An E-Collaboration Activity System for Research Institutions

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Abstract

The activity theory (AT) has been used comprehensively in academic studies in the past with varying results depending on many factors. In this paper, AT is considered a lens for addressing electronic collaboration (e-collaboration) for academic and research institutions (ARIs). The focus of this paper is on the advancement of theory for future improved use towards creating a sound and improved guide for future research.

The path towards innovation is paved and founded through well-defined theoretical guidelines followed by researchers, participants, and organizations. Underpinning theories continue to be used in academia to provide a solid basis and to afford a good foundation for research work. This enables research work to be reliable for the targeted output, participants, and communities. At times these theories present improvement opportunities for future practical applications and implementations. The Living Labs (LLs) present platforms for knowledge development; thereby their relationship with ARIs is inevitable. Together they facilitate improvement and innovation for ARIs.

The literature context is the foundation of this paper together with the empirical data collected through multiple sources such as questionnaires, interviews, and the researchers' reflective journal (RRJ). The study used snowball and purposive sampling. The study primarily used the Grounded Theory Method (GTM) approach with the subsequent data collection influencing the collection process. This main objective of this paper is to propose an activity system model for ARIs.

The proposed activity system model presented positive results when applied as the main study progressed. Further advancements can still be applied to the model thereby making it adaptable different environments.

Keywords: Academic and research institutions (ARIs), activity theory (AT), grounded theory (GT), grounded theory method (GTM), e-collaboration and living labs (LLs).

Introduction

Collaboration between academic and research institutions (ARIs) has become part and parcel of the daily routine at these institutions, thereby contributing meaningfully to their development. ARIs are always interested in developing knowledge, hence their selection as participants in this study. Other institutions, such as private educational organizations, were approached to participate, but their response rate was very low. The reasons for this included the fear to break confidentiality clauses and concerns regarding the loss of a competitive advantage. Regarding e-collaboration, it is noted that technology plays an ever increasing part in our lives and the way that we communicate or do things.

Research institutions are a fertile ground for theory advancement since their core focus is on academic work and research. There seems to be a tendency for researchers and innovators to be more easily located at ARIs than in private businesses. Building a model for ARIs should present wider opportunities for knowledge development.

This discussion is divided into the objectives and aims of the paper, succeeded by a section on ARIs and collaboration from a literature perspective. The following sections detail the supporting theories, methodology, and triangulation. The proposed activity system model is then presented as an output followed by a conversation on the results. The final section addresses the conclusion and future work to be done.

Objectives and Aims of the Paper

The objectives and aims of this paper are to:

- conduct a literature review on ARIs, collaboration, e-collaboration, LLs and the concept of maturity:
- review the collected empirical data from an e-collaboration investigation;
- advance the theory on e-collaboration;
- propose an activity system model for research institutions; and
- start a conversation on how the proposed system model should be used to advance research work.

Literature Perspective

This section features a discussion of ARIs and related matters from a literature perspective.

Collaboration between ARIs and Reason for the Focus

ARIs have a central role to play in conducting scientific and technical investigations, research, innovation, and continued improvement of knowledge in communities. The primary focus and scope of this paper is on e-collaboration and ARIs. In this regard, Mattessich & Monsey (1992) indicate that collaboration requires comprehensive planning and well-defined communication channels that operate on multiple levels. This highlights the importance of well-coordinated collaboration initiatives. ARIs normally are non-profit organizations or are government funded. This motivated the focus on and inclusion of ARIs in this study.

Horwath & Morrison (2007) discuss the ingredients of collaboration and identify certain essential ingredients required for collaboration, namely, the:

- pre-disposing factors.
- a mandate,
- membership and leadership,

- machinery,
- process, and
- outcome.

The collaboration amongst ARIs in South Africa (SA) can be illustrated with some examples. One such an example is that of the Human Science Research Council (HSRC) and Higher Education SA (HESA) who agreed that collaboration should take place between them. In a joint statement by the two organizations, they announced that they would enter into a MoU (memorandum of understanding) to promote and advance social science and humanities research in the interest of the government, industry, civil society and international agencies (Human Science Council Research Council [HSRC], 2006). This will culminate in the establishment of a framework that enables inter-institutional collaborations. A later source indicates that areas of collaboration have been identified between the HSRC and higher education institutions in SA at institutional, programmatic as well as project levels (Human Science Council Research Council [HSRC], 2010). This is a clear case where government collaborates with a research council.

