6.3 Limitations and future work

Our research has limitations in relation to the number of informants we spoke to from each case firm. Given that fieldwork was carried out during Covid 19 lockdown, we were not able to engage our informants in person and build rapport that would have allowed us to dig deeper into each of the case studies. Nevertheless, we spoke to a range of employees that touched upon different organizational units (both technical and business-oriented) which gave us useful and valuable insights.

Future studies could look more closely into the organizational aspects of technology adoption, not only in relation to RPA but at various emerging technologies, such as AI, blockchain, IoT. More studies on how organizations mobilise internal and external resources to manage the hype and expectations surrounding such technologies will shed light to innovative practices of technology adoption.

Acknowledgments

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Appendix A. Generic Interview Guide

*A.1. Opening interview (e*xplain research project and secure inform consent)

A.2. Explore hype around RPA and how it leads to adoption

Indicative themes:

- When and how did you come across RPA within your organization?

- Who are the key actors both internally and externally that drive information about RPA and also adoption processes?

- Understanding of RPA and its potential

- Do you know what other companies in your industry doing in this field?

- What are the expectations within your organization about the potential of RPA and the problems it can solve?

A.3. Moving from expectations to implementations

Indicative themes:

- Explain the process of matching business problems with RPA-related solutions

- Explain the process of going from an idea to someone's head to an actual implementation

- How are decisions made in relation to what technology to adopt and how?

- Where external parties involved in this process? What was their role?

- Where problems discussed in the context of RPA also previously identified?

- Where there attempts to solve them in another way?

A.4. Crafting internal expectations

- How did people involved in RPA adoption identify potential benefits and risks from implementing RPA?

- Any specific departments within the organization that were involved in RPA adoption?

- Any external parties involved in this process? If yes who and how?

- How did you select where to apply RPA?

A.5. Outcomes

- Has the RPA project met the initial expectations?

- How do RPA benefits match actual outcomes achieved?

- Any positive or negative implications from RPA implementations?

- Does your company have an end state it is trying to reach through RPA use?

- Where do you think this will go next?

A.6. Wrap up

- Anything else to add?

- Thank you.

- Possibilities of follow up?

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Digital Transformation in European Union: North is leading, and South is lagging behind

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Digital Transformation in European Union: North is leading, and South is lagging behind

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Abstract:
The transformation of the economy into a digital environment has become a necessary step in recent years. The consequences of the COVID pandemic have accelerated the digital transformation and the growth of the digital economy. Intensive business engagement in the digital economy requires innovative digital solutions and online means of promotion and sale. European Union (EU) countries need to create the conditions for the gradual transformation. The paper analyses business readiness for the digital economy in EU countries. It aims to compare and assess the current situation of digital readiness based on the set of selected indicators. The analysis includes a multidimensional comparison of EU countries, classification based on cluster analysis, and ranking based on factor analysis results. Results show significant differences among EU countries. Newer member countries, mostly from South-Eastern Europe, are still lagging behind the EU average in e-Commerce activities, usage of social networks, and cloud computing. Furthermore, factor analysis has been conducted to determine underlining factors describing the overall digital readiness of EU countries and rank them accordingly. As well as in the cluster analysis, factor analysis revealed that Nordic EU member countries perform very well and show the highest digital readiness.

1. Introduction

In the last few decades, the development of new technology has been happening rapidly, which has brought many changes to the functioning of businesses, governments, and everyday life. In addition, such rapid technology development led to many innovations, which altogether led to the emergence of the digital economy, a term coined by Tapscott [1] to describe new business models, commodities, markets, and services, particularly those relying on digital technology as a core corporate infrastructure [2]. Consequently, the usage of digital technologies opened up many possibilities for developing innovative business models or making serious changes to existing ones, known as the digital transformation process [3].

The digital economy and digital transformation have been some of the most discussed issues among both professionals and academics for a long time. Named topics have been previously often explored in the context of transformation to Industry 4.0 and its support (e.g., Pejić Bach et al. [3], Ustundag and Cevikcan [4], Lee et al. [5], Rajnai and Kocsis [6], Ghobakhloo and Iranmanesh [7]). In that sense, it has been often argued that one of the most important aspects of digital transformation is having a clear digital strategy (e.g., Pejić Bach et al. [3], Gobble [8], Kane et al. [9], Suša Vugec et al. [10]). Moreover, even governments recognize the importance of having digital strategies. For example, European Union (EU) presented its Digital strategy in February 2020, which indicates that "everyone is experiencing the digital transformation in their life" and emphasizes that every European, EU business, and even the planet will benefit from the presented digital strategy [11]. Moreover, the importance of digital transformation for enterprises and policymakers has increased after introducing social distancing rules in the fight against the COVID-19 pandemic.

Furthermore, the digital economy is one of the main areas to which a significant amount of EU funding is allocated in the recovery instrument "Next-generation EU" and the Multiannual Financial Framework 2021-2027. The current business readiness for the digital economy determines its future success for the next years or decades. It could be argued that using innovative digital tools and digital transformation is unavoidable for most enterprises.

This paper deals with the problem of preparedness for the digital economy and the transition of EU businesses to digital business solutions, i.e., preparedness for digital transformation. Its main goal is to identify key similarities and differences in digital readiness among EU countries and point out the strength and weaknesses of these countries. To meet this goal, three research questions have been stated, aiming to compare the current popularity of innovative digital tools in EU countries, being: (RQ1) What is the intensity of e-Commerce activities and usage of selected innovative digital solutions by enterprises in EU countries?; (RQ2) How can the EU countries be classified based on their similarities in digital readiness?, and (RQ3) Which EU countries are leaders in digital readiness, and what is the ranking of EU countries according to their overall digital readiness? Answering stated research questions allows authors to assess the overall digital readiness of enterprises in EU countries and, therefore, contribute to the body of knowledge on this topic.

After this introduction, the rest of the paper is structured as follows. The next section presents a brief literature review, providing a theoretical background of the study. The methodology and data used in the analysis are described in the third part of the paper. Next, the fourth part of the paper shows the most important results following the discussion. Finally, a summary and conclusions are provided in the last part of the paper.

2. Literature review

Several recent studies have examined the digital transformation of business in the EU, for example, Kääriäinen et al. [12], Kinnunen et al. [13], Borowiecki et al. [14], and Bouwman et al. [15]. However, most of them are focused on the process problems related to digitalization, accumulation of digital capital, or the level of overall digitalization in the country. While this paper is based on mentioned previous research, it pays significantly more attention to indicators related to the digital readiness of enterprises. It classifies and ranks EU countries according to enterprises' digital readiness for digital transformation. To some extent, a similar approach was previously used by Kozhevina et al. [16].

However, they calculated aggregated digital economy index based on different indicators suitable for the Russian economy [16].

The European Commission [17] annually monitors digital progress in EU countries via Digital Economy and Society Index (DESI) reports. DESI captures country profiles and identifies areas requiring action. There are five main DESI key areas of concern, being: (i) Human capital, (ii) Connectivity, (iii) Integration of digital technology, (iv) Digital public services, and (v) Research & Development in information and communication technology (ICT) [17]. Based on the overall results in the DESI 2021 report, Denmark, Finland, and Sweden are ranked as the three top-performing countries, while, on the other hand, Romania, Bulgaria, and Greece are placed at the end of the ranking [17]. This paper's analysis focuses on a much narrower yet still complex definition of the problem. In that sense, the approach within this paper captures only indicators related to enterprises and their e-Commerce activities and the usage of innovative digital solutions.

According to Tomičić Furjan et al. [18], enterprises face many challenges in keeping up with the competition due to the digital transformation of the economy. Moreover, those enterprises that are undergoing the process of digital transformation are required to make significant changes to their business models [15]. To achieve digital transformation, enterprises should reconsider their current operations and business models from the perspectives of innovative digital technologies [12]. Furthermore, the global digitalization trend puts pressure on a business in the EU. According to Schweer et al. [19], it is likely that enterprises in the EU are already significantly lagging behind other main global players like China and the United States in sales related to ICT. Moreover, the current state of a digital economy is also significantly different among countries within the EU [13]. In particular, enterprises in several of the EU's newest member countries lag significantly in digital transformation. Hence, this problem needs to be examined to find solutions. In that sense, significant measures toward digital transformation are anticipated to be required in the business and government sectors.

In the past decade, most of the attention related to the digitalization of business has been paid to e-Commerce [20]. It can increase the growth of enterprises in developed and developing countries [21], and, due to its convenience for both sellers and buyers, it gradually became the preferred way of doing business [22]. However, digital transformation currently requires much more than the involvement of enterprises in e-Commerce. Nowadays, there are many innovative digital tools that enterprises can use to increase effectiveness, including, for example, data mining [23] or cloud computing services [24]. In that sense, this paper examines the e-Commerce activities and focuses on using relatively new digital technologies, such as Big Data analysis and cloud computing.

When discussing digital transformation and digital technologies, one should also consider the possible ways of online communication with customers that enterprises have at their disposal. Using a website can be considered more traditional than social networks. However, both schemes have their potential benefits as well as limitations. The utilization of social networks for Business to Business (B2B) and Business to Customers (B2C) communication and e-Commerce has been studied in more detail, for example, by Ballestar et al. [25] or Davidaviciene et al. [26]. Schwertner [27] argues that Big Data, cloud, mobile, and social technologies are critical parts of business infrastructure. It has also been stated that such technologies would have higher revenues in the short term and enable enterprises to gain a bigger market valuation [27]. Cloud computing allows convenient, on-demand network access to a shared pool of configurable computing resources such as networks, servers, storage, or applications. Its application can reduce costs and provide access to the best possible technology [27]. Big Data refers to large, diverse data sources and types that provide difficulties processing them by traditional systems. Nevertheless, enterprises using big data management tools can significantly benefit from Big Data analysis, such as process innovation, identification of customers' needs, product design, risk management, and quality management [28]. This paper also compares the popularity of websites and social media as two main ways enterprises use online communication with their customers.

In terms of digital readiness, there have been some indexes previously developed. For example, a certain type of digital readiness index has been previously constructed by Philipp [29]. However, Philipp's [29] index was applied to assess smart ports, aiming to examine how the digital performance of ports can be assessed. Finally, Philipp [29] concludes that all investigated ports show rather low digital readiness for using selected innovative digital technologies. Similarly, Zalite and Zvirbule [30] compared the digital readiness of higher education institutions in EU countries. The results

again confirmed the existence of a digital gap between the best performing Nordic European countries and the less developed Southern and Eastern European countries [30]. Pirola et al. [31] assessed the digital readiness of small and middle-sized enterprises (SMEs) in Italy using case studies with 20 enterprises. They conclude that Italian SMEs show intermediate readiness for Industry 4.0; however, they mostly need support to understand their path towards digital transformation [31]. Therefore, the analysis within this paper also considers technologies for ranking countries according to digital readiness.

