Determinants of the Adoption of Virtual Team Collaboration as a Mode of Knowledge Transfer within Innovation Driven Organisations

Marius Anno van der Meulen[1][0000-0002-2385-3992] and Hanlie Smuts[2][0000-0001-7120-7787]

[1] Graduate School of Technology Management, University of Pretoria, South Africa
[2] Department of Informatics, University of Pretoria, South Africa
marno808@gmail.com, hanlie.smuts@up.ac.za

Abstract. Society 5.0 seeks to resolve social and economic imbalances through the integration of the virtual world and the physical world. Amid the COVID-19 pandemic the need and possibilities hereof has become so much clearer. This paper aims to shed light on the factors affecting the adoption of virtual team collaboration within innovation driven companies, as their primary mode of knowledge transfer. By getting insight into these factors, we will be on our way to enable individuals, companies and governments to promote effective adoption of virtual team collaboration. This in turn can reduce the knowledge gap that exists in developing post-colonial countries, by enabling knowledge to be better transferred between industries within the country and from outside the country. This paper provides an in-depth coverage of the existing literature starting by looking into knowledge transfer as a management principle, then looking at the innovation of virtual team collaboration itself and finally at the social system, an innovation driven organisation, into which the innovation will be adopted. The findings are then applied to the Diffusion of Innovation theory's Innovation-Decision Process. By understanding these key determinants, organisations may utilise this guidance in the application of virtual team collaboration (VTC) as a mode of knowledge transfer when considering innovation.

Keywords: Society 5.0, Virtual Team Collaboration, Innovation Driven Organisation, Knowledge Transfer, Knowledge Management, Diffusion Of Innovation, Innovation-Decision Process.

1 Introduction

In the age we live in, remote work, long-distance communication and virtual collaboration is becoming more of a reality every day, driven by the rapid improvements of the technologies that enable this [1, 2]. The capability to make use of the available technologies, to effectively replace face-to-face collaborating teams, can be a competitive advantage to any organisation driven to innovate [3]. Companies have the opportunity to collaborate across continents and share knowledge in this way [3]. However, not only companies can benefit from these innovations, but also educational institutions, such as Universities, can collaborate across borders and share and create

knowledge not limited to a single country's viewpoint [4]. Countries that are leading the charge in innovation can become more and more competitive on a global scale

In contrast to this, the outlook for African countries is not entirely the same [5]. After reaching political independence, African countries have not quite achieved full independence from their overseas powers. In the context of technology, Africa and, for this study, South Africa (SA) is still very much dependent on developed countries for technology and South Africa is continuously in a game of catch-up. SA makes great use of industrial work, but not that much on technology development. Through this dependence, SA can be construed as a technology colony with a knowledge transfer gap between the industrial sector and design and development sectors [5].

Bridging the knowledge transfer gap would mean to create the availability of a scientific or technology skill base within the design and development stage of the technology life cycle in industry [5]. In this creating exposure opportunities for indigenous knowledge workers at all stages of the technology life cycle. Enabling them to add value to technologies at earlier stages of the life cycle [5]. This in turn, shifts the SA industry towards a service and knowledge work industry [6], which places the intellectual property in SA [5]. This will enable SA to export the technology from SA and have the financial stem of the technology within SA [5]. Through VTC technology's ability to remove traditional boundaries such as time or geographical location VTC can happen on a global scale and can increase the competitive advantage of companies in SA and increase their operational flexibility [7]. Companies can break the communication barriers of time and distance and make use of VTC to do so [1]. A study into what determines the adoption of VTC by companies in SA, can possibly play a role in closing this knowledge transfer gap that is currently present in SA.

