
Activity Theory as a Tool for Understanding Complexities in Extended Organizations

Paul Peter Bata^{*}, Norman Alistair, Allen David

Division of Management, Leeds University Business School, University of Leeds, Leeds, United Kingdom

Email address:

polpitabata07@yahoo.com (P. P. Bata), A.W.T.Norman@lubs.leeds.ac.uk (N. Alistair), D.Allen@lubs.leeds.ac.uk (A. David)

^{*}Corresponding author

To cite this article:

Paul Peter Bata, Norman Alistair, Allen David. Activity Theory as a Tool for Understanding Complexities in Extended Organizations. *Science Journal of Business and Management*. Vol. 10, No. 1, 2022, pp. 47-54. doi: 10.11648/j.sjbm.20221001.17

Received: February 4, 2022; **Accepted:** February 23, 2022; **Published:** March 18, 2022

Abstract: The paper compares third generation activity theory (3GAT) and fourth-generation activity theory (4GAT) in extended organisations with multiple relationships that can be characterised as complex. The complexities are associated with the modern work environment with its complicated business processes and potentials for information sharing failures. 3GAT is a proven way of looking at multiple relationships in general but not sufficient in explaining the types of complexities associated with such complex and extended organisational settings possessing potential for lack of congruence of both physical and non-physical tools with which stakeholders engaged. Therefore, fourth generation activity theory was adopted in this study as a positive means of dealing with changes that support the new ways of working found in modern working environments which are increasingly concerned with shared objects. The types of complexities and extension in the setting drives contradictions which points to actual, or potential are as of failure, and in responding to these complexities (caused due to the lack of congruence in the different activity systems) knots form in a different way from the majority of other settings which have been researched. Understanding why the knots behaves in that way can be illuminated using 3GAT but does not necessarily resolve all the issues and nuances of the setting. Hence, 4GAT is seen as 1) a way of understanding the setting or problem issues. 2) understanding the needs and abilities of collaborating partners in understanding complexities and how to manage them and 3) understanding different elements that enhanced the achievement of relationship goals.

Keywords: Complex and Extended Settings, Complexities, Extension, Activity Theory, Organisational Goals

1. Introduction

The 21st-century workplace which is technological and multicultural has witnessed a dramatic change over the past 15 years [22]. We see, for example, the practice of non-employer firms which are famous for contracting responsibilities and using ad hoc collaborations [36]. These firms are extended as they rely on others to fulfil their responsibilities to their stakeholders. The argument that works changes, which have been rapid, are often, even usually, accomplished by the use of work team rather by a single worker [22] explains and supports the concept of extended organisations. This study used an examination organisation as case study and the data collected identified the use of teams as a way of working in complex and extended settings where different specialisms are needed in

the form of division of labour [5] and especially the use of knots in solving extension problems. However, what this study needs to understand is what factors are responsible (which act as a vehicle and not a primary outcome) for how these knots form and why these knots are different from other knots in academic literature.

Extension in this paper is seen as the extent to which an organisation has to collaborate across a set of other institutions to meet the aims it has to achieve which, according to [18], is complex. Such extension requires the organisation to manage and accommodate different relationships with a range of stakeholders and to maintain flexibility in these relationships which recognises and attempts to reconcile areas where there may be a lack of congruence between aims, systems and processes. Some of the relationships observed in this setting are based on, and governed by, well-articulated and formal contractual

arrangements while others are on evolved and simple methods (arrangements) which, while accepted and accommodated, are subject to far lower levels of formality and governance.

Any extension is considered potentially complex as it brings with its uncertainties and the potential for failures of information sharing. This paper, therefore, looked at an extended setting and the potential deficiencies caused due to contradictions and the lack of congruence in the different activity systems that provides specialised services for the central organisation. The deficiencies exposed in this study are multi-layered and multi-sourced and have enshrined within them the potential for information sharing failures.

The debate on the nature of extended organizational arrangements has been discussed in the organisational research area under different forms of working, and by different scholars, including, among many others, [32]; Provan & Lemaire [30, 34, 18]. However, the argument remains that there are still no definitive conclusions on issues regarding organisational extension and the impact on operations [31], p. 479; [30], p. 368). Indeed, many other factors come in to play in making extended relationships also complex which needs understanding and exploration to avoid reducing organisations' effectiveness, productivity, or efficiency [30]. Thus, the issue of extension and its complexities need to be understood in a clearer way that will help modern day organisations achieve their goals. This paper aims to advance this understanding through the use of activity theory to examine a specific case.