3. Methodology and data

The main goal of this paper is to identify key similarities and differences in digital readiness among EU countries and point out the strength and weaknesses of these countries. To meet this goal, three research questions have been stated, as it has been pointed out in the introduction of the paper.

In this paper, the authors compare EU countries based on the variables related to readiness for digital transformation and the digital economy. Variables used in the analysis are summarized in Table 1. The observed variables have been selected to reflect the most important aspects of the digital transformation: e-Commerce, providing infrastructure to employees (such as providing a portable device for business purposes and providing ICT training), communication of the enterprise with the environment (over the website and social network), and usage of security measures, as well as advanced technologies (such as cloud computing services and big data). This research does not include the United Kingdom; hence, 27 EU countries are included in the analysis. Most data are valid for 2021 and some for 2019 and 2020 (according to availability). Although the data for different years have been used in the analysis, the proposed approach is valid since the usage of the information technologies does not significantly change within a few years, especially for the actions of the enterprises related to the technology usage, such as the training to the personnel to develop their ICT skills, having insurance against ICT security incidents, and for the analyzing the big data for smart devices, which were the only three items available for the years 2019 and 2020, while for all the other items the data were available for the year 2020.

Table 1. Description of variables used in the analysis

	Variable	Description	Year
A	Enterprises with at least 1% e-Commerce sales	Enterprises with e-Commerce sales of at least 1% turnover (% of enterprises with 10 or more employees in the economy without financial sector)	2021
B	Enterprises with any e-Commerce sales	Enterprises having any e-Commerce sales	2021
C	Enterprises' total turnover from e-Commerce sales	Value of e-Commerce sales: Enterprises' total turnover from e-Commerce sales (% of the total turnover of enterprises with 10 or more employees without financial sector)	2021
D	Persons employed with a portable device for business purposes	Persons employed were provided a portable device that allows mobile internet connection for business purposes (% of total employment)	2021
E	Enterprises provided training to their personnel to develop their ICT skills (%)	Enterprises that provided training to develop/upgrade the ICT skills of their personnel (% of enterprises with 10 or more employees in the economy without financial sector)	2020
F	Enterprises with a website (%)	Enterprises having their website (% of enterprises with 10 or more employees in the economy without financial sector)	2021
G	Enterprises using any social networks (%)	Enterprises using any social network (% of enterprises with 10 or more employees in the economy without financial sector)	2021
H	Enterprises having insurance against ICT security incidents (%)	Enterprises having insurance against ICT security incidents (% of enterprises with 10 or more employees in the economy without financial sector)	2019
I	Enterprises buying cloud computing services (%)	Enterprises buying cloud computing services used over the internet (% of enterprises with 10 or more employees in the economy without financial sec)	2021
J	Enterprise analyzing big data from smart devices (%)	Enterprises analyzing big data from smart devices or sensors (% of enterprises with 10 or more employees in the economy without financial sector)	2020

Source: Authors based on European Commission [17].

The analysis has been conducted in three stages. The business enterprise sector plays a crucial role in the digital economy, and enterprises' preparedness for digital transformation seems essential for future success. Hence, this paper is focused on this issue. It compares the usage of innovative digital tools and the overall digital readiness of enterprises in EU countries based on available secondary data. Therefore, the authors first examine the share of enterprises with e-Commerce sales, compare the usage of selected innovative digital solutions, and propose an alternative way to classify and rank countries according to the digital readiness of enterprises.

Secondly, a cluster analysis based on cross-sectional country-level data from the European Commission's Eurostat database has been conducted [32]. All variables have been transformed to Z-scores before the analysis. Hierarchical cluster analysis was performed using Ward's minimum variance classification method, and the linkage measure was the Euclidean distance. This method is useful for classifying countries into rather homogenous groups (clusters) based on their multidivisional similarity. A similar type of hierarchical cluster analysis has been recently used, for example, by Pejić Bach et al. [33] to identify obstacles to the introduction of e-Commerce in European Countries. Each cluster has certain characteristics concerning countries' overall readiness for the digital economy. Cluster analysis has also been used by Kinnunen et al. [13] or Borowiecki et al. [14] to determine the degree of digitalization in the EU countries.

Thirdly, all EU countries have been ranked based on the overall digital readiness of their enterprises. The same ten variables have been used as inputs in factor analysis. The factor analysis results significantly reduce the problem's dimensions, and the calculation of eigenvalues will determine the number of key factors. In this case, only one single factor has been identified, representing the unobserved (latent) variable that captures most of the overall variance of all original variables. Factor analysis has recently been applied in a similar context by Hrustek et al. [34], using factor analyses to reveal critical digital economy factors such as e-Commerce, e-Banking, e-Work, and e-Employment. Based on the results, it is possible to assess the overall digital readiness of EU countries and rank them accordingly.

4. Results

The readiness of enterprises for the digital transformation and the digital economy can be seen as a multidimensional and complex problem, and several indicators can be considered to capture this issue partly. Hence, a set of ten variables, presented in Table 1, have been used to capture different aspects of business digital transformation and this section presents the study results.

4.1 Comparison of selected indicators in EU countries

The first part of the analysis is focused on e-Commerce sales of enterprises in EU countries. This can be considered the financial output from an enterprise's engagement in e-Commerce. Different indicators can assess the importance of e-Commerce for enterprises. This analysis compares two variables capturing the intensity of e-Commerce from different points of view. Firstly, the share of enterprises having at least 1% turnover arising from e-Commerce and the share of total turnover from e-Commerce sales on the overall turnover of enterprises in each EU country. In both cases, the differences between EU countries are relatively large, as presented in Figure 1. Denmark, Ireland, and Sweden have the highest share of enterprises engaged in e-Commerce.

Furthermore, enterprises from Ireland, Czechia, and Belgium have the highest turnover from e-Commerce activities. On the other hand, Bulgaria and Romania appear to have a very low engagement of enterprises in e-Commerce concerning both indicators. Together with Cyprus, Greece, and Latvia, these two countries have the lowest turnover from e-Commerce in the EU. Some countries such as France, Hungary, and Slovakia have a high turnover from e-Commerce despite the lower engagement of enterprises in e-Commerce. This could mean that larger enterprises with high turnovers are mostly active in e-Commerce here.

In the next step, the usage of two selected digital solutions for e-Business, namely cloud computing and Big Data analysis, have been compared. The attention has been focused on the shares of enterprises using the named two tools in the EU countries. Figure 2 illustrates the comparisons of both variables, where, in this case, the authors present Big Data analysis from smart devices and sensors (shown on the right axis).

Digital Transformation in European Union: North is leading, and South is lagging behind
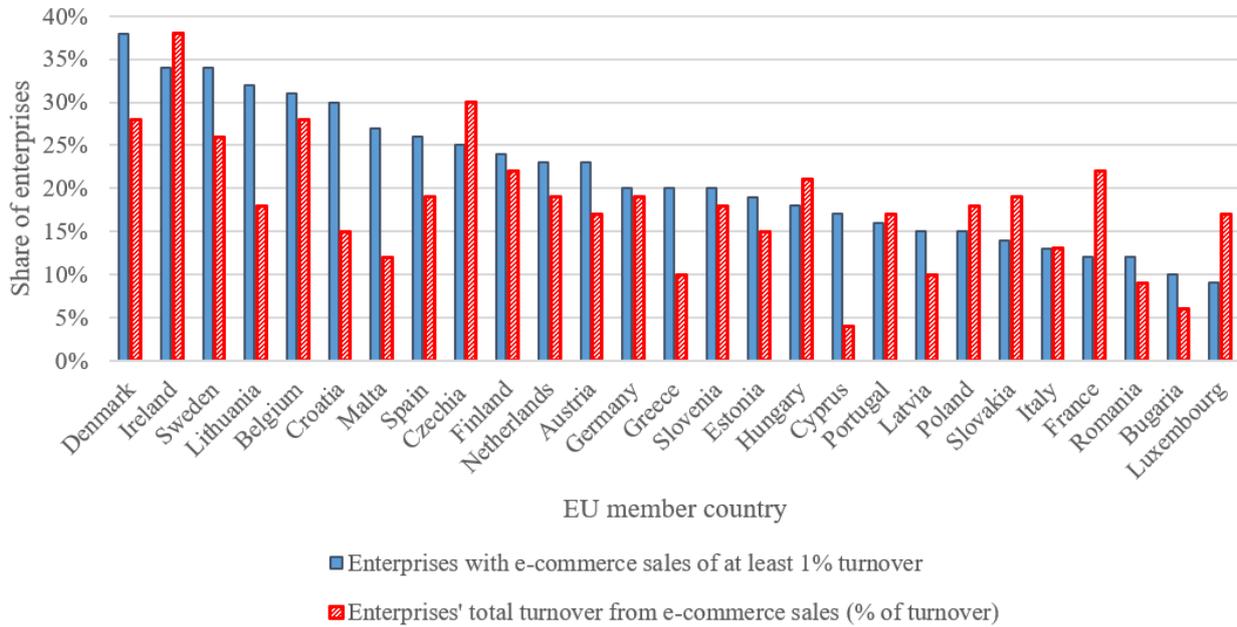
Fig. 1. The share of enterprises having e-Commerce sales (at least 1%) and share of turnover from e-Commerce sales in EU countries (2021)

Source: Authors based on data from the European Commission [17].
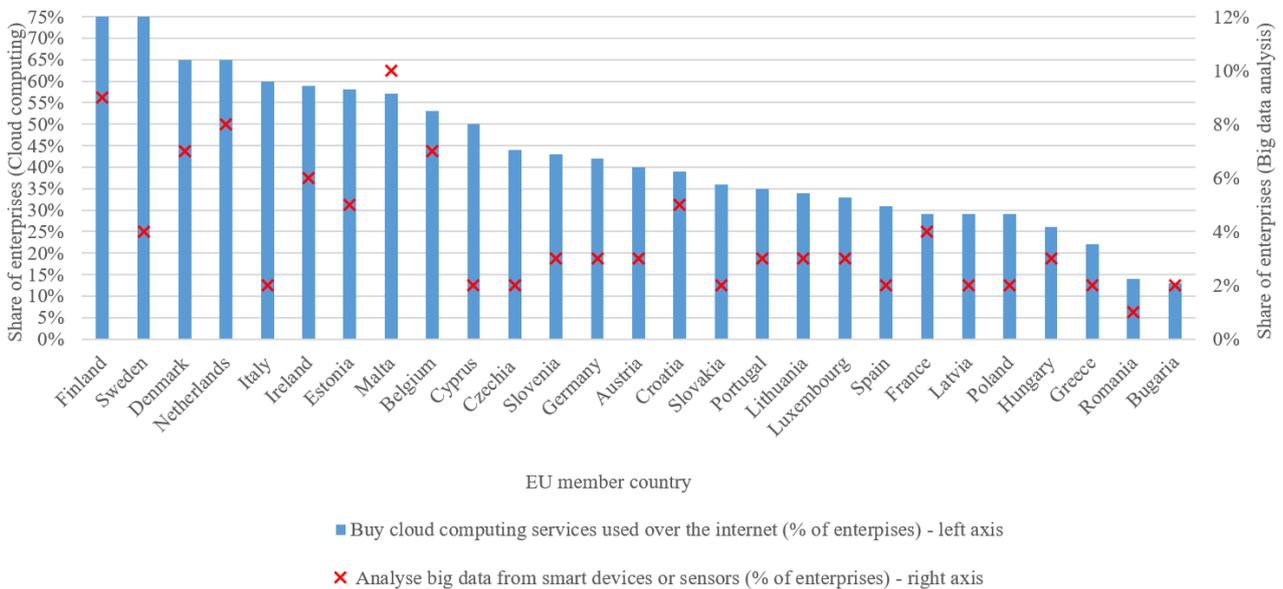
Fig. 2. The share of enterprises using two mentioned digital solutions for e-Business in EU countries (2020, 2021)

Source: Authors based on data from the European Commission [17].