Therefore, this paper aims to add to the body of knowledge of knowledge transfer as well as present an informative document sheading light for companies on how VTC can be diffused and better adopted to decrease the current knowledge gap. This is done by exploring answers to the question: "*What are the determinants of the adoption of VTC as a mode of knowledge transfer within innovation-driven companies operating in SA*?" An understanding of the key determinants may enable organisations to consider VTC

The following section (Sect. 2) provides and in-depth overview of the literature followed by the methodology applied in Sect. 3. Sect. 4 presents the exploration of an adoption model and the final section (Sect. 5) concludes the paper.

2 Background

The little research and development that is done in SA, is at tertiary institutions and very little of that is retained in the country, but rather transferred, at an early stage to the more fertile technology centres or "hubs" overseas. Very little research gets transferred to development and thereafter manufacturing within the borders of SA. This creates a knowledge transfer gap within the industry technology life cycle [5]. Knowledge transfer can be improved, in and into SA through virtual team collaboration (VTC). The need for better knowledge transfer arises on the level of a larger social system, namely

the country. But for this need to become addressed, it needs to become the need of multiple smaller social systems, such as companies or industries, in the larger social systems [8]. With improved adoption of virtual team collaboration, as an innovation, in organisations in SA, it might be possible to bridge this gap in knowledge transfer.

In the remainder of this section, an overview of knowledge transfers aspects, virtual team collaboration and innovation driven organisations are presented.

2.1 Knowledge Transfer

Knowledge can be described as information that has been processed by an individual [9]. Knowledge is either tacit or explicit [10]. Tacit knowledge refers to the concrete know-how and physical skills that one might attain through experience and repetition of certain tasks. It involves parallel processing complexities of current problems at hand, to develop a subjective understanding based on one's own values. In contrast to this, explicit knowledge is objective, discretely recorded knowledge that can be understood in a linear fashion upon consumption [10].

There are six knowledge management processes identified from literature that play an essential role in the transfer of knowledge. *Knowledge discovery and detection*, to recognise and categorise knowledge. *Knowledge organisation and assessment*, to ensure successful identification, retrieval and understanding of knowledge [11]. *Knowledge sharing*, which is an obvious part of knowledge transfer, but which is an incredibly important part and a critical competency any organisation needs to develop [9, 11]. *Knowledge reuse* of created knowledge, needs to be properly managed, since for a lot of companies this also is a source of competitive advantage[12]. *Knowledge creation* is implemented through practice, collaboration, interaction and education [10]. *Knowledge acquisition* meaning knowledge obtained from external sources [13].

Nonaka [10] observed that it is through continuous iterations of communication between individuals that ideas get developed into knowledge. This communication happens in communities of interaction such as work teams. In this study it is proposed that VTC can be used to extend the reach of these communities, by allowing inputs from overseas sources, at the inception stage [8, 14]. At the same time, this deviation from the norm of communication creates challenges to the effective transfer of knowledge.

Knowledge is one of the linchpins of an organisation's competitive advantage and the foundation for a lasting advantage as it cannot be easily transferred or replicated outside the organisation [15]. Knowledge is the justified belief or understanding of information on a subject that is obtained through previous experience and that enables an entity to take more effective action [1, 16]. Individuals form ideas in their heads and according to Nonaka [10] this is exactly where they remain unless validated through social interaction and knowledge transference. This interaction creates shared meaning within an organizational context and shapes the collective interpretation of events [17].

2.2 Virtual Team Collaboration

According to Townsend, Demarie [6, p.18], virtual teams (VTs) can be defined as "groups of geographically and/or organisationally dispersed co-workers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task. A slightly more recent definition of virtual teams states that it is a team that functions, through using technology in various degrees to collaborate, across locational, temporal and relational boundaries [18]. Virtual teams rarely, if ever, meet in a face-to-face setting". Although it was found that virtual teams are a more popular topic in research it was decided to differentiate between VTs and VTC, where finding VTC adoption determinants will be the aim of this study. Adding on to the definition of virtual teams, virtual team collaboration is the method of knowledge transfer between VT team members. Virtual team work has a lot of advantages and disadvantages for team members and although virtuality has sometimes been found to impede the performance of teamwork, this is not a unanimous finding as there are ways to mitigate negative effects of virtuality [3]. Mbatha, Ocholla [19] found that the use of information communication technology tools, and it is assumed by association VTC as well, is limited and underdeveloped in African countries. The companies that might need this most are especially the small to medium enterprises (SMEs) who are located in a single location, struggling to expand past certain physical borders [20].