Initiatives exist where research institutions collaborate amongst each other and also with other organisations. Formalized memorandums of understanding (MoU) which features details of the collaboration terms are listed as important to ensure progress and improvements over time (South African Technology Network (SATN), 2011, TUT Web, 2011 and UCT Research Office, 2011).

In this paper the term ARIs is defined according to the study by the Academy Of Science Of South Africa (ASSAf) (2010) that classifies universities in three categories: University (Univ), Comprehensive University (Comp) and University of Technology (UoT). The other two categories are statutory research bodies (SRB) and research funding institutions (RFI).

Anyangwe (2012) asserts that higher education institutions and further education colleges must be prepared to share expertise. This assertion supports the initiatives for this paper on improvements for theoretical foundations in e-collaboration while focusing on ARIs.

ARIs as Living Labs

The Knowledge-center for OpenLivingLabs.eu (n.d.) describes a living lab by stating that: "The living lab approach is a new innovation strategy that increases the chance your products become a commercial success, the living lab community provides support for the two processes involved in living lab innovation: the process of developing products and services with end-users and the management and collaboration process".

Lama and Origin (2006, p. 6) describe LLs as "a user-centric research methodology for sensing, prototyping, validating and refining complex solutions in multiple and evolving real life contexts." Living labs challenge us to examine new technologies in everyday contexts as used by people to achieve their goals. In this context, people from different areas of life are challenged to explore innovative tools by interacting with them and discovering new ideas to expand their knowledge and to explore ways of acting (Lacasa, Martinez, Mendez, & Cortes, 2007, p. 2).

Essentially LLs are computer-supported environments for the development of real communities in real, live environments. They are based on pillars such as collaboration, virtualization, learning, value chain optimization, and experimentation as well as various research activities which could include action research, GT research, and AT. Important stakeholders take an active part in the creation, design, and implementation of innovative solutions to problems experienced in real situations by turning real-life situations into LLs as real time experimental environments and learning support systems (Hattingh & van der Walt, 2012).

Figure 1 presents the researcher's view of LLs modelled around factories as presented by Buitendag, Hattingh, & van der Walt (2012).