As shown in Figure 2, cloud computing services are more popular than Big Data analysis from sensors and devices. This could be expected because cloud computing can be used for various purposes, while Big Data analysis, in this case, is related to certain devices. The highest usage of cloud computing services is found in Finland, Sweden, and Denmark. However, all three Nordic countries have various intensities of Big Data analysis. Big Data analysis from the sensors and devices is the most popular in Malta, followed by Finland and Netherlands. Romania and Bulgaria fail to keep pace with most countries in both indicators.

Furthermore, e-Business solutions and online promotion tools can likely lead to higher e-Commerce sales. Hence, this potential role of cloud computing services and social media usage is linked to the share of turnover from e-Commerce in Figures 3 and 4.
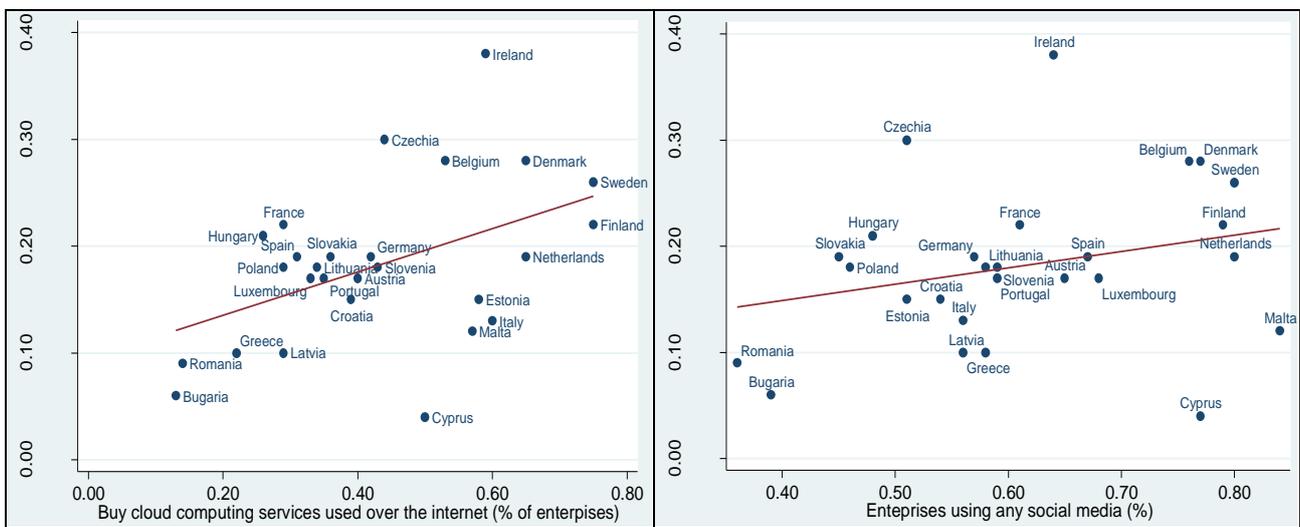
Fig. 3 and Fig. 4. The potential link between enterprises' turnover from e-Commerce and usage of cloud computing and social media (2021).

Source: Authors based on data from the European Commission [17].

The potential relationship to e-Commerce turnover seems to be more evident in the case of cloud computing. Countries with a higher share of enterprises using cloud computing have a higher share of enterprises' turnover from e-Commerce. The link seems to be also present concerning social media mentioned but is slightly less evident. Czechia and Ireland appear to be two of the most significant outliers in both cases. Despite a rather average usage of both tools, these two countries show a high share of e-Commerce turnover.

4.2   Cluster analysis of EU countries

This part of the analysis aims to classify EU countries into relatively similar groups according to their overall digital readiness. To achieve this goal, a hierarchical cluster analysis has been used. It is based on ten variables capturing digital readiness (shown in Table 1 in the Methodology section), taking into account indicators capturing the intensity of e-Commerce, turnover from e-Commerce, technical equipment for working from home, IT training, the existence of own website, usage of social networks, having insurance against ICT security problems, usage of cloud computing services and Big Data analysis. The dendrogram graphically illustrates the results of clustering in Figure 5. Countries with similar digital readiness have been included in the same clusters at a certain distance in multidimensional space.
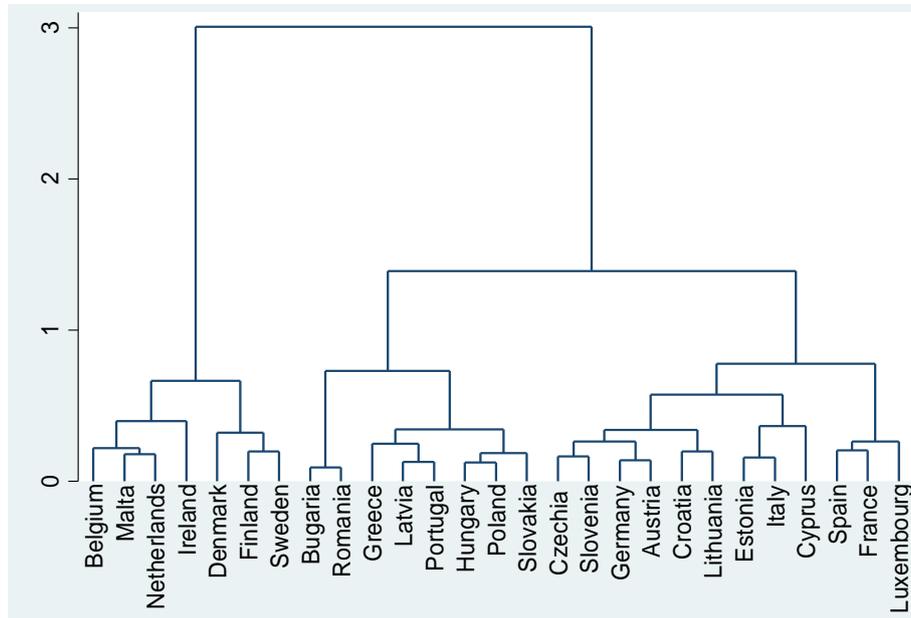
Fig. 5. Dendrogram of cluster analysis: similarity/dissimilarity in overall digital readiness of enterprises in EU countries

Source: Authors' work.

The optimal number of clusters has been determined based on the results of the Duda-Hart pseudo-t-squared test. The results of the named test are presented in Table 2.

Table 2. The results of Duda-Hart test to determine optimal number of clusters - lower pseudo T-squared statistics is desirable

Number of clusters	1	2	3	4	5	6	7	8	9	10
Je(2)/Je(1)	0.54	0.65	**0.65**	0.42	0.54	0.62	**0.35**	0.17	0.55	0.59
Pseudo T-squared	21.7	9.6	**5.3**	8.0	4.3	4.3	**3.8**	5.0	3.2	2.8

Source: Authors' work.

Results of the cluster analysis with the ranking of the cluster in each indicator are shown in Table 3. There are three main clusters formed at relatively long distances. However, it can be useful to consider an even lower level of clusters where countries can be classified into a greater number of more homogenous groups. The optimum number of clusters can be determined by the inflection point of the Duda-Hart pseudo-t-squared test. The lower value of pseudo-t-squared statistics with higher Je(2)/Je(1) values is desirable in this case. This test is explained in detail in Rabe-Hesketh et al. [35]. According to mentioned approach, seven clusters appeared to be optimal. Hence, seven clusters have been determined at a lower level, and three can be identified at a higher level.

Table 3. Summarized results of cluster analysis, ranking of clusters in each variable, and overall ranking according to the level of digital readiness

Clusters		Countries	Variables – rank of each sub-cluster										Overall
I.	II.		A	B	C	D	E	F	G	H	I	J	
1.	C1	Belgium Malta Netherlands Ireland	2.	2.	2.	3.	2.	2.	2.	3.	2.	1.	**The highest digital readiness**
	C2	Denmark Finland Sweden	1.	1.	1.	1.	1.	1.	1.	1.	1.	2.	
2.	C3	Bulgaria Romania	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	**The lowest digital readiness**
	C4	Greece Latvia Portugal Hungary Poland Slovakia	4./5.	6.	6.	5.	6.	6.	6.	4.	6.	6.	
3.	C5	Czechia Slovenia Germany Austria Croatia Lithuania	3.	3.	3.	4.	3.	3.	5.	6.	4.	3.	**Medium digital readiness**
	C6	Estonia Italy Cyprus	4./5.	4.	4.	6.	4.	5.	4.	5.	3.	4./5.	
	C7	Spain France Luxembourg	6.	5.	5.	2.	5.	4.	3.	2.	5.	4./5.	

Note: Variables used in cluster analysis:
A - Enterprises with e-Commerce sales of at least 1% turnover (%) – 2021; B - Enterprises with any e-Commerce sales (%) – 2021; C - Enterprises' total turnover from e-Commerce sales (% of turnover) – 2021; D - Persons employed with a portable device for business purpose (% of employment) – 2021; E - Enterprises provided training to their personnel to develop their ICT skills (%) – 2020; F - Enterprises with a website (%) – 2021; G - Enterprises using any social media (%) – 2021; H - Enterprises having insurance against ICT security incidents (%) – 2019; I – Enterprises buying cloud computing services used over the internet (%) – 2021; J – Enterprises analyzing Big Data from smart devices or sensors - 2020.
Source: Authors' work.

It is possible to categorize countries into three groups with different digital readiness at a higher level. The first group of countries has the best digital readiness, and the second group identified by cluster analysis has the worst digital readiness. In contrast, the third group of countries has medium digital readiness.

However, it is also important to focus on seven lower-level clusters. The homogeneity within the separate clusters becomes much higher when using this classification. For example, cluster C2 consists of Denmark, Finland, and Sweden. This cluster appears to be the best in almost all indicators, and these countries have excellent digital readiness according to selected variables. Countries classified in cluster C1 also have very good digital readiness as well. This cluster has the highest share of enterprises using big data analysis from sensors or devices and scores the second-highest in most indicators. Belgium, Malta, Netherlands, and Ireland are included in the cluster.