Individual knowledge is legitimized by social interaction [10] it thus stands to reason that knowledge transfer should often occur within a team context. But the way we collaborate in teams can also be altered to include virtuality. Which might increase or decrease the efficiency with which this happens through the necessary tools and structures [2, 17, 21]. Virtual team collaboration is discussed through the dimensions of virtuality, tools and success factors to the effective use of VTC. Larson and Dechurch [22] define virtual collaboration as "remote communication through digital tools". Knowledge collaborations happens through activities between two or more people using a structured platform which enables them to achieve these objectives [1]. Add a dimension of virtuality on to that and you can infer that VTC is the method or design of knowledge transfer inherent in the way these VTs function. VTs are often temporary and only last for a predetermined time, which can have a negative effect on the members of such a team and does not give them a chance to build a shared meaning [17, 23] or social capital [1]. This is why it is proposed to use VTC as a primary mode of KT to improve the possibility of shared meaning building in VTs as they will be constantly in use and virtual social spaces can be structured as a necessary part of these companies [1]. The perceived ability to build shared meaning in temporal teams can possibly affect the adoption of VTC. In addition to this VTs should meet occasionally to improve these social structures, so an organisation's abilities to enable this occasionally over large distances can also determine whether the adoption of VTC will remain in place for an organisation[17, 24].

Among the challenges of using virtual team collaboration or working in virtual teams is the intercultural differences between members if the teams are geographically dispersed [17]. Cultural differences create a lack of shared meaning in a life world level. This means that there are differences in how we automatically interpret information

based on previous experiences. Creating this shared meaning based on other levels usually takes effort in any organisation and is easier to do in person[17]. South Africa is in a unique position of great multiculturalism, which means the individuals are better adapted towards cultural differences [25].

2.3 **Collaborative tools**

The improvements of collaborative technologies is what has enabled us to move in any instance from traditional face-to-face collaboration to different levels of virtuality over the years [26]. Collaborative technology is an overarching term used to describe tools such as wikis, blogs, podcasts, chat platforms, video conferencing, enterprise social media, messaging or emailing applications and file sharing platforms [22, 26]. And for a team to effectively use these tools, they need a certain level of information communication technology (ICT) competency and efficacy or self-efficacy. This self-efficacy can be a barrier to the adoption of VTC but can also be improved through training in these tools. So sequentially an organisation's perceived ICT training ability can also influence whether they decide to adopt VTC or not [27].

This said, VTC is media dependant, as collaboration in VTC is mediated through technologies, this makes them technology dependant [26, 27]. So a necessary requirement for VTC is some form of groupware technology, giving it the knowledge repositories and functionalities to create shared-objects-of-work amongst participants[17]. This space should allow for articulation of work, construct meaning around objects and agreements around how meanings will be assigned [17]. This technology should enable all the KT processes to be successful. VTC tools serve as a form of group memory enabling the re-use of knowledge by current members or induction of new members into what has been done [26].

The knowledge, skills, abilities and other (KSAO) characteristics of individual team members also influence the performance of a virtual teams [3] and whether members are perceived to have these KSAOs can be assumed to influence the decision to adopt or reject VTC. These KSAOs include for example: knowledge of media transfer, communication skills, willingness to trust others and share knowledge[28], ability to work with people from other cultures and, self-, time-, and project management abilities [3]

Collective KSAOs are important in any team, whether virtual or face-to-face and are for example cognitive emergent states of shared mental and transactive memory, affective mental states of cohesion and trust, and behavioural integration processes [22]. One of necessary characteristics to the performance of VTs, whether for individuals or the collective is the ICT efficacy and the training processes around the use of ICT [29]. How easily the technology can be implemented and adapted to the organisational structures also determines whether it will be adopted and used on a continuous basis.