Activity theory in this study serves both as a framework and a tool for the understanding of these complexities caused by extension which, in turn, have potentials to cause information-sharing failures. In trying to understand these complexities, the paper compares 3GAT which has so far been used in this study as it makes provision for such collaboration within different activity systems by helping us to understand 1) issues of change [22] 2) issues of expansive learning at work [15]. On the other hand, the debate on the use of 4GAT is ongoing and suggests that it is a positive tool for dealing with the modern workplace and its modifications that support the new ways of working found in modern working environment concerned with shared objects [36]. 4GAT has been applied in research to help in understanding, and as a means of improvement of, extended relationships [20]. The finding of our data which is about knots in complex and extended organisations suggest that knots form in extended organisations, however, the understanding of how these knots form and why these knots are different from other knots in academic literature is the area that may require comparing the illuminatory power 3GAT and 4GAT. This contrast will help in exploring the extent to which 4GAT has something to offer in increasing our understanding of the setting by 1) looking at barriers affecting multiple relationships, 2) understanding of needs and ability to meet these needs and 3) understanding the elements that aid and enhance the achievement of relationships goals.

Third generation activity theory has guided the process of this research from beginning to analysis stage as it took into consideration multiple activity systems as in the case of 21st-century work environment and as a part of a setup of different activity systems that, in its totality, creates the need to interact with each other. However, it is not sufficient in explaining the various complexities that arise based on extension such as seen in teams or in modern day division of labour based on shared object [32]. Nevertheless, the process has helped in exposing extended relationships as a collaboration process which is deemed necessary for organisations to deliver the business' aims and mandate [33, 30, 36, 18]. These relationships serve as a way of providing the expertise the main organisation lacks and which is necessary to meet their goals. Achieving these goals requires knowledge management and information exchange as a way of communication and dealing with different work process [16]. This form of collaboration is both the driver of, and driven by, extension which is complex as different operational methods come into play and different tools are needed to communicate with collaborating partners in achieving congruity around shared objects.

The rest of the paper is structured as follows. Section two explores activity theory and potential limitations in relation to extended organisations, section three highlights the role of contradiction and congruency in extended relationships, section four recounts the research method and findings, section five compares third and fourth generation activity theories in understanding complexities and section six provides concluding remarks.

2. Activity Theory and Potential Limitations in Relation to Extended Organisations

Activity theory (AT) pioneered by a group of Soviet psychologists headed by Lev Vygotsky (1896-1934) and the approach was chosen for this study as the theory considered human action and its interaction with the object of activity. It uses the object-oriented activities as a prime unit of analysis as the theory accommodates other activities as well which are undertaken by external partners in extended relationships. It also takes into consideration work/activity systems performed by more than one actor within the environment where culture and other complexities are considered in the activity [15]. The theory is synonymous with identifying areas of tensions and contradiction which can be linked to failure and driving change in activity systems.

The general concept of AT in the past has not been extensively applied to the study of human performance at work but rather, it has more often been used in circumstances where social and organisational problem understanding is needed, such as "developmental work research" and work activity dynamics [6]. The characteristics of activities in the theory according to [39] it's mediating; pragmatic; situated;

provisional and contested abilities, however, when many activities are undertaken at the same time, there are tendencies that some difference will emerge, which may eventually cause tensions and contradictions among activities and the constituent activities are not fixed but change with the conditions [29].

Khayyat (2016) described AT as an approach that is still evolving and developing and states that three generations of the theory have so far been put to use and their limitations also identified. He described the first-generation activity theory (1GAT) as being individualistic as it only considered one subject and the tool use to achieve and object. Part of the limitation of 1GAT is that it did not consider the social aspects of relationships and other factors needed to for extended relationships [28, 20].

Second-generation activity theory (2GAT), developed with the expansion of a larger activity triangle to include the rules, community and division of labour as components, was proposed by Engestrom who defined a system of activity as a collaborative process which serves as the generator for a constantly emerging context [14]. This took care of the limitation identified in 1GAT and one of the core features of 2GAT is regarded as its unit of analysis which is based in purposeful human action and shows how the components in the activity system evolve in coordinating the other components driven by systems, aimed at resolving contradictions. 2GAT also gives a conceptual idea of the distribution of human action, and it considers other people who have relationships with the system, i.e. the community and different division of labour. However, according to [20] like 1GAT, 2GAT is limited by its ability to have more activity sharing one object (shared object) and for that it does not really consider multiple relationships in depth especially the type found in complex and extended settings.