Compared to the mentioned two, five clusters have significantly lower digital readiness. Cluster C5, including Czechia, Slovenia, Germany, Austria, Croatia, and Lithuania, appears to be third in most categories. However, enterprises in these countries have a rather low level of insurance against ICT security incidents and social media usage. On the other hand, countries in cluster C7 (Spain, France, and Luxembourg) perform very well in both categories. Moreover, this cluster also has a high share of employed people equipped with portable devices for communication. On the contrary, this share is low in cluster C6, Estonia, Italy, and Cyprus. This cluster performs moderately in almost all other categories.

The second worst performing cluster is cluster C4 (Greece, Latvia, Portugal, Hungary, Poland, Slovakia). The digital readiness, in general, is low here. This cluster performs at the average only in the share of enterprises having insurance against ICT security incidents. This could be due to higher security risks and lower ICT security in these countries.

The cluster with the lowest level of digital readiness is labeled C3 and consists of Bulgaria and Romania. This cluster performed the worst among all seven in all ten indicators included in the comparison.

4.3 Factor analysis and ranking according to overall digital readiness

The final part of the analysis aims to rank individual EU member countries according to their digital readiness. The factor analysis has been used to find a single ranking indicator of digital readiness. The analysis is based on all ten variables presented previously in Table 1. The main results of factor analyses are summarized in Table 4.

Table 4. Results of the factor analysis (eigenvalues and uniqueness of each variable)

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1	**6.3082**	**5.432**	**0.789**	**0.788**
Factor 2	0.877	0.386	0.109	0.898
Factor 3	0.491	0.098	0.061	0.959
Factor 4	0.393	0.301	0.049	1.009
Factor 5	0.0917	0.06	0.011	1.002
Variable included in Factor 1				**Uniqueness Factor 1**
Enterprises with e-Commerce sales of at least 1% turnover				0.819
Enterprises with any e-Commerce sales				0.854
Enterprises' total turnover from e-Commerce sales (% of turnover)				0.669
Persons employed with a portable device allowing communication (%)				0.761
Enterprises provided training to their personnel to develop their skills (%)				0.877
Enterprises with a website (%)				0.836
Enterprises using any social media (%)				0.818
Enterprises having insurance against ICT security incidents (%)				0.709
Buy cloud computing services used over the internet (%)				0.837
Analyze big data from smart devices or sensors (%)				0.735

Source: Authors' work.

Applied methods allow the authors to reduce dimensions of comparison significantly. In this case, only one factor sufficiently captures the overall variance of all ten variables. According to the eigenvalues (higher than 1), the optimum number of factors appears to be one. Hence, only one factor has been considered. Therefore, no rotation can be applied in this case. More than 78% of the variance is described by this factor alone. According to the uniqueness indicator, variables capturing insurance against ICT security incidents and big data analytics appear to be the two most unique. These variables are the least similar to the other eight variables included in a single factor; hence, their variability is captured only partially by a single retrieved factor.

Finally, each EU country's estimation of factor scores has also been provided. This score is a numerical value representing countries' relative standing on factor 1. Assigned factor scores allow the authors to compare countries' overall digital readiness captured by factor 1. All EU countries' factor scores and final rankings are summarized in Table 5.

As can be seen, Denmark, Sweden, and Finland are the top-performing countries according to the factor scores. These countries have the highest overall digital readiness, as captured by the selected variables. On the other hand, Bulgaria and Romania are the two worst-performing countries. The results are in line with the findings obtained from cluster analysis. Thence, two different approaches lead to similar results. Most Eastern European EU member countries have been placed in the last seven countries. Despite this, some examples of good practices among similar countries, such as Slovenia, Czechia, Croatia, and Lithuania.

Table 5. Ranking of the countries according to digital readiness based on the factors scores concerning Factor 1

Rank	Country	Factor score	Rank	Country	Factor score	Rank	Country	Factor score
1.	Denmark	1.868	10.	Slovenia	0.183	19.	Portugal	-0.573
2.	Sweden	1.707	11.	Czechia	0.073	20.	Italy	-0.598
3.	Finland	1.591	12.	Croatia	0.063	21.	Poland	-0.727
4.	Ireland	1.439	13.	Germany	0.023	22.	Hungary	-0.802
5.	Belgium	1.139	14.	Lithuania	0.013	23.	Greece	-0.815
6.	Malta	0.880	15.	Cyprus	-0.215	24.	Latvia	-0.825
7.	Netherlands	0.808	16.	France	-0.302	25.	Slovakia	-0.871
8.	Spain	0.267	17.	Estonia	-0.347	26.	Romania	-1.880
9.	Austria	0.214	18.	Luxembourg	-0.418	27.	Bulgaria	-1.898

Source: Authors' work.

5. Discussion

As mentioned in the literature review, the digital transformation process appears inevitable for most enterprises to maintain their competitiveness in a global market and digital economy. Several reports have shown that a significant amount of money has been directed toward the digital transformation market and investments into digital technologies, making it grow rapidly [36], [37]. Moreover, this trend is anticipated to persist. The Meticulous Research Report [38] reveals that the global digital transformation market is expected to grow at a compound annual growth rate (CAGR) of 22.7% from 2019 to 2025.

Considering the global situation in a recent period, it could be concluded that the COVID-19 pandemic outbreak had a very strong influence on the previously mentioned rapid development of the digital transformation market. Due to the strict social distancing measures that have been introduced as part of the fight against the virus, almost every aspect of human lives has gone digital. Some workers, such as healthcare or police, have been declared essential since their work could not be done from home, while every non-essential job has been either paused for a while or continued to be executed from home. In that sense, for employees to work from home, many enterprises had to introduce or speed up the digital transformation process of their business operations, which also drew the interest of many researchers. For example, Bogdandy et al. [39], Zalite and Zvirbule [40], and Händel [41] examined digital transformation in education, as well as digital readiness and competitiveness of the education institutions during the pandemic. At the same time, Savić [42] investigated the digital transformation of the workforce, concluding that enterprises that have improved their digital skills and remotely engaged their workers were in a far better position to not only survive exceptional conditions caused by the pandemic but also to face the short successfully- and long-term problems that are expected in the post-pandemic times, which is also confirmed by Soto-Acosta [43]. Previously mentioned examples of various studies confirm the importance of the topic of digital readiness, which has been investigated within this paper.

Nevertheless, even now, when the world is mostly returning to normal conditions, interest in digital transformation and investments in digital technologies do not fade. In their research, Sheridan et al. [44] reveal that 69% of executives believe that digital initiatives are crucial to the success of their enterprises. At the same time, the PWC report [45] states that 60% of senior executives recognize the digital transformation of their enterprises as crucial for business growth in 2022. Therefore, the significance of investigating enterprises' digital readiness in the transition to digital solutions is confirmed.

In the context of the EU, the European investment bank [46] indicated that the COVID-19 pandemic also hastened Europe's economic digital revolution since many enterprises invested in digitalization as a direct consequence of the pandemic conditions. The primary users of the disruptive digital technologies in the EU before the COVID-19 outbreak were the most innovative and modern businesses [46]. However, the COVID-19 pandemic and intensive social distancing measures extended the digital transition to the entire society, making digitalization essential to the survival of enterprises [46]. Therefore, from 2020 to 2030, the EU has employed a set of digital principles and long-term digital

targets for Europe's digital transformation, proposing a Digital Compass comprising four main areas: (i) government, (ii) infrastructures, (iii) skills, and (iv) business [47]. One of the EU's digital targets included in the Digital Compass is to have 75% of EU enterprises using cloud computing technologies and Big Data analysis by 2030 [47], two technologies recognized and examined within this research. In that sense, DESI is a monitoring system to measure the progress towards setting digital goals. Moreover, according to Baker McKenzie [48], one of the key investments in digital transformation is cloud computing, which is in line with the results of this research presented in Figure 2, revealing cloud computing to be more popular than Big Data analysis within the EU enterprises.

As stated in the introduction, the primary purpose of this study was to uncover major parallels and contrasts in digital readiness among EU member countries and highlight these countries' strengths and weaknesses. The study results suggest the existence of rather significant differences in readiness of the business sector for the digital economy among EU countries. However, the presented methodology within this paper allowed authors to classify similar countries into separate homogenous groups. The paper's main aim was to identify key similarities and differences in digital readiness among EU countries and point out strengths and weaknesses. The analysis fulfilled this aim by answering three research questions set at the beginning of the study. In this study, we compare EU countries based on user-selected digital tools and other variables related to readiness for the digital economy.

The first research question deals with the importance of e-Commerce and selected innovative digital tools for enterprises in EU countries. This study revealed that Denmark, Finland, and Sweden are the top three countries engaging enterprises in e-Commerce, which is in line with previous results. For example, the same countries (but in a different order) have been identified as the best for receiving online orders in the EU by Orviska and Hunady [49]. The findings of this study are also in line with those of Cheba et al. [50], who confirmed Denmark, Finland, and Sweden to hold the top positions when observing criteria related to the e-Commerce drivers, and Denmark and Sweden to be in the top positions in the ranking of countries having highest e-Commerce activities in cities. It is also important to notice that the leading countries are mostly in the top places on different indicators. They are in top positions according to innovative digital tools and communication via social networks. Such high positions of Finland and Sweden do not come as a surprise, considering that, according to the European investment bank [46], enterprises in those countries have invested between 51% and 60% of their funds towards becoming more digital due to COVID-19. In comparison, Denmark invested between 41% and 50%. All three named countries are frontrunners in the Corporate Digitalisation Index [46].

On the other hand, countries like Romania and Bulgaria are significantly lagging behind the average of the EU in almost all aspects. This gap can be related to factors affecting engagement in e-Commerce and using ICT infrastructure by enterprises. Countries with lower performance can have a problem with the lack of infrastructure. This is also confirmed by the European investment bank [46], which argues that digital infrastructure is vital for unlocking investments in digital transformation. Technical obstacles and lack of government action are also the main barriers to e-Commerce [20], [51]. The problem can also be related to insufficient online security, as reported by Halaweh [52]. The findings of this study also suggest that enterprises in the countries with under-average digital readiness tend to use insurance against ICT security incidence more often. This could be due to lower online security in these countries. Furthermore, the quality of legal and regulatory frameworks in the country seems to be also important for the growth of the digital economy [20], [53]. In addition, research by the European investment bank [46] shows that advanced digital technologies in Romania and Bulgaria are below 58%, placing them at the lowest two places within the modest group of EU countries according to the Corporate Digitalisation Index.