The use of VTC as primary mode of transfer has certain perceived pros to its adoption by an organisation. It gives an organisation access to worldwide markets and can bring together experts and their knowledge regardless of location. It also has pros to the individual within a team like flexible hours and reduced traveling times. It however also has disadvantages to it such as difficulty working with the technology, asynchronous communication in different time zones, new industry and organisational norms

need to be established, and cross-cultural challenges across different countries or provinces. Some of the mentioned benefits can also become hindrances where a VT member working from home struggles to draw the line between work and their personal life causing conflict and mistrust in teams[7].The perceived benefits and disadvantages to the adoption on both an individual and organisational level is believed to influence the adoption decision of VTC [3].

2.4 Innovation Driven Organisations

Van De Ven [30] defines innovation as" the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order". Described differently, innovation relates to the adoption or rejection of an idea that is perceived to be new. For this study, the adoption of VTC as primary mode of knowledge transfer will be studied through companies that is believed to include the idea of continually innovating processes as a part of their competitive strategy. This is because these companies are most likely to have previously adopted or rejected VTC or might plan to do so in the future. An organisation's innovativeness is thus already an antecedent to the adoption of any innovation [8], especially one that has a chance of increasing the interconnectedness of individuals in an organisation, which by itself will perpetuate innovativeness [8, p. 326].

Innovation should ideally also be at the frontend of an organisation's operations, rather than reactive to its environment [10]. Innovativeness is structured and defined by organisational leadership [22]. This consistent and endured innovativeness is an indicator of behavioural change. Where innovation champions for VTC are either opinion leaders within an organisation or part of the decision-making unit, innovation adoption is more likely to happen. [8, 31]. Diffusion and adoption of innovation needs to happen within a social system [8, p. 27]. The reasons for studies into innovation is either for marketing reasons or for strategic organisational management reasons [31], and this study aims to study adoption of innovation for both, but through the strategic management view of why an organisation would adopt VTC. It studies the adoption of innovation within an external social system of a country and through a study unit of an organisation.

Among the possible influences on an organisation's innovativeness is leadership and how agile, responsive and transformational it is [22]. Another factor is the organisational culture and willingness to embrace initiatives [32]. How the decision making is done within the organisation can also determine whether or not an innovation will be adopted, in other word how much power is in the hands of a small number of people can possibly negatively or positively affect the adoption of innovations [33]. Complexity of organisations (the level of experience and expertise) has been found to be positively correlated to innovativeness. Formality and interconnectedness within companies has been found to negatively affect the innovativeness of a company. Organisational slack (having more resources than needed) has been found to be positively correlated to innovativeness, along with the organisational size [33]. An organisation that sees itself as entrepreneurial might also be prone to risk taking and it can be proposed that

this might also influence its innovativeness [34]. An innovation also needs to fit into the organisational systems as is, without too much adaption [8].

For an organisation to be seen as an innovation driven organisation in this study, it thus has to constantly adopt new processes and exert innovative behaviour over a large period of time [31]. Ruvio, Shoham [35] confirmed 5 constructs that can also be used to measure an organisations innovativeness, and which will also be used along with traditional measure of number of innovations adopted over time. These are: *Creativity,* the focus of an organisation to adopt or creating new ideas. O*rganisational openness,* an organisational ability to flexibly respond to new ideas or industry changes. *Future orientation,* which is a temporal measure of how prepared an organisation is for future environmental changes and its positioning in perspective to these changes. *Risk taking,* the measure of how willing managers are to make large risky resource commitments, considering the possible gains or losses relating to these risks. *Pro-activeness,* an indication of a organisations pursuit of business opportunities to overcome inertia. Organisations with higher levels of innovation adopt more [35].