The third-generation activity theory (3GAT) is presently the current stage of application developed and used in most research as it ratifies and take into consideration the multiple activities are part of a setup of different activity systems that are based on the idea of a shared object [32], thus helping in the understanding of how extended organisations relate to others and the shared object - which also depicts multiple relationships. Some difficulties are still experienced in the understanding of how the setting works as consideration has not been given to the environmental surroundings and its barriers, the needs and abilities of collaborators. It also did not give room for improvement by way of allowing other elements to be introduced to aid or enhance the achievement of organisational goals.

3. The Role of Contradiction and Congruency in Extended Relationship

Contradiction is defined by [2] as “*anything within an activity system that opposes the overall motive of the system*”. Thus, in this study contradiction is used as an indicator of failure / instability in the system, with potential

to drive change in either of the two directions as observed in the case study situation, 1) *specialised expertise* as knots form to handle the problem and disband or 2) plans are put in place using different teams and groups to manage such problems. The process of transforming the shared object to the desired outcome is affected by any form of contradiction or misfit which is why direction 1 or 2 were put in place as reactions to the failure / instability. In the two scenarios the different activity systems combined and input their services into the shared object. The processes guide the shared object and activity system processes to deliver the desired outcome. An example is having a range of activity systems that input into the examination process to produce a (shared object of) the credible certificate. This different system has different specialisation needed for the examination to be successful and different motives too, some provide expertise as markers, some as supervising team while other serve as custodians to the examination questions or some invigilators. While the different motives come into play for a shared object which is the credible certificate, it becomes difficult to comprehend the complex nature of such extended relationships as different types of contradictions are found within the component of activities (using different tools in communication with the overall activity system) or between constituents’ activities (tools and community using them).

While the need for achieving credibility of the certificate becomes imperative to all its stakeholders, the system requires stability by way of congruency in the different activity systems and a greater understanding of stakeholders. This is achievable by way of information sharing amongst the collaborating partners for better understanding of partner’s capabilities [24] and for coping with environmental uncertainties [40]. Therefore, information sharing is a primary strategy for achieving organisational success and a process for increasing efficiencies and performance [42].

4. Research Method and Findings

An interpretive research paradigm was the guiding focus that informed the study, it considered individual’s perception of what reality is, which varies between people and is socially constructed from one person to another [37]. Accordingly, AT provides an appropriate lens for understanding the phenomena driven by extension and thus having engendered in it, complex. The study used semi-structured interviews, observations and document analysis in collecting empirical data from four different groups:

- 1) employees of an examination organisation which comprise management and middle level staff of the organisation,
- 2) stakeholders consisting of other examination organisations, ministry staff supervising the organisation,
- 3) teachers who form part of the examination team, school proprietors and custodians of examination materials,
- 4) certificate end users (Universities, certified skilled workers, and employers of labour.

A total of 46 interviews and eight different scenarios of observations were carried out totalling 42 hours of observation with an average of between 4 to 6 hours a day over a 23-day period.

To make sense of the qualitative empirical data collected Nvivo was used to undertake four basic processes of integrating the data; organising it; exploring it by means of querying the data and, finally, interpreting it. During the process of exploring and interpretation a holistic view of the settings was exposed, including the processes, and some initial insights to problems that affect sharing were identified - which include among others the level of awareness of the need for exchange of information, the lack of congruity of tools, and lack of ability to meet the needs of the relationships. The problems identified affect the shared object of examination and the transformation of the outcome to credible certificate. This affects the prime purpose of the examination organisation as their goal achievement is threatened if their output (the certificate) loses credibility. Consequently, the system has devised a way of responding to such extended relationships and consequent failures / tensions / contradictions by way of knots formation. However, the knots observed are slower than reported in other settings, and membership of them is 'crafted' as opposed to spontaneous / rapid. There is also a tendency for a specialised member making up membership of one knot to, either sequentially or simultaneously, have membership of another similar knot.

Although there is no settled definition of knot -working according to [21] knot-working is a new means of working characterised by a group of workers. It is also a way of solving problems of expertise and recruiting specialised members [13]. Despite the different ways the phenomenon is perceived, the practice is seen in various disciplines today as it serves as a means of improving collaboration [5]. Knot-working is characterised as a "short-lived" way of problem solving but efficient in accomplishing task [9], p. 25) this same concept is still open to different application and empirical testing in different areas of research.

Bleakley, A., (2013) described the shift as seeing knots as a way of problem solving to a way of managing complexity at work [9]. Similarly, [21] describes knot-working as a new way of working characterised by a group as a vital part of quality working in knots. The new way of working and the new shift is perceived as proactive development where organisations don't sit and wait for problems to happen but find ways of understanding them and managing tensions / issues through collaborative working [19].