The second research question deals with classifying EU countries according to their similarities in digital readiness. As presented in Table 1, ten selected variables have been used as proxies for digital readiness. These variables capture different aspects of digital readiness. Hierarchical cluster analysis has been used to classify the countries into relatively homogenous groups based on all ten variables. Three main clusters and seven sub-clusters have been identified. Countries performing well in digital reediness are included in the first two sub-clusters, cluster C1 (Belgium, Malta, Netherlands, and Ireland) and C2 (Denmark, Finland, and Sweden). Countries in the other five clusters should improve in almost all aspects of evaluation to enhance their digital readiness. For example, those included in cluster C3 (Bulgaria and Romania) and cluster C4 (Greece, Latvia, Portugal, Hungary, Poland, Slovakia) have particularly low

digital readiness. As with the first research question, this study's results comply with some previous studies. For example, Kinnunen et al. [13] used cluster analysis based on different variables. They classified Denmark, Finland, Sweden, and the Netherlands in the same cluster and argued that these are the most digitalized EU countries.

Similarly, Borowiecki et al. [14] apply cluster analysis based on the DESI index. They classified Demark, Finland, Sweden, and the Netherlands in the same cluster based on data from the years 2015 as well as 2020. The results are similar to the one in this study, but the Netherlands has been included in a different sub-cluster. However, they decided to use only four main clusters instead of three and seven sub-clusters in this paper [14]. In addition, Kovács et al. [54] also used DESI in their analysis and revealed Denmark, Netherlands, Finland, and Sweden to have the highest internet services digital readiness. Nevertheless, the approach used in this paper is also unique due to the selection of variables. In this study, the analysis is focused on variables related to enterprises' e-Commerce activities and usage of innovative digital solutions have been used.

The third research question ranks EU countries according to their overall digital readiness. The factor analysis has been applied to determine a single factor repressing digital readiness. The estimated factor scores make it possible to rank all countries. The results have already been, to some extent, indicated by the clustering. However, this method allows the authors to classify and rank individual countries. Based on this approach top five performing countries are Denmark, Sweden, Finland, Ireland, and Belgium. The three top countries are in the same order, according to the DESI 2021 index [17].

On the other hand, the countries with the worst digital readiness in the EU are Bulgaria, Romania, Slovakia, and Greece. These results are somewhat similar to those achieved by Kinnunen et al. [13]. Named authors found that Romania appears to be the least digitalized country [13]. Hence, the main research questions within this paper have been answered, providing a scientific contribution to the literature and practical implications providing possible explanations for the noted differences among different EU member countries.

6. Conclusion

Digital transformation is considered one of the main trends in business which brings many opportunities, challenges, disruption and changes for enterprises in terms of business processes and infrastructure, products and services enhancements, new business roles and organizational structure, increased innovation etc. [56], [57], [58], [59]. The importance of this problem is increasing with Industry 4.0 transformation and the application of social distancing measures due to the COVID-19 pandemic. Therefore, this paper examined the digital readiness of enterprises in EU countries based on the set of variables capturing a different aspect of this problem. The main goal was to identify key similarities and differences in digital readiness among EU countries and point out these countries' related strengths and weaknesses. The methodology that has been used in the paper, including cluster and factor analysis, was set to target this goal.

This study revealed significant differences among EU countries regarding their digital readiness and usage of selected innovative digital tools, i.e., cloud computing, Big Data analysis, websites, and social media. The intensity of e-Commerce among enterprises is the highest in Denmark, Ireland, and Sweden, and these three countries mostly dominate in other indicators. On the contrary, Romania and Bulgaria are mostly placed on the other end of the ranking. Furthermore, based on the cluster analysis, Romania and Bulgaria are included in the same cluster. Some strengths and weaknesses related to each identified cluster have been pointed out. Despite the complexity of the digital economy, there is some obvious positive correlation among all ten variables used in the analysis. It allows the authors to determine a single factor describing digital readiness in general. EU countries have been ranked according to the factor scores. As has been previously mentioned, this study confirmed some of the previous findings of other authors, e.g., Kinnunen et al. [13], Borowiecki et al. [14], Orviska and Hunady [49], Cheba et al. [50], Kovács et al. [54], etc.

This study brings some new empirical insight into the digital economy problem and businesses' readiness for digital transformation in the EU. In that sense, several implications of this research must be pointed out. The EU policies have to address a significant gap between the best and worst EU countries, and regional support must be strongly focused

also on digitalization and innovation. Therefore, the findings of this study confirm the necessity of significant investments in the digital economy, especially in the Next-generation EU program and the new Multiannual Financial Framework. However, the exact allocation of resources is also important. Especially the following three main priorities seem to be crucial to support digital transformation: (i) elimination of administrative barriers and creation of economic incentives for business digitalization; (ii) further development of ICT infrastructure; and (iii) investments in digital skills, as also reported by Dobrolyubova et al. [55].

Although this study extends the body of knowledge, and despite the authors' best effort to use the appropriate methodology and find correct answers to stated research questions, certain limitations still need to be recognized. The first limitation is related to data availability. Most of the variables used in the analysis are available only for one or two years. Hence, examining trends or using panel data analysis was impossible, and only cross-sectional data could be used. However, some variables can be used as a proxy for digital readiness, which is available for longer.

Another potential problem is the correlation of variables used in this analysis. While the approach used in this paper took advantage of the correlation when using factor analysis, this data is not ideal for cluster analysis. Nevertheless, digital readiness is a fruitful area for future research. There are several directions of examining this topic in the future, one of which is the possibility of searching for the factors affecting e-Commerce and digital transformation and related trends.

Acknowledgment

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Challenges and critical success factors of digital communication, collaboration and knowledge sharing in project management virtual teams: a review

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Abstract:
Technological advancements, globalization, and the COVID-19 pandemic have transformed digital communication into a central tenet of many project management virtual teams (VTs). However, successful VTs are dependent on communication, collaboration and knowledge sharing among team members. Through a systematic literature review, this study investigates the challenges and critical success factors of digital communication, collaboration, and knowledge sharing in project management VTs. As a result, eight key common themes were identified - trust, cultural diversity, collaboration tools and technology, communication and knowledge hoarding, leadership, psychological safety, communication guidelines and training, and resource planning. Furthermore, given the geographically dispersed nature of VTs, they face additional challenges than teams that interact face-to-face (in-person). Therefore, mitigating the challenges by focusing on the identified themes could lead to project success.

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1. Introduction

With the acceleration of virtual project execution and the rapid advancement in information and communication technologies, traditional face-to-face or 'in-person' ways of working have transformed. As a result, many organizations have adopted virtual ways of working, either through fully virtual project teams or a hybrid-based approach [1, 2]. The importance of communication and knowledge sharing in any project-based environment is essential for project success, and this has become more evident with the rise of digital project execution [3]. Additionally, the drive toward project virtual teams (VT) has accelerated with the widespread proliferation of new digital communication technologies and the global COVID-19 pandemic [4-6]. A survey suggested that approximately 66% of multinational corporations utilize VTs, where 80% of the respondents believed this number would continue to increase [5]. This number is expected to be significantly higher in the post-COVID era and will remain prevalent for the foreseeable future. Therefore, VTs must communicate effectively to ensure project success, and digital communication plays a vital role in this endeavor.

Dispersed project VTs typically comprise individuals with various cultural backgrounds, moral reasonings, skills and knowledge, which are brought together to achieve a common goal through different virtual collaboration platforms, including but not limited to, telephone, email, instant messaging, video conferencing and cloud-based information sharing platforms [5, 7].

With project tasks continuously growing in complexity for geographically dispersed and electronically dependent teams, internet-related technologies have become necessary for project execution and stakeholder communication [3]. Significant academic literature has been published on team communication, collaboration, and trust in a project management environment and its effect on project success. For example, a proposed model for project management success indicated that project management success becomes more likely as the degree of collaboration improves, which is influenced by the level of trust between project team members [8]. Moreover, quality communication is required for trust and collaboration in the project to thrive [9]. Thus, digital communication in VTs is critical as it is one of the primary ways knowledge is shared in such a team.

Digital communication refers to the process of sharing information, messages and ideas with others over a particular time and place, with the aid of digital channels and devices [10]. However, digital communications pose several challenges that traditional face-to-face communication typically does not, requiring teams to adapt. One such team adaption is the use of 'swift trust', which refers to situations whereby members of a VT transfer trust from other familiar settings by utilizing stereotypical impressions of each other [11]. The most prevalent challenges digital communication faces are categorized into three main areas. The first relates to information security risks, such as data privacy, confidentiality and security issues. The second challenge relates to the technology that inhibits efficient and effective communication. The last relates to ineffective leadership and inadequate resource planning.

Digital communication in VTs has become essential for many firms to execute projects effectively, ensuring stakeholders are adequately engaged, and it is expected to be used extensively in the foreseeable future. Given the global adoption and continued use of digital communication in VTs, research must focus on identifying the challenges and critical success factors of digital communication, collaboration and knowledge sharing in project management VTs. As of writing, there are no systematic literature reviews that address these aspects holistically. According to Fink, cited in Okoli and Schabram [12], a systematic literature review must be "systematic in following a methodological approach, explicit in explaining the procedures by which it was conducted, comprehensive in its scope of including all relevant material, and hence reproducible by others who would follow the same approach in reviewing the topic" (p. 1). The reasons for conducting a systematic review are to summarize the evidence about technology or treatment, to summarize the evidence of the advantages of a specific method, to identify any research gaps in the existing research, and to provide a deep understanding of new phenomenon [13]. These reasons fit with the aim of our review. Hence, this review fills the gaps by answering the following research question related to digital communication, collaboration and knowledge sharing in project management virtual teams.

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Research Question: What are the challenges and critical success factors of digital communication, collaboration and knowledge sharing in project management virtual teams?

The remainder of the paper is structured as follows. The next section presents the research method. The following section discusses the results obtained from the analysis of the shortlisted literature. Finally, a discussion and conclusion are outlined, along with limitations and avenues for further research.

2. Research Method

A systematic literature review was methodologically conducted to locate, appraise and analyze the available evidence to provide an informative and evidence-based response to the research inquiry [14, 15]. The PRISMA model [16] was used to underpin the search parameters, the inclusion and exclusion procedures and the screening. The review was based on four procedural stages outlined in the PRISMA model, including identification, screening, eligibility and inclusion (see figure 1).

2.1 Search strategy and keywords

A theory-driven, progressive sampling approach was used to collate the literature related to digital communication in project management, i.e., sequential selection of literature based on content/theory rather than statistical considerations, to develop an overarching understanding of literature. Furthermore, a repetition strategy was used to select various academic literature, where similar articles are selected (published by different authors, academic institutions and countries) to ensure diverse perspectives and approaches are encapsulated. This academic literature included peer-reviewed journal articles, conference papers and book chapters. Thought leadership articles, blogs, reviews, editorials, and letters were excluded as sources of information, given their lack of academic creditability. Only literature published in English was included. Literature published before the year 2000 was excluded, given the progressive evolution of communication, collaboration and knowledge sharing over the past two decades.