3 Methodology

The purpose of our research is to identify the key determinants organisations may consider in the application of VTC as a mode of knowledge transfer. design science where the research aim is on utility [36]. We followed a design science approach where the research aim is on utility, i.e. key determinants in this instance [37, 38]. In particular, we applied the design science research conceptual framework proposed by Hevner et. al [39] that consists of 3 aspects: environment, knowledge base and research.

Firstly, *environment* refers to people, organisations and technologies defined as business needs through organisational strategies, organisational structures, as well as roles and characteristics of people working within the organisations. Secondly, the *knowledge base* points to the scientific foundations such as frameworks, constructs or models, as well as methodologies such as data analysis techniques and measurement. *Research* is then conducted based on two complementary phases, develop and build, and justify and evaluate, guided by the articulated business need and anchored in applicable knowledge from the knowledge base.

The design artefact, in our study the determinants of the adoption of VTC as a mode of knowledge transfer, contributes in its application to the context where the business need was identified. By applying the proposed framework for information systems research, a research project addresses the utility of a new artefact and presents the evidence in support of the research project outcomes. Hence, the research problem, the artefact and its utility must be presented in such a manner that the implications for both research and practice are clear.

The scientific foundation that guided our study is Rogers' [8] innovation-decision process (IDP) i.e. the process an individual or decision making unit goes through sequentially when making a decision to adopt an innovation or not [8]. The phases of this process include knowledge, persuasion, decision, implementation and confirmation. They are described by Rogers in his book Diffusion of Innovation [8], as:

- **Knowledge.** When the unit learns of the existence of the innovation and seeks to reduce the initial uncertainty about it through outlets such as mass media.
- **Persuasion.** When the unit evaluates the knowledge it gathered to form an opinion on the innovation.
- **Decision.** When the decision to start implementing it takes place and the innovation is groomed for implementation and if possible, it is used on a trial basis.
- **Implementation.** Comes after the decision and trial when the innovation is put into practice, but the user is still uncertain and needs assistance.
- **Confirmation.** When the unit seeks for reinforcement on the efficacy of the innovation and whether it should not discontinue its implantation.

The process is also illustrated along with the generic adoption determinants in Fig. 1.

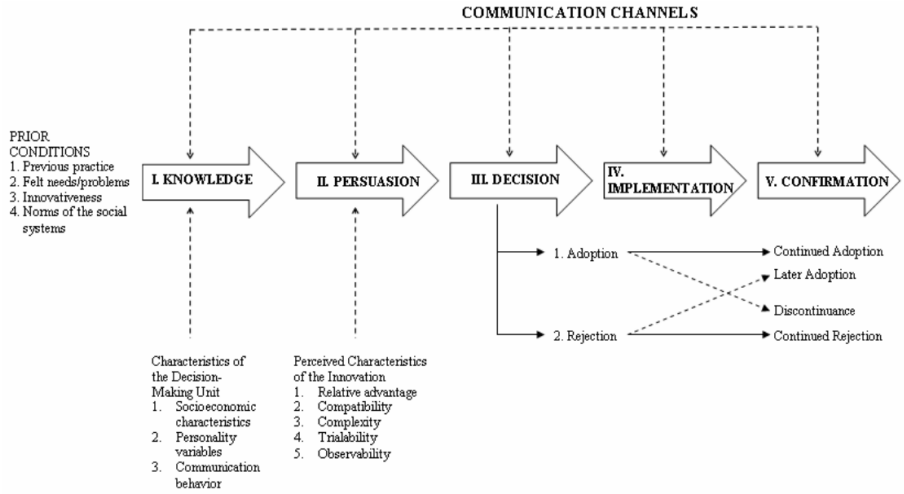

Fig. 1. Rogers's visualisation of the Innovation-Decision Process[8, p.185]

By applying this Innovation-Decision Process, we consider the key determinants of adopting VTC as knowledge sharing mechanism.