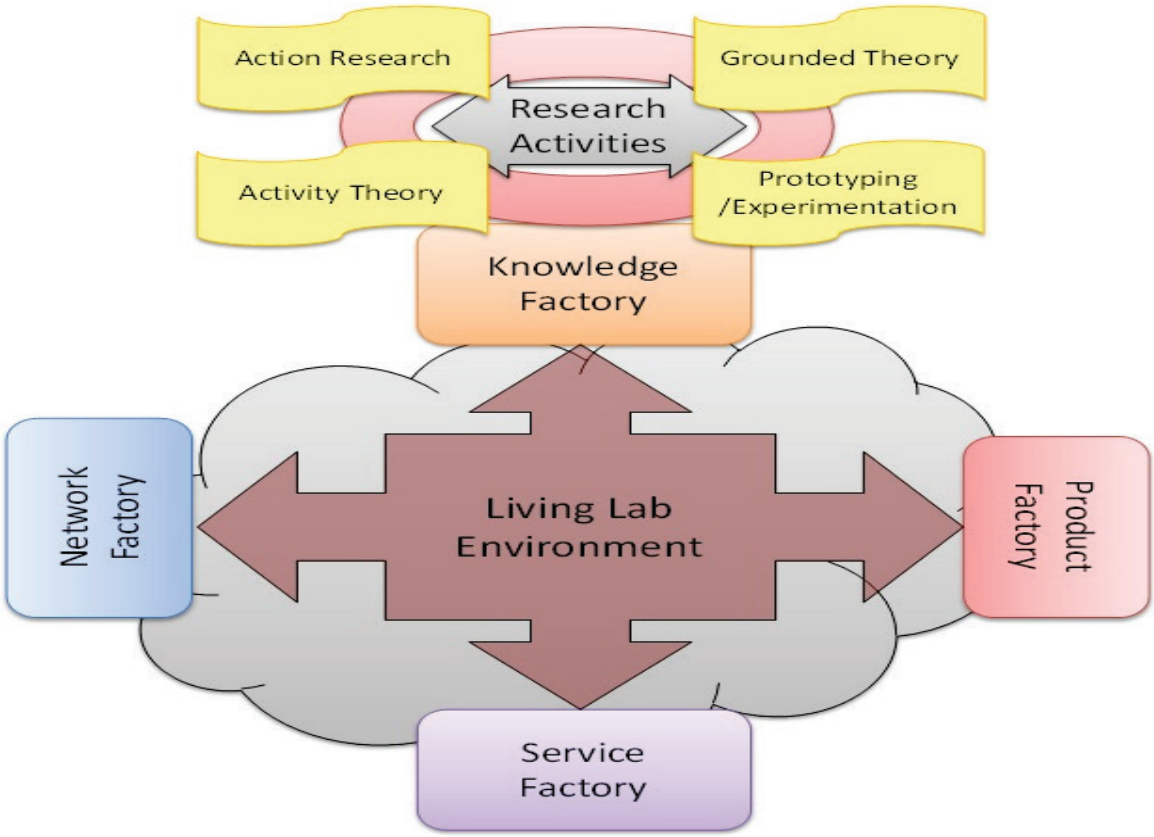

Figure 1: LLs Factory Framework and the KF research activities

To the best known knowledge of the authors, the first presentation of the LLs factory framework in SA was presented by Buitendag and van der Walt (2007) and has subsequently undergone various improvements and enhancements (Buitendag & van der Walt, 2011; Buitendag, van der Walt, Malebane, & De Jager 2012; van der Walt, Buitendag, Jansen Van Vuuren, & Zaaiman, 2009). A simplified overview of the latest improved framework is depicted in Figure 1 while the full version can be accessed in Buitendag et al. (2012).

Figure 1 illustrates the conceptual LLs framework used for this research, which basically consists of four simple virtual factories that are interconnected and interdependent on the deliverable of each factory. In brief, each of the factories has its own deliverable and operates in the same manner as a standard factory would. Each of the virtual factories is modeled around the logical groupings of similar functions and activities. The virtual factories are partially based on the concept of a real life factory with some similarities to the factory design pattern as well.

The predominant purpose of the network factory (NF) is the profiling and registration of community members. The service factory (SF)'s predominant purpose is to deliver and utilize current available services to help meet the objectives and functions of the LLs. The product factory (PF) could also be called the tools factory as it is responsible for the creation of tools and methodologies for the LLs. The knowledge factory (KF) promotes, stimulates, and provides an environment

for the generation and discovery of knowledge through the application of various research activities and methods, as highlighted in the figure.

From the definitions supplied, as well as from the framework presented, it is evident that any ARIs could easily be regarded as LLs. Research conducted by De Jager, Buitendag, and van der Walt (2012) highlighted the idea that social media tools could easily be utilized to promote the various activities such as the e-collaboration practices of an HEI (higher education institute), which is in essence also an ARIs. De Jager *et al*. (2012) motivate this notion by stating that "LLs allow people and organizations to test tomorrow's best innovations. User interaction facilitates creativity, collaboration, innovation and information which are then shared again among users".

Core Elements for E-Collaboration

Kock (2005) define *e-collaboration* as collaboration among individuals engaged in a common task using electronic technologies. The definition states that *e-collaboration* is not limited to computer mediated communication (CMC) or computer supported cooperative work (CSCW). Twinomurinzi (2007) supports this definition by indicating that *e-collaboration* is the exchange of information with the stakeholders playing a role in the outcome of the collaborative process. Kock and Antunes (2007, p. 44) assert that *e-collaboration* comprises electronic technologies and related methods that enable collaboration among groups of individuals engaged in common tasks. *E-collaboration* is therefore broad in nature, with its key components being technology in each initiative. Eloff (2009) presents three significant points that support e-collaboration, these are:

- In a globalised world, no single institution can come up with all the answers or be relevant in all circumstances;
- Collaboration with both the private sector and academia is essential if technology is to properly serve the best interests of everyone concerned including those without access to it now; and
- Collaboration across academic disciplines is also vital because Information and Communication Technology (ICT) research done without attention to its impact on socio-economic and cultural issues is quite pointless.