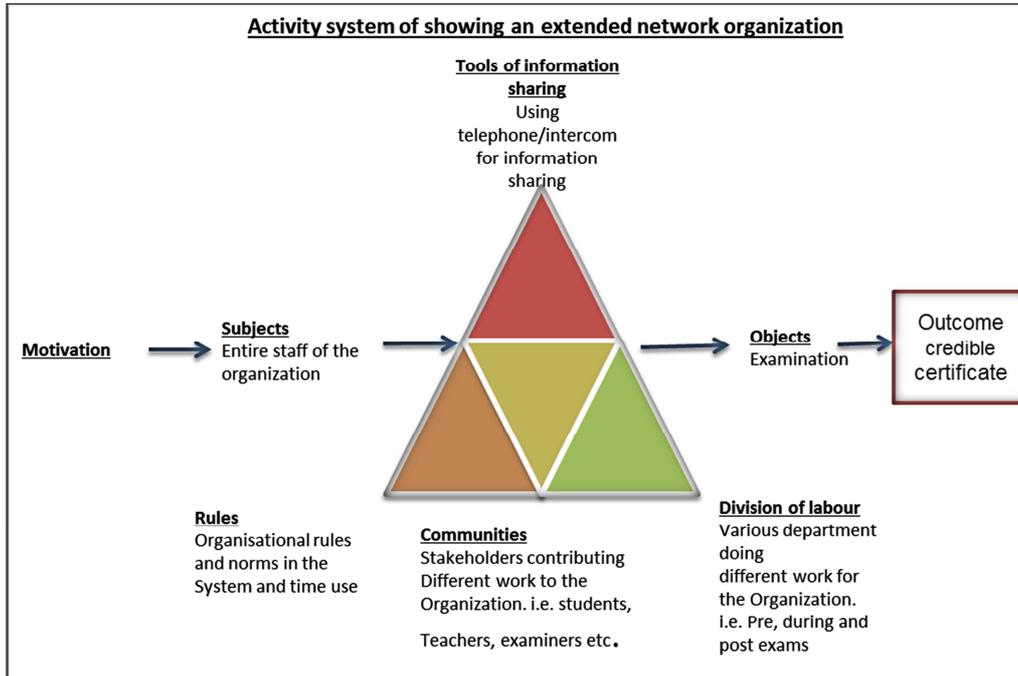
The focus now is the understanding of the knots that form in the case study organisation which we observe to be different from the rapid and immediate formation reported in much literature to date [13]. Despite differences, they remain recognisable as knots as they are used as plan for professional interaction and a transformer of professional identity and provide solutions to emerging problems [21] and do so in complex and extended settings.

In line with identifying the areas of misfits and contradictions which we described as affecting the transformation of the outcome, activity theory and especially the third-generation activity has provided that lens through which this understanding can be achieved. Therefore, fourth generation activity theory will be compared with the third as according to [36] 4GAT is a positive tool for dealing with modern day workplaces that are transient (temporary like that of knots) and of a poly-contextual nature, and 4GAT allows the consideration of different circumstance which in the case of this study is in part at least driven by the extended relationships in the setting.