4 Exploring the key determinants of adoption of Virtual Team Collaboration for knowledge sharing

In order to directly relate the background knowledge to the adoption of VTC in Innovation Driven Organisations specifically, this paper proposes to view the process through a window of the three domains of research. These domains are the social system within which the adoption takes place, the Innovation Driven Organisation in this case. The management principle of knowledge transfer and finally the innovation, VTC, itself which is adopted from an external environment. Finally, it is also suggested that the adoption of the innovation be viewed through the looking glass of the Innovation-

Decision Process. Fig. 2 is an illustration of the how these different factors contribute to the determinants to adoption.

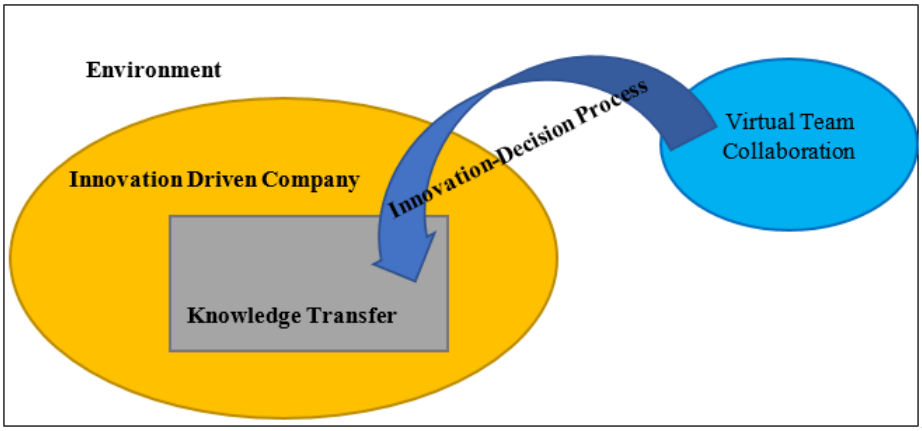

Fig. 2. Proposed interaction between adoption affecting factors (author contribution)

Fig.3 Shows the proposed mapping between the theory in Section 2 of this paper and the DOI model. These are only the primary determinants extracted from the theory and not an exhaustive list.

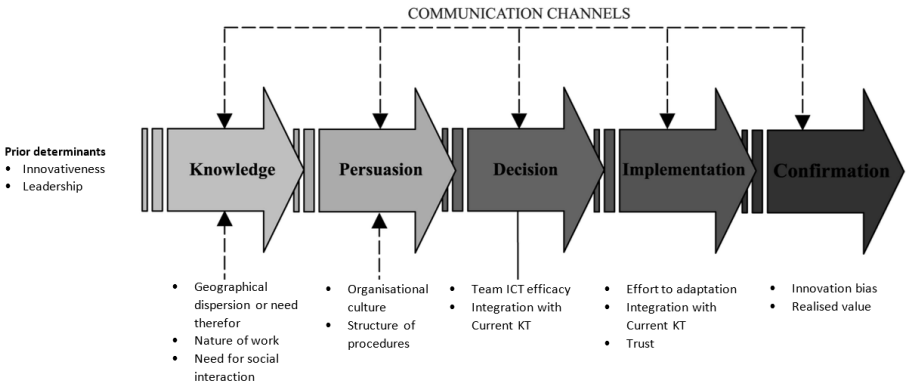

Fig. 3. Proposed DOI mapping for adoption of VTC as KT mode (adapted from Rogers [8, p.185])

In Fig.3 the authors compared the existing literature found in section two and placed the primary determinants from the literature into the different stages of the Innovation-Decision Process as defined in the DOI theory. This was based on the context of the theory and where it was found to be most applicable, starting with prior determinants that affected the decision even before the organisation gathered any knowledge on the innovation and ending with the confirmation stage.

5 Conclusion

The paper shows multiple dimensions of factors affecting the adoption of VTC as a primary mode of knowledge transfer. These factors whether implicit or explicit can improve the way future research sees the adoption of this innovation.