The points above are important as a guide towards an improved understanding of collaboration since they present different scopes of e-collaboration and their impact.

Value and Benefits for ARIs in Collaborating

Derived value is always an important motivator for participating; the same is applicable for collaboration amongst ARIs. McKinsey Global Institute (2011) identifies the benefits for collaborating as follows in terms of it being 'increased' or 'reduced / decreased':

- **Increased**: refers to access to knowledge, speed of access to internal experts, employee satisfaction, innovation and revenue.
- **Reduced/ decreased**: refers to communication costs, travel costs, operational costs and time to market for products;

McKinsey Global Institute (2011) further noted that the popularity of each derived value can vary due to many factors such as industry and the specific participants.

Mindbuilt Technologies (2012) lists collaboration suite benefits: increased efficiencies, reduction in complexity, enhanced organizational intelligence, develop stronger relationships, reduction in travel costs, reduction in long-distance phone calls, easy to install and manage, low overheads, and boost employee morale.

While investigating collaboration by ARIs, Lavhengwa and van der Walt (2010) conclude that collaboration is essential for academic research to continue and add value through contributing to the body of knowledge. Lavhengwa and van der Walt also indicate that in order to achieve a high standard and level of collaboration, researchers must work together.

Gartner (2011) indicates that strategic technology can impact on an organization's long-term plans, programs, and initiatives. This can, for instance, offer opportunities for strategic business advantage for early adopters.

In support of value, SAP Research in Dresden (2012) indicates that collaboration within and across enterprise boundaries has become increasingly important, as value creation is more and more distributed.

Academy of Science of South Africa (ASSAf) (2010) indicated that establishing large-scale research institutes dedicated to collaboration is a cost-effective and efficient way of developing high-level capacity at the cohort level.

The Concept of Maturity

Hardy (2009) indicated that assessment of the relative maturity is done by comparing it with an accepted model of "best practices". This is relevant for this study since the focus is to consider best cases and develop an improved maturity model. Hardy (2009) describes bench marking maturity assessments as depicted in Figure 2 below:

Figure 2: Benchmarking using Maturity Assessments

The concept of "maturity" is discussed since it features in the proposed model in this paper. Figure 2 shows cases where maturity consists of six stages starting with "Non-existent" progressing to "Optimized". The concept of maturity was also evident in the study, indicating that collaboration has multiple maturity stages.

Theory as a Lens for Investigation

This section addresses the supporting theories for this paper while using the theories as a lens for further investigation. The discussion starts with GTM as a support base followed by a detailed view of the AT.

Grounded Theory Supporting Research Activities

It is important to note that in this paper grounded theory (GT) and grounded theory method (GTM) are used interchangeably. GTM in this paper is guided by the discovery of theory from data, systematically obtained and analysed in social research (Fouché, 2005, pp. 270-271; Glaser & Strauss, 1967). Strauss and Corbin (1990) further define GTM as an approach where the data collection, analysis, and theory stand in a reciprocal relationship with each other.

An article by Fernández (2004, p. 59) on GT method and case study data in IS research indicates the following: "Grounded theory offers a very strong methodological foundation for IS researchers wanting to engage in theory-building studies of emerging socio-technical phenomena".

Hayhoe (2010) motivates the use of GT by stating that GT:

- is particularly applicable in areas where there are none or little theories in existence;
- allows a researcher to agree or disagree with current theories and may lead to the adoption of a particular theory by a researcher, which the researcher may claim as his or her own (it also allows the researcher to adapt the theory over time;
- is also suitable, when the researcher does not want to test an existing hypothesis;
- allows for a mixed mode of research sampling which may include both qualitative and quantitative data; and
- permits the collection of a broad range of data beyond the scope of more structured methods.

Figure 3, adapted from the work of Buitendag and van der Walt (2011), highlights how the GTM could be implemented in LLs/ARIs environment. The GTM process is based on the work as presented by Muller (2010), Dick (2005), and Pandit (1996).