5. Third Generation Against Fourth Generation Activity Theory for Understanding Complexities

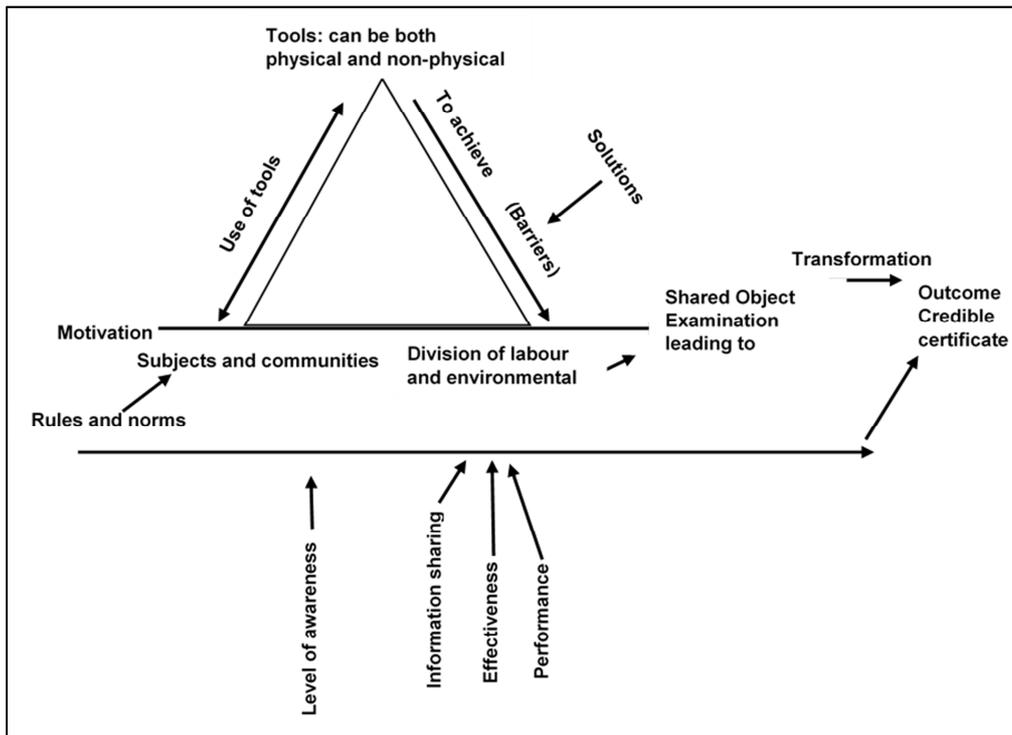
Third generation activity theory model as shown in figure 1 was used in the study as it gave a conceptual idea and understanding of dialogue in a network of multiple events [15]. This touches on the new form of working under extended relationships, like the use of technology and modern division of labour, however, the approach is not explicit in explaining the ways of achieving effectiveness required to transform the process to the expected outcome.

Thus, fourth generation activity theory model in figure 2 is flexible in nature and allows the introduction of different elements for better understanding and thus for planning how organisations can manage their relationships in order to allow space for improvement [20, 4]. This applies to the different arrangements and types of working found in modern day environments that are complex and include, for example, team-working, call centres, use of groups, virtual working and e-business. Other are scattered working [35, 5] contingent labour [10]; distance working using technological applications, telework and peer production work [8]. All these operations involve the use of shared objects founded in extended relationships as described in the introductory section and the 3GAT model, while providing insights, does not fully show a realistic picture of potential/actual difficulties the collaboration is likely to face. The process of achieving the objectives of the collaboration was stressed earlier by the need to achieve congruity, and one of the ways seen in the case study organisation solving problems of incongruity is the formation of knots. The system is such that these things happen logically to solve any difficulty being experienced and fourth generation model shown in figure 2 acknowledge the difficulties in achieving such objectives - common in extended relationships. ([20] p. 7) defines barriers as "material obstruction of any kind erected or preventing access to a place" the obstruction are the complexities caused because of extension that is likely to hinder organisations in relationship to achieve their goals.



Source: Paul Bata, 2022

Figure 1. Third-generation activity theory.



Source: Bata, P. P. (2020)

Figure 2. Model of fourth-generation activity theory.

The fourth-generation activity theory as shown in the model is transient in nature which explains and support the ideas of knots in problem solving as knots in themselves are transient as they change with particular problems [36]. However, the transient nature also helps us to understand the

need for a member of a specific knots to also make up membership of another similar knots when the need arises. An extended organisation has a multi-perspective view which depends on experience and expertise. [36] described modern day organisations as “multi-perspective in nature and poly-

contextual” and this form of organisations takes into account specialised form of working examples such as the manner of use of teams and knots found in the case study organisation.

The environment and its surrounding is another area where 3GAT, although valuable, can be seen as not giving adequate consideration as such issues are only identified through tensions and contradictions in the activity system whereas 4GAT allows for adequate planning with respect to the kind of division of labour the relationship aim to achieve. This is achievable by way of information sharing as knowledge about a partner is vital to the relationship. According to [12] the statement by Francis Bacon in 1597 that “Knowledge is Power” was denoting the power human have over nature to better the human condition. This is what we find today in a modern work environment where planning helps organisations to identify their areas of lack and collaborate with others to make up for this lack. Similarly, non-employer firms involved in subcontracting need information to plan for better understanding of the relationship [36]. According to [10] knowledge-based planning is a driver to redefining how new organisations learn and work. This kind of knowledge necessitates collaboration which is on the increase in today’s working environment mostly found in extended teams.