An initial set of keywords and phrases were used as part of the search strategy to ensure all overarching themes were covered while narrowing the initial search to only the most relevant articles. The following keywords were used: virtual team, global virtual team, virtual project execution, digital communication/collaboration, agile project execution and project management critical success factors. An additional search strategy was implemented using the initially identified articles' reference list to source additional relevant literature.

2.2 Screening and selection

Four trusted academic research databases (Web of Science, Scopus, Science Direct and Elsevier) were used to source relevant literature. These research databases were selected based on their creditability amongst researchers, literature coverage, discipline focus area, accessibility and general popularity. Figure 1 illustrates the PRISMA process used to select relevant academic literature whereby an initial set of 447 articles was refined and shortlisted based on the exclusion of duplicates, year published, article title, abstract and methodological quality to reach a final article count of 31 relevant literature sources.

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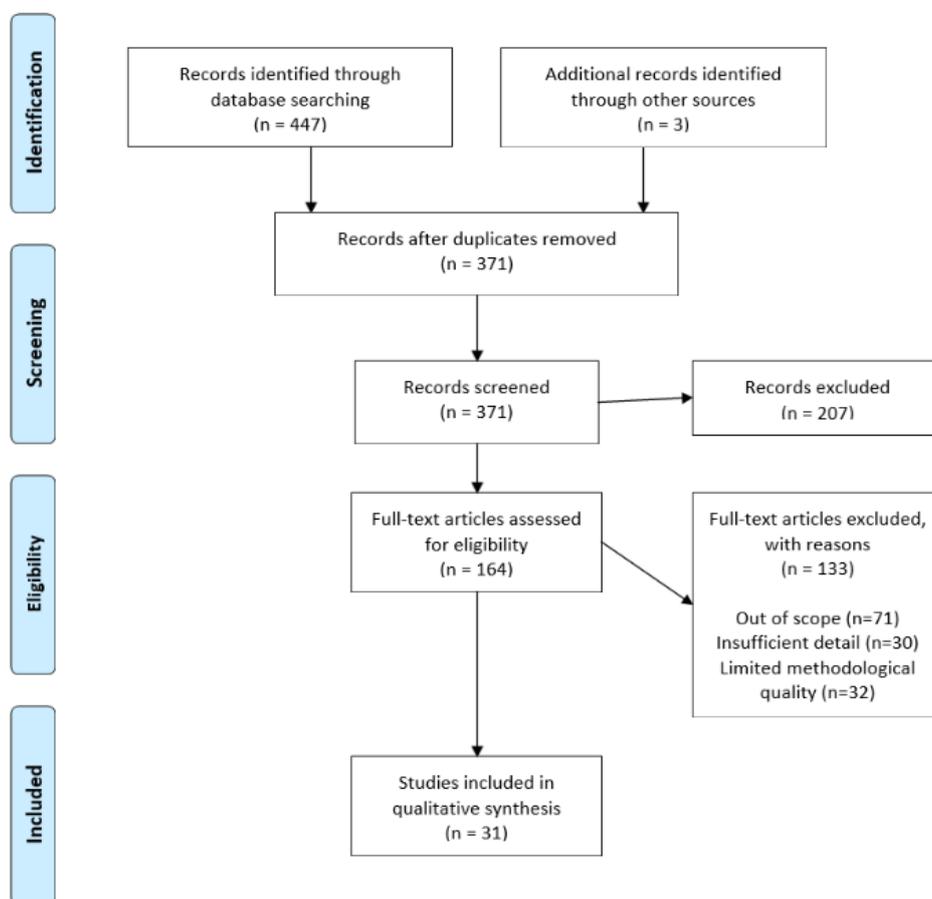
Fig. 1. PRISMA literature selection and reduction process

2.3 Data extraction and quality assessment

According to the Cochrane handbook for systematic reviews, the data extraction process should collect sufficient and unambiguous data that accurately represents the source in a structured and organized manner [17]. Hence, a data extraction framework in the form of an Authors Matrix [17, 18] was developed in Microsoft Excel (see exemplifying sample in Appendix A). It was used to track all shortlisted articles' key information, including but not limited to the article title, author(s), year of publication, primary industry, core concepts discussed and main findings.

A quality assessment was also conducted on the extracted data. A series of quality assessment questions, based on the Methodological Quality Questionnaire [6], were answered to determine the extracted data's overall quality, The quality assessment questionnaire (see Appendix B) focused on assessing the source and author creditability, selection bias, methodological rigor, and usefulness in addressing the research question. Answers were graded as either "Yes", "No", "Can't Tell" or "Not Applicable", where factors to consider were listed under each criterion.

2.4 Synthesis and analysis

Once the data was extracted and the quality thereof assessed, a concept matrix was used to analyze the connections between the shortlisted literature [18,19]. Apart from identifying common themes, the matrix highlighted gaps in the

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research, where additional supportive articles and content were required. The concept matrix was used to identify commonalities amongst the various academic literature, highlighting the bigger picture of critical topics of the systematic review through overlapping claims in individual sources. The completed concept matrix (see exemplifying sample in Appendix C) was also used to calculate the frequencies per theme.

Consequently, eight common themes were identified in the review, as shown in Figure 2, highlighting the reviewed literature's frequency per theme. These themes were mapped per article to easily track and refer to specific articles during the literature review process.

Fig. 2. Concept matrix theme analysis count

Collaboration tools and technology was the most discussed topic, with 24 of the 31 reviewed articles discussing the importance of technology, and 12 of the 24 elaborating explicitly on the importance of such technology, totaling 36. Trust was the second most discussed theme, followed by communication guidelines and training and psychological safety. The following section discusses the results obtained from the systematic review of the literature.

3. Results

The onset of VTs has had a substantial impact on how teams communicate and can assist firms in mitigating risk, minimizing operation costs, and eliminating redundancy of tasks [20]. A significant portion of the academic literature focuses on how digital platforms influence team interaction and the key success factors that allow VT to collaborate effectively [7, 21, 22]. Moreover, Evans [23] states that "collaboration and knowledge sharing are fundamental aspects of problem-solving, decision making and innovation, and are therefore vital for success" (p. 175).

Chen et al. [24] focused on the development of a trust evaluation method between team members in VTs to ensure co-workers effectively share information and collaborate, and found that effective management, resource planning and trust facilitate maximum collaboration. Similarly, Verburg et al. [7] identified critical success factors for project management with similar recommendations that included clear rules for communication, management competency, and team trust. A common theme highlighted in various academic papers was how multicultural teams alter team dynamics and trust and that team members lack the skills to work with people of diverse cultures [25-27].

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Based on the systematic literature review, eight key common themes were identified. A conceptual model (see Figure 3) was developed to visually illustrate how the eight themes related to the overarching question of digital communication, collaboration and knowledge sharing in virtual teams. First, collaboration tools and technology form the core foundation for VTs to operate, as, without such technology, the concept of VTs ceases to exist. Second, in most instances, cultural diversity (indicated by the second dotted line) will be present in VTs, specifically in dispersed settings. Cultural diversity has both a direct and indirect impact on how VTs collaborate. Third, four pillars form the basis of effective communication, collaboration and knowledge sharing, namely effective resource planning (where the correct individuals are selected based on the task at hand), trust between team members, effective leadership and well-defined communication guidelines and training. These four pillars result (arrowhead pointing down) in psychological safety that further enhances communication and reduces knowledge hoarding within a VT context.
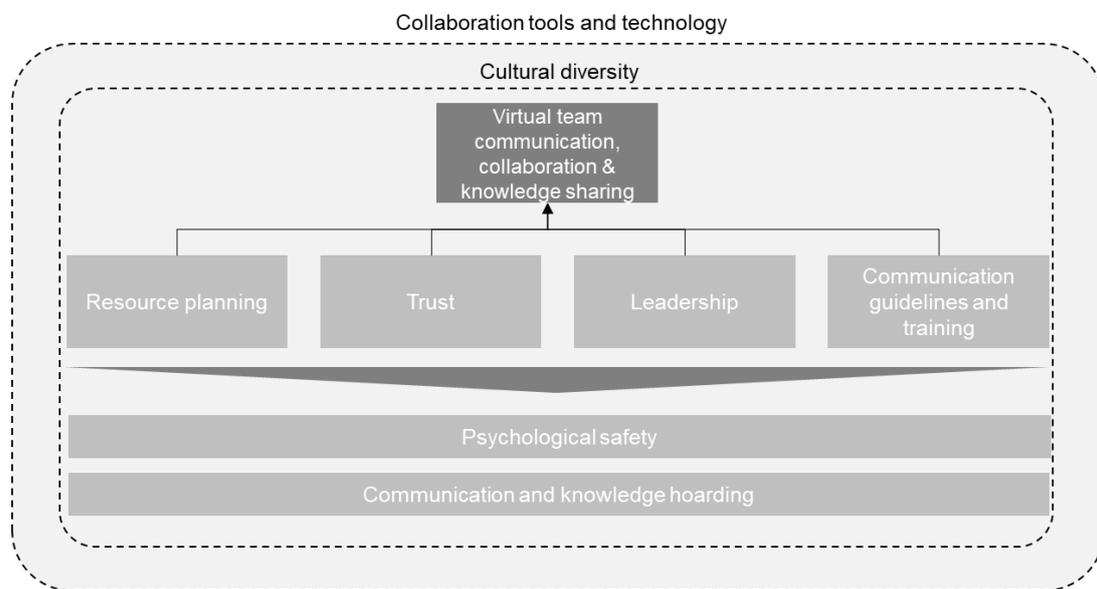
Fig. 3. Conceptual model

The eight key themes are mutually exclusive yet interrelated, with one theme often impacting another. Given the complexity of team interaction and social behaviors, a systematic analysis of each key theme's theoretical underpinnings is discussed below.

3.1 Theme 1: Trust

Trust is defined as "one's psychological state reflecting a strong expectation that the other will not seek self-interest at the expense of their welfare, thus increasing the willingness to accept vulnerability" [28]. Trustworthiness is an evaluation of the characteristics of a trusted objective. What is significant for virtual interactions is that trust is not solely the trustworthiness of individuals, but also the trustworthiness of the systems teams use for organizing interactions.

Trust is an essential part of building relationships in most human-based interactions, how individuals interact impacts how trust is formed. Trust has been analyzed and examined at the interpersonal, individual, organizational, inter-organizational, calculus-based and cognitive-based levels [20]. Trust can enhance VT effectiveness, support positive behavior and improve conflict [24]. However, numerous factors impact interpersonal trust, including cultural diversity,

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interaction experiences, perception of trustworthiness and risk versus reward [1]. Noteworthy, individual levels of trust for multicultural teams decreased during the VT lifecycle, while it increased for unicultural teams, primarily attributed to discrepancies in language, habitual behavior and values [25].