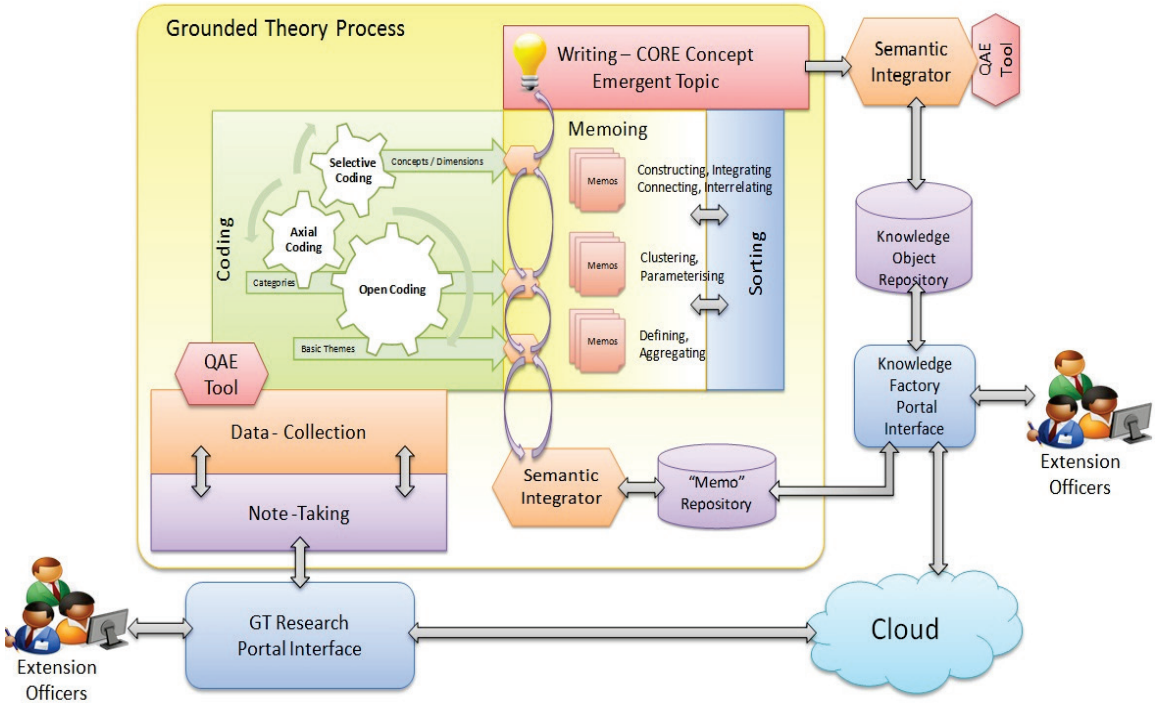

Figure 3: GTM implementation in LLs/ARIs environment

For this paper, GTM represents a good theory for further theory advancement influenced by evolving data collection. It is also evident that the GT methodology could easily fit into an environment which promotes e-collaboration activities.

Activity Theory Foundations

In beginning a discussion on AT, it is imperative that the basic mediational model described by Vygotsky (1978) is noted in this paper. The model consists of three elements (Tool, Subject, and Object) which remain foundational in work on AT and systems. Vygotsky further introduced the

concept of *mediated action*. Mediated action asserts that humans do not interact directly with their environment; instead tools and signs provide mediation and enable interactions to be taking place. There is a relationship between humans and tools when actions are performed.

Uden, Kumaresan, and Salmenjoki (2007) refer to the importance of contradictions being the motive force of change and development as aspects of an activity, because they are used as sources of development. Supported by Kuutti (1996), contradictions are known to trigger reflection and assist with the activity improvement. Contradictions are significant for this paper with the expansion of theories.

In a discussion on AT, Vygotsky (1978) lists four basic components that are further emphasized as featured in the statements below:

- A **subject** is an individual or group of individuals involved in a common **activity**.
- The **subject** undertakes an activity in order to achieve an **object**.
- Activities comprise working with **tools**.