4GAT model in figure 2 makes provision for information sharing, level of awareness and elements that are introduced in this study to help us understand the needs and ability to achieve goals. Information awareness was introduced as the importance of information was stressed by all the different groups surveyed. According to them awareness and information are enablers to understanding needs and the Cambridge English dictionary defines enablers as people that create the possibility for a particular thing to happen. An example given in the dictionary is information technology (IT) which is a possibility but not a complete solution. In this study, we use 4GAT to identify the potential ways of achieving goals, though it may not be an entire solution. IT under communication tools is seen as a possibility needed to create the ability specially to share information and for the achievement of organisational aim. An example is where the shared object needs to be communicated by way of information sharing using IT tools to other collaborating partners. The same information shared can be utilised for achieving organisations goals through.

- 1) Planning/comparing/decision making [27].
- 2) Used for knowledge accusation [17].
- 3) Used as a way of gaining mutual benefit for collaborating partners [4].
- 4) Utilised for the understanding of other stakeholder’s perspectives [40] and
- 5) Used for understanding each other’s capability [24].

In this study 4GAT uses information as an enabler to achieve the goal of an organisation. This is done by way of analysing the needs to communicate with others and share information in the overall interest of the examination. [36] described communication in new work settings by way of information sharing which is achieved in different ways using various forms.

The other element used in this study in connection with 4GAT is effectiveness and performance. [20] in his study used effectiveness in explaining the need for the entire activity system to be efficient towards achieving the objectives, in this study effectiveness is key to the transformation of the outcome as each of the collaborating partners needs to achieve effectiveness which is then inputted into the shared object. The specialisation involved in this setting demands each component to be effective in order to deliver the services on time and as expected. This aspect of effectiveness for specialised collaborators explains why the knots in the case study form in a different manner to the others found in the literature. Two basic aspect are involved here, expertise of that specialised group and the absolute requirement that delivery must be effective. The knots form in a manner that membership is crafted due to the needed (scarce) specialisation which has to be sought as it is unlikely to be readily available to hand, and it must be the right expertise with knowledge of the problem. This reduces the speed of the knot formation process as compared to some of the other settings in which knot-working has been discussed [5].

The performance in the case study organisation related to organisational sustainability and such is needed in making the transformed outcome acceptable by all. [25] suggest that organisations need to be innovative to improve their performance. This type of innovativeness is what drives multiple relationships and performance is a key aspect of such a relationship. In crafting knots, high performance expertise with good knowledge and understanding need to be sought and recruited and that aspect make for a different experience from other knots where an expert forms part of a knot. Here not only is expertise needed, but good knowledge and performance is required to deliver an outcome. A scenario given shows crafted knots as way of responding to deficiencies in complex and extended organisations [5] - the example centred around a situations where knots formed to negotiate with a university that was, suddenly, not accepting the transformed shared object (credible certificate) Such knots cannot be formed from those ‘on-the-scene’ but need to be crafted based on expertise and good knowledge (domain, organisational and political) and this explains why it takes longer to craft such knots.

4GAT in this study allows the understanding of how organisation in extended settings create the awareness by way of information sharing between collaborating partners to enable them identify problems and make plans to managing the barriers or problems.

6. Conclusion

This paper compares 3GAT and 4GAT in understanding why knots found in the case study organisation are, in some respects, different from the knots in other academic literature while still remaining, recognisably, knots. In analysing the new ways of working found in a complex and extended setting. 4GAT provides a good lens to understand this

phenomenon. It was adopted as it complements third-generation activity theory (3GAT) and the two lenses were used alongside each other. The contrast was useful to aid the understanding of its application and in this case 4GAT helped in explaining the phenomena - allowing provision for adding new elements in explaining action and drivers for such action. It is a tool for improvement and creating awareness by way of appropriate information sharing. 3GAT on the other hand is a complementary tool that gives a clear road map to settings and relationships, but the approach is not explicit in explaining different ways of achieving the effectiveness required to transform the process of shared object into the expected outcome. The provision and allowance for the introduction of different elements in 4GAT has assisted in explaining a way to better understand of the setting or problem issues in modern and complex / extended work-settings by identifying the needs through information sharing, understanding the complexities and how to manage them and providing direction to different elements that enhanced the achievement of relationship goals. Reasons for the qualitative differences seen in the formation of knots in the case study are attributed to;

- 1) Due to the transient nature of the extended relationships knots, which are short lived, are a feasible tool for problem solving and since it is short lived, the tendency of members maintaining membership of multiple knots (either simultaneously, or more probably sequentially) is increased as a possibility as expertise is emphasised over availability.
- 2) Effectiveness is identified as a key factor to the transformation of the outcome of the relationship, therefore, collaborating partners need to achieve that effectiveness which is inputted into the shared object. The demand each component to be efficient in order to deliver the services on time and as expected. Consequently, knots form in a manner that membership is crafted due to the needed specialisations which have to be sought where such is not readily available, and which must be the right expertise with appropriate knowledge (domain, organisational and political) of the problem. This circumstance explains the slow nature of the knot formed in the case study.
- 3) Innovation and performance an important aspect of that relationship in extended relationship.