By applying the information contained in this paper prospective adopters of VTC can see what to take into account when making their decisions. Companies and governments can promote the adoption of this innovation better than before and developers designing VTC tools can create a better product by taking this information into account.

Further to the research methodology and particular design science framework followed, this paper still lacks the application of industry knowledge through a possible longitudinal or cross-sectional study, which will be the next step to an ideal and practical view of what would determine the adoption of VTC as knowledge sharing mechanism.

References

1. Gao, S., et al., *Factors affecting the performance of knowledge collaboration in virtual team based on capital appreciation.* 2015.
2. Hacker, J.V., et al., *Trust in Virtual Teams: A Multidisciplinary Review and Integration.* Australasian Journal of Information Systems, 2019. **23**.
3. Schulze, J. and S. Krumm, *The "virtual team player":A review and initial model of knowledge, skills, abilities, and other characteristics for virtual collaboration.* Organizational Psychology Review, 2017. **7**(1): p. 66-95.
4. Swartz, S., B. Barbosa, and I. Crawford, *Building Intercultural Competence Through Virtual Team Collaboration Across Global Classrooms.* Business and Professional Communication Quarterly, 2020. **83**(1): p. 57-79.
5. De Wet, G., *Emerging from the technology colony: A view from the South.* 2010.
6. Townsend, A.M., S.M. Demarie, and A.R. Hendrickson, *Virtual teams: Technology and the workplace of the future.* Academy of Management Perspectives, 1998. **12**(3): p. 17-29.
7. Horwitz, S.K. and C. Santillan, *Knowledge sharing in global virtual team collaboration: applications of CE and thinkLets.* Knowledge Management Research & Practice, 2012. **10**(4): p. 342-353.
8. Rogers, E.M., *Diffusion of innovations*. 2010: Simon and Schuster.
9. Wang, S. and R.A. Noe, *Knowledge sharing: A review and directions for future research.* Human Resource Management Review, 2010. **20**(2): p. 115-131.
10. Nonaka, I., *A Dynamic Theory of Organizational Knowledge Creation.* Organization Science, 1994. **5**(1): p. 14-37.
11. Alavi, M. and D.E. Leidner, *Knowledge management and knowledge management systems: Conceptual foundations and research issues.* MIS quarterly, 2001: p. 107-136.