Er and Lawrence (2011) refer to a basic model of activity, as adopted from Kaptelinin and Nardi (2006), which also lists the four elements highlighted in the statements above with the addition of **"Outcome"**.

Hashim and Jones (2007) investigated applications of AT in education, information systems, and the humanities. They concluded that AT is useful since it describes activities as hierarchical in nature and provides a model for decomposing activities into actions and operations.

Activity Theory in a Living Lab

LLs incorporate the collective action of various members and stakeholders from diverse settings. Innovation fueled by co-creation and collaboration ultimately leads to the development of LLs objects, which could take on various forms such as a product, service, or tool.

Borchorst and Bødker (2011, p. 175) highlight the concept of AT from a human perspective by explaining that human activity is carried out through the application of actions which propose to transform and create objects from the material state to the final outcome. They further explain that the object is often the target of human expectations and reflections to motivate the change activity, where the actions are realized through various sets of operations, which are often triggered by different conditions. The interrelated activities are also sometimes the drivers of change and subsequent adoptions to the final deliverable.

Hardman (2005, p. 260) points out that the main unit of analysis in AT is that of an activity system, where the system refers to a group of people or the community sharing a common object It could also be seen as a problem space where tools are used to transform the object. Uden, Valderas, and Pastor (2008) explain that the activity cannot exist as an isolated entity and that the activity implies that there is an agent as an individual or common group. The activity is performed by a subject who could be an individual or group using tools to achieve a certain objective by transforming objects into desired outcomes.

Figure 4 redrawn by these researchers as presented by Hardman (2005, p. 260) and Tan (2009, p. 12), highlights the AT model as originally presented and described by Engeström (1987, p. 78) and Engeström (1992, p. 12) as a human activity system.