One of the main challenges individuals face in VTs is the development of trust, given the reduction in formal and informal interaction time between individuals [29]. Trust is seen as a critical success factor for VTs, as most tasks are conducted independently, i.e., performed by each team member without supervision. This requires significant confidence in one's ability to trust individuals to execute tasks, with team members often relying on the functional expertise of colleagues to complete tasks [1]. Developing trust in VTs is particularly challenging due to unshared and conflicting goals; however, knowledge sharing is enhanced through coordination and cooperation [28]. Therefore, project execution through virtual platforms brings a certain level of risk, as individuals depend upon one another to complete project tasks virtually.

Conflict and trust are central issues of knowledge sharing and virtual alliances in organizational teams. Strong levels of mutual trust amongst individuals can improve knowledge/resource sharing and joint risk-taking [1]. One of the primary challenges VTs face is encouraging the formation of trust and maintaining and growing trust through various phases of the team life cycle. Greenberg et al. [30] identified five stages in a typical VT lifecycle: team establishment, inception, organization, transition and task accomplishment. The foundation of trust between team members is typically established during the inception and organization phase, and it is, therefore, essential that appropriate communication and collaboration channels are used to enhance trust [30].

Furthermore, VTs interact primarily through digital channels such as telephone or computer-based collaboration platforms, which, compared to face-to-face interaction, reduces social context cues, often resulting in lower levels of social control and behaviors associated with lower levels of trust [7, 28, 31]. To mitigate this risk, the most appropriate collaboration technology should be used, where team members are confident in its ability to share information effectively [32]. Literature also suggests that team members meet face-to-face/in-person for project kick-off to ensure mutual trust is established and where virtual interaction is the only possible means of establishing trust, individual connection sessions are recommended [7, 25, 33]. This allows individuals to connect personally, forming close personal connections that drive trust through virtual engagement. Researchers also recommend a hybrid-based model where both digital and face-to-face communication mediums are used to interact [25]. Likewise, the addition of video to audio-based communication has been shown to improve the quality of strategic decision-making in VTs [21].

It was noted that most of the reviewed literature explicitly highlighted the importance of trust in VTs and was the second-most discussed of all themes. However, the appropriate actions to instill trust were limited, with only high-level success factors highlighted.

3.2   Theme 2: Cultural diversity

Cultural diversity is defined as the diversity of individuals' cultural values that distinguishes one's background and national culture from another [27]. Virtual teams are characterized as being culturally diverse, with researchers having mixed opinions on their effect on VT dynamics and collaboration [32]. Cultural differences were noted between Western and Eastern team members with numerous cultural discrepancies such as language, socially unacceptable working hours, falsehood, lack of respect and confrontational attitude [34]. These cultural discrepancies resulted in team members hoarding knowledge and a lack of knowledge sharing [35]. Specifically, it was noted that Eastern team members worked harder and during more socially unacceptable hours, particularly in VT settings, where well-defined working hours are lacking and that the Western colleagues are more individualist and self-focused than those from the East [34]. Similarly, VT members from countries such as Japan and Brazil tended to follow their leaders without question [32].

Unfortunately, cultural diversity is a source of misunderstanding and conflict [36]. However, contrary to this challenge, literature encourages cultural diversity, emphasizing the enhancement of innovation, creativity, ideas, and different

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perspectives that culturally diverse members bring to VTs [35, 37]. Therefore, diversity can be regarded as an important condition for the success of VTs if managed correctly [27].

Managing cultural differences is essential to ensure knowledge is freely shared across multicultural team members and leverages the rich diversity of perspectives, skills and knowledge. Leaders can improve trust and performance through a thorough understanding of cultural differences and their impact on virtual groups [38]. Training should be provided to assist team members in adapting to diverse work styles and cultures and working in harmony [26]. Klitmøller and Lauring [31] suggested that language commonalty be implemented in VTs, in terms of verbal and written communication, which refers to using one primary language for communication, typically English. Furthermore, cultural intelligence should be developed to positively contribute to social integration in VTs as it allows team members to understand culturally diverse people through sound reasoning and appropriate behavior [27].

3.3 Theme 3: Collaboration tools and technology

The role of information and communication technology as an enabler is essential for communication and building relationships in VTs [7]. Furthermore, technology is essential for VTs to carry out basic team functions such as collaborating, managing knowledge, communication and decision-making [26].

Lee-Kelley and Sankey [34] have segmented collaboration technology into three incremental generations, depending on the level of interaction and effectiveness. First-generation collaboration technology includes platforms such as emails and conference calls, where human-based emotions are limited, and the primary means of communication are vocal or written. Visual illustrations of information through PowerPoint presentations, videos and online meeting tools are classified as second-generation collaboration tools and are proven to improve human engagement. Third-generation collaboration technology is web-enabled shared workspaces via the internet and cloud-based platforms [34]. This includes new online communication technologies such as online file-sharing systems, global systems for mobile communications, electronic data interchange, web 2.0 applications and cloud computing services [20]. Researchers have recommended the extensive use of second and third-generation technologies for global VT collaboration, with first-generation used primarily for brief information-sharing interactions [35, 39]. Furthermore, rich media (e.g. video conferences) are preferred for knowledge sharing over lean media (e.g. emails) as it allows one to address misinterpretations more easily [31]. A collaborative technological environment in geographically distributed teams provides avenues for interactivity, knowledge sharing and coordination [40].

A study that analyzed the key drivers for project success and value creation noted that an over-reliance on technological infrastructure could hamper the growth of multinational companies when expanding into regions where the necessary technology does not exist [34]. In addition, a lower level of collaboration has been attributed to interactions on digital collaboration platforms, with both system performance and system design as critical elements [28]. Nevertheless, providing strong technical support for VT settings assisted in achieving faster project conduct and control [7].

It must be noted that despite the benefits of rich media, it can add to the challenge of culturally distinct communication behavior discussed in the previous theme. Communication guidelines should therefore be established to ensure diversity exclusion does not occur.

3.4 Theme 4: Communication and knowledge hoarding

Virtual teams are vulnerable to communication breakdowns, mistrust, conflicts and power struggles and must develop mechanisms for sharing knowledge, experiences, and insight critical for accomplishing their mission [35]. The fundamental elements in effectively communicating and sharing knowledge are not solely reliant on the technologies that VTs use but also on the ability and willingness of team members to be actively involved in knowledge sharing [35]. This involves team members actively responding to queries, participating in brainstorming sessions and decision-making, and disseminating ideas among team members [35].

While globally dispersed teams often offer members the opportunity of increased flexibility, research suggests that it is more challenging to manage the communication processes in these VTs [31]. Communication using such digital

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channels typically results in misinterpretation of messaging due to the ambiguity of tone and absence of body language cues [41]. To overcome this challenge, VTs require media-rich communication channels when the knowledge to be shared is of a complex and equivocal nature. Media-rich platforms enhance verbal and non-verbal signs as well as enhance cues individuals use for social categorization, i.e. cultural exclusion, which is known to have negative effects on team communication [31]. On the other hand, videoconferencing resources have led to significant improvements in the quality of team decision-making [7]. Therefore, collaborative structures of decision-making are recommended in VTs.

From a knowledge-sharing perspective, VTs are more hesitant to share tacit knowledge than traditional face-to-face teams, given team members' lack of social and informal trust [29, 37]. This is referred to as knowledge hoarding, where team members purposefully withhold certain information due to feelings of mistrust and lack of reciprocity. To mitigate this challenge, Rosen et al. [35] suggest the development of a team Transactive Memory System (TMS) that represents 'the collective team knowledge that individual team members have developed or acquired, encoded, stored and can retrieve'. By developing a TMS, team members can quickly locate valuable knowledge within the collective data bank over time. One of the primary principles that VTs require is knowing "who knows what" and "who can I go to for information," allowing members to access individual knowledge repositories. Hence, VT leaders should also ensure that team members have quick and easy access to relevant information and existing knowledge, to maximize team outputs and enrich members with as much information as required. Additionally, knowledge sharing is positively related to trust, which encourages team members to share openly [42].

3.5 Theme 5: Leadership

Leadership in a virtual context is typically referred to as 'e-leadership' or 'virtual leadership', and is defined as 'a social influence process mediated by advanced information technologies to produce a change in attitudes, feelings, thinking, behavior, and/or performance with individuals, groups, and/or organizations' [43]. The widespread implementation of VTs has created a new context for leadership and teamwork and is considered a critical success factor for VT performance, with participants emphasizing similar sentiments [44].

VT leadership also monitors team performance and facilitates team development [45]. One of the critical success factors VTs require is the ability for teams to remain resilient, which is defined as the capacity to bounce back from a setback. These setbacks typically occur when essential VT processes start to break down. A bounce-back happens when VTs work closely together to return to a level that produces value-added outcomes through collaboration. A study investigating what makes resilient VTs, concluded that effective leadership is the primary influencing factor that allows teams to bounce back from setbacks, whereas resilience emerges from collaboration and interaction between team members and leaders [32]. Therefore, VT leaders must facilitate and motivate team member interactions, strategically designed to build resilience. This is significantly more important in VT teams than in face-to-face teams, where team member interaction occurs naturally. Leaders who can help develop VT resilience, focus on empowering and transformational leadership, enhancing team design, improving transactive memory, and increasing creativity [32].

Leaders with high levels of motivational, cultural intelligence will positively impact social integration and performance [27]. In addition, the skills of a traditional face-to-face project manager are required over and above the additional specialized skills required in a virtual context, including but not limited to the articulation of goals, assignment of responsibilities and providing continuous feedback [7]. Throughout the collaboration process, leaders should monitor employees struggling or falling behind and encourage them to feel comfortable enough to reach out for help. Recurring personal connection sessions between individual team members and the project leader are recommended to informally catch up and allow leaders to assess team members' sentiments and take appropriate actions [22].

3.6 Theme 6: Psychological safety

Psychological safety was identified as the most important determinant in successfully sharing knowledge in a virtual environment, and it is considered to be the shared belief that a team feels emotionally safe and comfortable for members to take interpersonal risks that challenge the status quo in an open and trusting environment [32]. These researchers also

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contend that if VT members do not feel safe in taking risks for fear of embarrassment or interpersonal punishment, the team is at risk of missing out on information critical to overcoming adversity. Psychological safety also encourages team members to be open and candid enough to try new things, think outside the box, and discuss novel ideas [32].

Psychological safety is more relevant in VTs than in traditional face-to-face teams, given the limited social, informal interactions and visual cues, where typically, one person can speak at any given point in time, resulting in more introverted individuals feeling excluded from the team [34, 35]. In addition, for teams to successfully develop psychological safety across the entire team, members require mutual trust and mutual respect, which can be challenging when they do not share the same physical space [46]. Psychological safety also helps cultural teams have more effective processes, and it is especially relevant for working in adverse conditions [32].