12. Forsgren, N., R. Sabherwal, and A. Durcikova, *Knowledge exchange roles and EKR performance impact: extending the theory of knowledge reuse.* European Journal of Information Systems, 2018. **27**(1): p. 3-21.
13. Gaines, B.R., *Organizational knowledge acquisition*, in *Handbook on Knowledge Management 1*. 2004, Springer. p. 317-347.
14. Cetindamar, D., R. Phaal, and D. Probert, *Technology management: activities and tools*. 2016: Macmillan International Higher Education.
15. Almeida, P., R. Grant, and A. Phene, *Knowledge acquisition through alliances: Opportunities and challenges.* The Blackwell Handbook of Cross-Cultural Management, 2017: p. 67-77.
16. Chhim, P.P., T.M. Somers, and R.B. Chinnam, *Knowledge reuse through electronic knowledge repositories: a multi theoretical study*. Journal of Knowledge Management, 2017. **21**(4): p. 741-764.
17. Bjørn, P. and O. Ngwenyama, *Virtual team collaboration: building shared meaning, resolving breakdowns and creating translucence.* Information Systems Journal, 2009. **19**(3): p. 227-253.
18. Martins, L.L., L.L. Gilson, and M.T. Maynard, *Virtual Teams: What Do We Know and Where Do We Go From Here?* Journal of Management, 2004. **30**(6): p. 805-835.
19. Mbatha, B.T., D.N. Ocholla, and J.L. Roux, *Diffusion and adoption of ICTs in selected government departments in KwaZulu-Natal, South Africa.* Information Development, 2011. **27**(4): p. 251-263.
20. Tesar, G. and Z. Vincze, *Motivating SMEs to Cooperate and Internationalize: A Dynamic Perspective*. 2017: Routledge.
21. Gibson, C.B. and S.G. Cohen, *Virtual teams that work: Creating conditions for virtual team effectiveness*. 2003: John Wiley & Sons.
22. Larson, L. and L.A. Dechurch, *Leading teams in the digital age: Four perspectives on technology and what they mean for leading teams.* The Leadership Quarterly, 2020. **31**(1): p. 101377.
23. Chamakiotis, P., et al., *The role of temporal coordination for the fuzzy front-end of innovation in virtual teams.* International Journal of Information Management, 2020. **50**: p. 182-190.
24. Baker, J., *The technology–organization–environment framework*, in *Information systems theory*. 2012, Springer. p. 231-245.
25. Singh, P. and R. Rampersad, *Communication challenges in a multicultural learning environment*. Journal of Intercultural Communication, 2010. **23**: p. 1404-1634.
26. Raghupathi, V., *Changes in Virtual Team Collaboration With Modern Collaboration Tools.* i-Manager's Journal on Information Technology, 2016. **5**(2): p. 5-13.
27. Majchrzak, A., et al., *Technology Adaptation: The Case of a Computer-Supported Inter-Organizational Virtual Team.* MIS Quarterly, 2000. **24**(4): p. 569-600.
28. Alsharo, M., D. Gregg, and R. Ramirez, *Virtual team effectiveness: The role of knowledge sharing and trust.* Information & Management, 2017. **54**(4): p. 479-490.
29. Lin, C.-P., C.-K. Chiu, and N.-T. Liu, *Developing virtual team performance: an integrated perspective of social exchange and social cognitive theories.* Review of Managerial Science, 2019. **13**(4): p. 671-688.

30. Van De Ven, A.H., *Central Problems in the Management of Innovation.* Management Science, 1986. **32**(5): p. 590-607.
31. Subramanian, A. and S. Nilakanta, *Organizational innovativeness: Exploring the relationship between organizational determinants of innovation, types of innovations, and measures of organizational performance.* Omega, 1996. **24**(6): p. 631-647.
32. Fuller, M.A., A.M. Hardin, and C.L. Scott, *Diffusion of virtual innovation.* ACM SIGMIS Database, 2007. **38**(4): p. 40.
33. Lundblad, J.P., *A review and critique of Rogers' diffusion of innovation theory as it applies to organizations.* Organization Development Journal, 2003. **21**(4): p. 50.
34. Gabriel, M.L.D.d.S. and D. Da Silva, *DIFFUSION AND ADOPTION OF TECHNOLOGY AMONGST ENGINEERING AND BUSINESS MANAGEMENT STUDENTS.* International Journal of Innovation, 2017. **5**(1): p. 20-31.
35. Ruvio, A.A., et al., *Organizational Innovativeness: Construct Development and Cross-Cultural Validation.* Journal of Product Innovation Management, 2014. **31**(5): p. 1004-1022.
36. Venable, J., J. Pries-Heje, and R. Baskerville, *FEDS: a Framework for Evaluation in Design Science Research.* European Journal of Information Systems, 2016. **25**: p. 77–89.
37. Kuechler, B. and V. Vaishnavi, *A Framework for Theory Development in Design Science Research: Multiple Perspectives.* Journal of the Association for Information Systems, 2012. **13**(6): p. 395-423.
38. van der Merwe, A., A. Gerber, and H. Smuts, *Guidelines for Conducting Design Science Research in Information Systems*, in *Communications in Computer and Information Science: ICT Education*, B. Tait, J. Kroeze, and S. Gruner, Editors. 2020, Springer: Cham. p. 163-178.
39. Vaishnavi, V. and B. Kuechler *Design Research in Information Systems. DSR in IS, [Online]. Available: http://desrist.org/design-research-in-information-systems/*. 2004.