The flexibility in 4GAT allows a better understanding of setting and different circumstance as when compared to the setting 3GAT present. Therefore, this study is proposed to help with the ongoing debate on how 4GAT is used in understanding setting and apply different elements to aid the situation and circumstance.

7. Recommendation for Future Work

The importance of 4GAT has been highlighted in understanding complexities in extended organisations especially in the modern way of working brought about by COVID-19 pandemic where working is characterizes by

teams and knots formation using different information technology and its accessories in achieving organizational objectives. This paper therefore recommended as a follow-up study area or a new research domain the understanding of these different knots which are characterized according to this paper by different behaviors in terms of formation and membership. These stated domains needing further work looking at the organisational and political aspects of different knots formation which remains open to new areas of research.

References

- [1] Allen, D., Karanasios, S., and Slavova, M. (2011). "Working with Activity Theory: Context, Technology, and Information Behavior," *Journal of the American Society for Information Science and Technology* (62: 4), pp. 776-788.
- [2] Allen, D. K., Brown, A., Karanasios, S., and Norman, A. (2013). "How Should Technology-Mediated Organizational Change Be Explained? A Comparison of the Contributions of Critical Realism and Activity Theory," *Mis Quarterly* (37: 3), pp. 835-854.
- [3] Ardichvili, A. (2008). Learning and knowledge sharing in virtual communities of practice: Motivators, barriers, and enablers. *Advances in developing human resources*, 10 (4), 541-554.
- [4] Bata, P. P., Norman, A., and Allen, D. (2020). Information Sharing Behaviour of Complex and Extended Organisations. *International Journal of Business and Management*, 15 (11), p 41.
- [5] Bata, P. P. (2020). New Knots and their behaviours in complex and extended organizations. *Journal of Business and Management* Volume 22, Issue 7. Ser. VI (July 2020), PP 47-54.
- [6] Bedny and Bedny, G., & Karwowski, W. (2003). A systemic-structural activity approach to the design of human-computer interaction tasks. *International Journal of Human-Computer Interaction*, 16 (2), 235-260.
- [7] Belkin, N. J., Oddy, R. N., & Brooks, H. M. (1982). ASK for information retrieval: Part I. Background and theory. *Journal of documentation*, 38 (2), 61-71.
- [8] Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom*. Yale University Press. Bradner & Mark.
- [9] Bleakley, A., (2013). Working in "teams" in an era of "liquid" healthcare: What is the use of theory? *Journal of interprofessional care*, 27 (1), pp. 18-26.
- [10] Burton-Jones, A. (2001). *Knowledge capitalism: Business, work, and learning in the new economy*. OUP Catalogue.
- [11] Dietz, J., Proper, E., Tribolet, J., Halpin, T., Hoogervorst, J., Op't Land, M., & Winter, R. (2009). *The Enterprise Engineering Series*.
- [12] Dietz, T., Rosa, E. A., & York, R. (2009). Environmentally efficient well-being: Rethinking sustainability as the relationship between human well-being and environmental impacts. *Human Ecology Review*, 16 (1), 114-123.