A significant correlation between psychological safety and effective virtual leadership was identified by Rosen et al. [35], stating that virtual leaders should create conditions where VT members can see the overall positive value of knowledge sharing. For example, leaders can encourage psychological safety by promoting regular informal/social interactions, promoting a trial-and-error culture, sharing personal information and allowing team members to share first [46].

3.7 Theme 7: Communication guidelines and training

Clear communication rules and trust are required to accomplish work. Project managers perceive these two conditions as vital for improved project control, project conduct, and goal accomplishment [7]. In addition, when team adversity occurs, a well-defined framework of procedures and norms should already be in place that drives VTs to work collaboratively [32].

In order to support VT's progress, management and support guidelines should be used, including seamless project management, process control and how the product and process-related information is shared [1]. In addition, as VTs have membership diversity, team members should be provided with training and support to facilitate communication through both technical and non-technical modes [47]. Consistency in communication in a virtual setting is paramount, particularly when using the same collaboration tool across the team [34].

The agile approach is a common communication framework many organizations use to execute projects, particularly in the software engineering industry. Agile project execution focuses on rapid iterative development, and project requirements and solutions evolve through collaboration between teams. A study investigating the techniques, strategies, and challenges of distributed agile projects found that different techniques are used for local and global knowledge sharing [48]. The study identified some communication guidelines and practices implemented for knowledge sharing: team pairing, customer collaboration, Scrum/Kanban boards, virtual innovation boards, and workshops/seminars. Additionally, daily scrum meetings were frequently used to assign work and plan tasks for the rest of the day.

Team training was also highlighted as a significant success factor in VTs, particularly regarding effectively using the selected collaboration technology [31, 39]. However, little detail was provided regarding what type of training is specifically required, stating that the training is project and team specific. Hence, virtual leaders need to be cognizant that particular specialized training may be required, such as about technology platforms, virtual collaboration, and agile methods.

3.8 Theme 8: Resource planning

Resources can be segmented into three mutually exclusive categories: team resources for team organizing, including required skills and knowledge; product resources for product development and implementation; and external resources for teams. The planning and management of these resources are more challenging for VTs than traditional face-to-face project execution as these resources are typically more geographically dispersed, requiring a higher degree of management and leadership.

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Effective VT collaboration relies on efficiently managing distributed resources, safe and timely sharing of resources and strategic human resource management [24]. Researchers who developed a trust evaluation method for VT co-workers found that given the higher degree of uncertainty associated with virtual project execution and the increased need for innovation required a secure, flexible and dynamic resource management and sharing system [34]. Furthermore, the technology resources available at different VT sites could be different [47].

The initial selection of human resources that form part of the core project team is essential for project success, where the correct individuals are selected based not only on their skills, knowledge and competencies but also on their ability to effectively communicate and socialize with others [34]. However, human expertise and vertical integration can be utilized in VTs to make resources readily available [47]. In addition to selecting the right team members, VT leaders also need to manage product resources, most notably the confidentiality of certain information such as intellectual property, patents and licenses.

4. Discussion and conclusion

This study provided an overview of the challenges and critical success factors of digital communication, collaboration and knowledge sharing typically faced in project management virtual teams (VT). Based on a review of VT-related literature, it is evident that additional challenges exist for VTs compared to traditional face-to-face teams, given their often geographically dispersed nature and heavy reliance on digital collaboration technology. However, researchers agree that virtual means of working offer team members more flexibility regarding time and location of work [31, 49]. The findings of the reviewed literature corroborate the generally held view that communication, collaboration and knowledge sharing in VTs is more challenging than in traditional face-to-face teams; hence VTs require additional support.

The eight identified themes are summarized in Table 1. These themes are viewed as the key factors that are significantly different from traditional face-to-face teams, requiring a more meticulous planning approach to enable VTs to execute their defined goals successfully.

One of the principal findings from this review was the significance of trust in virtual settings and that VT members require an additional sense of trust on a personal and process/system level [1, 28, 44]. The literature recommended that all team members meet face-to-face/in person during the inception and organization phases of the project lifecycle in order to establish individual trust during the early phase of project execution, with a hybrid model being the ideal approach to maximize team collaboration and knowledge transfer thereafter [25, 42]. In addition to individual trust, team members need to trust the systems and technology used to communicate and collaborate [28].

Psychological safety should be embedded by allowing team members to be open and candid, think outside the box and discuss novel ideas without fear of retribution [32]. Leaders are seen as the shapers of a psychologically safe team culture in which they enable VT members to feel safe to share ideas, offer constructive criticism and seek help [35].

Technology was a critical foundation for digital communication, with the recommendation of using a combination of first, second and third-generation collaboration technology [34]. Given the media richness of third-generation collaboration technologies, such as video conferencing tools, it is advisable to use them for large and complex information exchanges, particularly those that involve knowledge-sharing activities. Virtual team members should be provided with adequate training and technical support to become competent in using the selected technology [39]. Furthermore, appropriate virtual communication guidelines that outline how team members should interact and share should be developed and followed [48].

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Table 1: Themes of communication, collaboration and knowledge sharing in virtual teams

Key themes	Overview and key research points: challenges and critical success factors
1. Trust	- Digital communication channels hinder individual trust - VTs require high levels of trust, which is more challenging to develop in virtual settings - Multicultural VTs have lower levels of trust than unicultural teams due to discrepancies in language, habitual behavior and values - Face-to-face interactions are recommended during project kick-off to establish trust among team members
2. Cultural diversity	- Cultural diversity breeds cultural discrepancies - Diversity in cultural backgrounds is a source of misunderstanding and conflict - Team members require cultural intelligence
3. Collaboration tools and technology	- Technology is essential for VTs to carry out their basic team functions, such as collaborating, communication, decision making and knowledge sharing - VTs use a combination of first, second and third-generation collaboration technology; however third-generation technology is recommended - Rich media communication is preferred over lean media
4. Communication and knowledge hoarding	- VTs are prone to communication breakdowns, mistrust, conflicts and power struggles - Standard communication guidelines should be set out and agreed upon by the team - Teams must develop knowledge-sharing mechanisms - Tacit knowledge is more challenging to share than explicit knowledge - Media-rich digital platforms improve the level of communication - Developing a Transactive Memory System is key to effectively sharing information - Quick and easy access to relevant information and existing knowledge is required
5. Leadership	- Effective virtual leadership enhance VTs resilience - Virtual leaders should actively promote member interaction and lead conversations - Empowering and transformational leadership traits are required in virtual settings - Virtual leaders should monitor employees who are struggling and encourage them to reach out for help
6. Psychological safety	- Team members should feel safe sharing thoughts and ideas openly - Strong correlation between psychological safety and effective virtual leadership - Promote informal/social interactions and a trial-and-error culture
7. Communication guidelines and training	- Clear communication rules and trust are required to work collaboratively - An agreed-upon language is recommended, primarily the most common language spoken amongst the team - The agile approach fosters knowledge sharing in distributed teams. - Team member training on how to fully utilize collaboration technology and tools, frameworks and methodologies should be provided
8. Resource planning	- Selection of the correct resources – technology and non-technology related - Utilize the right human personnel and vertical integration

The benefits of cultural diversity must be leveraged rather than seeing it as a challenge. Cultural diversity provides a rich diversity of perspectives, skills and knowledge that must be adequately utilized. In order to minimize VT conflict and knowledge hoarding, teams need to develop cultural intelligence and access cultural diversity training [26, 27]. Virtual team leaders have an essential role in their teams' implementation, functioning and cohesiveness. They must strategically select digital communication technologies and human resources to suit the virtual working environment. Likewise, virtual leaders need to have skills and traits to enhance VT resilience.

The study showed that the eight identified themes contribute distinctively, but often in overlapping ways, to the challenges and critical success factors of digital communication, collaboration and knowledge sharing in project management VTs. Furthermore, given the recent shift by many firms to work either on a pure virtual or hybrid model, the obligation of VTs to effectively communicate, collaborate and execute project deliverables is noteworthy. Therefore, VTs need to be aware of the peculiarities, challenges and success factors that are integral to executing projects virtually. Additional training may be required for teams to adjust to the new virtual working methods.

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As with any study, this study also has its limitations. The limited number of shortlisted articles may have excluded certain perspectives and insights, resulting in a potential gap. The decision to exclude academic literature published prior to 2000 may have also limited the findings. A gap in the literature was observed with respect to investigating VT structures and the resulting impact on team collaboration and knowledge sharing. Future research could include the suitability of various team structures based on team size, industry and type of project. Furthermore, future research could identify best practices on how VTs should be structured to assign roles and responsibilities to ensure knowledge is effectively and accurately shared.

Finally, many industries have adopted virtual teamwork, especially due to the COVID-19 pandemic, and a continued increase in the adoption of VT work in the future can be expected. While VTs add additional complexity to communication and collaboration in the form of distance, time and cultural diversity, further research is required to determine if and to what extent a hybrid approach mitigates these complexities.

Acknowledgements

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Appendix A. Authors Matrix – exemplifying sample

No.	Author(s)	Article title	Journal title	Publication year	Type of Research	Research Method	Industry	Core Concepts	Core Findings
1	Tarila Zuofa and Edward G. Ochieng	Investigating barriers to project delivery using virtual teams	Procedia Computer Science	2021	Primary research	Semi-structured interviews	Professional services - Nigeria	Barriers included: greater misinterpretations leading to uneven participation, limited performance, greater conflict, and lack of accountability, monitoring, lack of experience and ineffective personnel skills development.	1. Retaining the need for PMs to develop strategies for ensuring trust and constantly clarifying project goals & guidelines in virtual teams. 2. VTs can work better for the delivery of knowledge & service-based projects that involve design, analysis and planning. 3. Firms must have a clear understanding of parameters for projects it considers for implementing virtually 4. VTs offer cost savings & flexibility.

Appendix B. Quality Assessment Questionnaire

No.	Questions	Yes	No	Can't Tell	Not Applicable
1	Was the source of information used in the article credible?				
2	Were the author(s) and institute who published the article creditable?				
3	Was selection bias avoided in the information used to develop the data?				
4	Was the method used to develop the data appropriate?				
5	Was the method used to combine the findings of studies appropriate?				
6	Are the stated conclusions supported by the data presented?				
7	Were the data and overall article reported in a logical and systematic manner?				
8	Does the extracted data provide value in answering the research question(s)?				

Appendix C. Concept Matrix – exemplifying sample

No.	Article title	Concepts							
		Trust	Cultural diversity	Collaboration tools and technology	Communication and knowledge hoarding	Leadership	Psychological safety	Communication guidelines and training	Resource planning
1	Investigating barriers to project delivery using virtual teams	✓		✓		✓			
2	Advanced multi-phase trust evaluation model for collaboration between coworkers in dynamic virtual project teams	✓✓						✓✓	✓
Concept matrix key: ✓ - theme discussed in the article; and ✓✓ - theme discussed explicitly in the article									

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