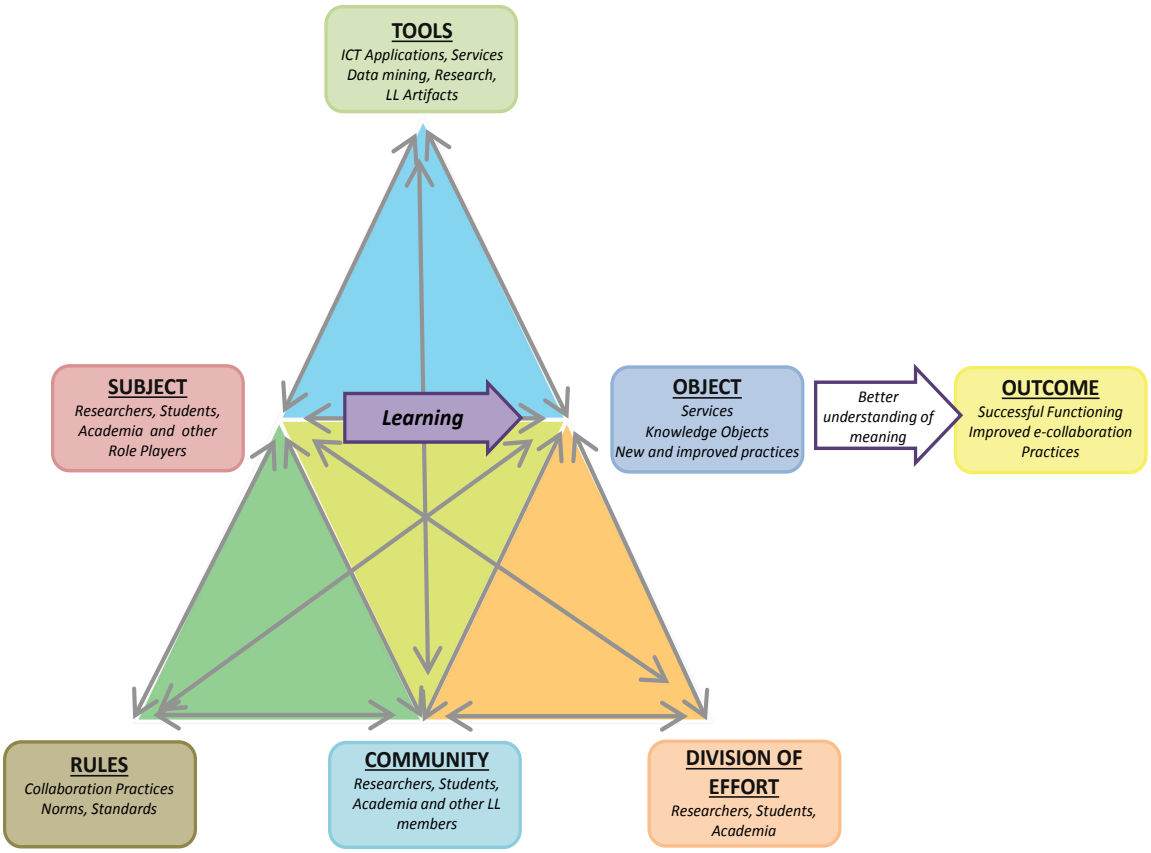

Figure 4: AT process within the scope of the activities of LLs for ARIs

Figure 4, as constructed by the researchers, presents the AT process within the scope of the activities of LLs for ARIs. The figure presents the researchers' interpretation of the AT process. The figure highlights the fact that learning as an inherent activity is intrinsically done in order to gain a better understanding of the object that is studied to produce the required outcome(s).

Relating Activity Theory and Collaboration

When considering AT, collaboration normally forms part of investigations, discussions, and findings. Below are some referenced statements from literature to support this argument.

The theory suggests that the situated instantiation of the activity system forms a critical aspect of collaboration in an organizational context (Iivari & Linger, 1999). This is connects AT to collaboration.

Knowledge work today is increasingly collaborative, because practical problems to be addressed are often complex and span across specializations. Such collaboration is difficult because of the traditionally individualistic culture of the professions (Jones & Burgess, 2010).

As systems development is a socially collaborative activity, AT works well with method engineering which has benefits as a theoretical exercise and a practical tool (Hashim & Jones, 2007).

A great challenge in education is the rise of computer-supported collaborative learning as a new tool of teaching (Hashim & Jones, 2007).

AT is able to clarify the nature of the collaborative activities and indicate how people can socially participate while interacting with the technology (Er & Lawrence, 2011).

Similar to the way in which doctors operate, reporters also make use of preparation (research), collaboration (both formal and informal), and personal knowledge in their work (Er and Lawrence, 2011).

The preceding section presented the context for the activity systems and how they this relates to collaboration.

The Methodology Applied

This paper shares work from a qualitative perspective as described by O'Connor (2002, p. 44) as an approach that attempts to uncover meaning via analysis of non-numerical empirical materials that come from multiple sources of information. These sources may include interviews, observations, audio-visual materials, and existing researcher-developed documents. This is relevant since the paper is based on the researchers' experience of applying GTM and investigating the use of the AT.

The method to achieve the objectives starts with reviewing the current work and supporting theories as foundations. The final sections will attain the aims by introducing the model and initiating a discussion towards further work.

The multiple literature reviews conducted were considered and used to establish trends in the theories being investigated.

Guided by the GT method, this paper considered the statement by Ramenyi and Money (2006, p. 170) indicating that the choice of a methodology can change during the research project, since this is seen as a journey in which the researcher can move from one paradigm to another.

Welman, Kruger, and Mitchell (2010, p. 194) indicate that in a qualitative study it is essential for triangulation to be applied to ensure the reliability of the results. Triangulation is defined as the use of more than one method or source of data in the study of a social phenomenon, so that the findings may be cross checked. Welman *et al*. (2010, p. 194) further indicate that an attempt is usually made to corroborate findings according to at least three different approaches. In order to achieve triangulation, multiple literature reviews and three data collection techniques were applied throughout the study, namely document analysis, interviews, and questionnaires.

Below is a list of some questions that were sent to participants in the study:

- Are you aware of any collaboration by your institution? Name and discuss the stage, level and give more details.
- Identify and discuss the collaboration efforts / initiatives with ARIs.
- Are any services identified for collaboration by your institution?
- What services related to collaboration are offered on your website?
- Can a researcher publish on the website? (What are the terms, if any)?