- [13] Engeström, Y., Engeström, R., & Vähäaho, T. (1999). *When the center does not hold: The importance of knotworking* (Vol. 381).
- [14] Engeström, Y. (1989). Developing Expertise at the Changing Workplace; Towards a Redefinition of Expertise'. Technical Report 130. La Jolla, California. Centre for Information Processing, University of San Diego.
- [15] Engeström, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualization. *Journal of education and work*, 14 (1), 133-156.
- [16] Holman, D., Wall, T. D., Clegg, C. W., Sparrow, P., & Howard, A. (Eds.). (2003). *The new workplace: a guide to the human impact of modern working practices*. John Wiley & Sons.
- [17] Huo, B., Han, Z., Zhao, X., Zhou, H., Wood, C. H., & Zhai, X. (2013). The impact of institutional pressures on supplier integration and financial performance: Evidence from China. *International Journal of Production Economics*, 146 (1), 82-94.
- [18] Institute of risk management IRM, (2014) Extended Enterprise: Managing risk in complex 21st century organizations. Executive summary [online] at https://www.theirm.org/media/1155369/IRM-Extended-Enterprise_A5_AW.pdf
- [19] Kaatrakoski, H., & Lahikainen, J. (2016). "What We Do Every Day Is Impossible": Managing Change by Developing a Knotworking Culture in an Academic Library. *The Journal of Academic Librarianship*, 42 (5), 515-521.
- [20] Khayyat, M. (2016). A Proposed Model for the Fourth Generation of Activity Theory to be applied on the Smart City Research.
- [21] Korpela, J. and Kerosuo, H., (2014), September. Working together in a knot: The simultaneity and pulsation of collaboration in an early phase of building design. In *Procs 30th Annual ARCOM Conference* (pp. 865-874).
- [22] Landy, F. J., & Conte, J. M. (2016). *Work in the 21st Century, Binder Ready Version: An Introduction to Industrial and Organizational Psychology*. John Wiley & Sons.
- [23] Lawson, B., Petersen, K. J., Cousins, P. D., & Handfield, R. B. (2009). Knowledge sharing in interorganizational product development teams: The effect of formal and informal socialization mechanisms. *Journal of Product Innovation Management*, 26 (2), 156-172.
- [24] Liu, J., Huang, X., & Liu, J. K. (2015). Secure sharing of personal health records in cloud computing: ciphertext-policy attribute-based signcryption. *Future Generation Computer Systems*, 52, 67-76.
- [25] Maletič, M., Maletič, D., Dahlgaard, J. J., Dahlgaard-Park, S. M., & Gomišček, B. (2016). Effect of sustainability-oriented innovation practices on the overall organisational performance: An empirical examination. *Total Quality Management & Business Excellence*, 27 (9-10), 1171-1190.
- [26] Mihm, J., Loch, C. H., Wilkinson, D., & Huberman, B. A. (2010). Hierarchical structure and search in complex organizations. *Management science*, 56 (5), 831-848.
- [27] Mishra, J. L., Allen, D. K., & Pearman, A. D. (2011). Information sharing during multi-agency major incidents. *Proceedings of the American Society for Information Science and Technology*, 48 (1), 1-10.
- [28] Montoro, C., & Hampel, R. (2011). Investigating language learning activity using a CALL task in the self-access centre. Reading.
- [29] Nardi, B. A. (Ed.). (1996). *Context and consciousness: activity theory and human-computer interaction*. Mit Press.
- [30] Provan, K. G., & Lemaire, R. H. (2012). Core concepts and key ideas for understanding public sector organizational networks: Using research to inform scholarship and practice. *Public Administration Review*, 72 (5), 638-648.
- [31] Provan, K. G., Fish, A., & Sydow, J. (2007). Inter-organizational networks at the network level: A review of the empirical literature on whole networks. *Journal of management*, 33 (3), 479-516.
- [32] Roth, W. M., & Lee, Y. J. (2007). "Vygotsky's neglected legacy": Cultural-historical activity theory. *Review of educational research*, 77 (2), 186-232.
- [33] Rouse, M. (2012). Extended Enterprise [Online]. Tech Target. Available: <http://searchcio.techtarget.com/definition/Extended-enterprise> [Accessed June 23 2014].
- [34] Spinuzzi, C. (2014). How Nonemployer Firms Stage-Manage Ad Hoc Collaboration: An Activity Theory Analysis. *Technical Communication Quarterly*, 23 (2), 88-114.
- [35] Spinuzzi, C. (2007). Guest editor's introduction: Technical communication in the age of distributed work. *Technical Communication Quarterly*, 16 (3), 265-277.
- [36] Spinuzzi, C. (2015). *All edge: Inside the new workplace networks*. University of Chicago Press.
- [37] Tracy, S. J., (2019). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. John Wiley & Sons.
- [38] Van Der Vegt, G. S., & Bunderson, J. S. (2005). Learning and performance in multidisciplinary teams: The importance of collective team identification. *Academy of Management journal*, 48 (3), 532-547.
- [39] Vakkayil, J. D. (2010) Activity Theory: A useful framework for analysing project-based organisation. *Journal of decision makers*, 35 (3), pp 1-18.
- [40] Wong, C. W., Lai, K. H., Cheng, T. C. E., & Lun, Y. V. (2015). The role of IT-enabled collaborative decision making in inter-organizational information integration to improve customer service performance. *International Journal of Production Economics*, 159, 56-65.
- [41] Yamagata-Lynch, L. C. (2010). Understanding cultural historical activity theory. In *Activity systems analysis methods* (pp. 13-26). Springer US.
- [42] Yang, T. M., & Maxwell, T. A. (2011). Information-sharing in public organizations: A literature review of interpersonal, intra-organizational and inter-organizational success factors. *Government Information Quarterly*, 28 (2), 164-175.