The data collection for this research took place over a period of three years, starting in 2009 and ending in 2012. The data collection is still continuing. The selected participants are well-informed and knowledge creators in their areas of expertise in research and related academic fields. Most of the participants work at various universities and others conduct work for research councils.

Empirical data were collected from participants in four categories as indicated earlier by ASSAf (2010), UNIV, SRB, GOV and by means of a blog. A total of 31 questionnaires were completed and returned by the selected participants.

The table below shows the different types of participants used in the study and the paper.

Table 1: Participants who responded			
Category Name	**Units**	**Percentage (%)**	**ARIs Type ID**
UNIV	18	19.35	Univ, Comp, UoT and DLI
SRB	9	9.68	SRB and RFI
GOV	4	4.30	Gov
Blog	*62	66.67	Blog
Grand totals	***93**		

* = Indicate that this is an ongoing data collection and the number may have increased since they were last retrieved.

Data were also collected through multiple observation units with participants at different locations. Below is a sample of these:

- University computer laboratory (12 units);
- Academic conferences (7 units); and
- University colloquiums (6 units).

The above listing of observations allowed the researcher to collect data, while other researchers and academics were participating in academic activities.

Table 1 indicates the level of interest and the number of participants. The high number of Blog participants indicates the growth in the use of e-collaboration technologies.

Related Literature Discussion, Findings, and Outcome

Suggestions on Implementation – the Way Forward

The understanding contained in the preceding sections and diagrams was adopted in this paper as noted in later sections, towards the development of the activity system.

There are key common elements of the AT, these were listed and highlighted in earlier sections. This will form part of the theory advancement and propositions.

Er and Lawrence (2011) state the following: “Activity Theory centers on mediation and the concept that the way humans undertake an Activity is influenced by the environment around them”.

The above statement is significant in enabling an improved understanding of AT and the elements involved.

Guided by earlier literature analysis, data collected and practical experiences this paper encapsulates the understanding of AT by the following statements:

- A research approach that integrates human activities and technologies.
- The evolution of multigenerational systems of actions in research and innovation.
- The coming together of actions and tools to produce activity systems.

The teaching and learning activity system model presented by Greenhow and Belbas (2007) indicates that peer collaboration and group assignments exist. There is also a suggestion that students should learn from and help each in order to succeed. While the activity systems by Greenhow and Belbas (2007) present a level of collaboration, the scope is limited to individuals and within the

same class, project or institution. There is a need to extend the scope beyond this and explore wider collaboration coverage. This paper takes this initiative further.

This study adopted the third generation activity system described by Engestrom (1999, 2001) and Vygotsky (1978) as a joint activity or practice which is taken as the unit of analysis for AT rather than an individual activity. In this third generation, the activities are now joined and related to one another towards one outcome. The selection of this generation is because in this paper two independent systems are presented for each component and later derive one outcome.

Preliminary Empirical Study Findings

This section lists preliminary study findings from the research relating to participants regarding collaboration and ARIs. The findings support the literature that has already been discussed. These findings are grouped per category in Table 2.

Table 2: Summation of the preliminary findings

Summation category	Findings	
On the main study theme	•Mutual interest by collaborators •Collaboration with multiple-research councils •Collaboration with government •Institutions focusing on specific areas of research •Web sites are important •The Internet helps in the collaboration •Collaboration enables faster communication •Knowledge economy drives collaboration •Leadership programs to assist in collaboration	
On the driving forces	• Biases, racial differences, gender and cultural factors • Co-authorship (more than one researcher writing a paper or article) of research papers and other work • Funding • Leadership • Memorandum of Understanding (MOU) • Real-time communication and technologies • Training	
On the tools and technologies	• Blogs • Collaborative authoring tools • Email • Fax • Facebook	• Intranet and Internet • Online discussion groups • Social Forums • Telephone • Twitter

Another significant finding is that the geographical distances are no longer a limiting factor for collaboration when technology is introduced.

In the next section the outcomes of the investigation are discussed and opportunities for further discussion are provided. The responses collected from the empirical data collected are also elaborated further.

An E-Collaboration Activity System Model for Research Institutions

Literature indicates that there is no universally accepted method of implementing AT (Barab, Barnett, Ymgala-Lynch, Squire, & Keating, 2004). However, through the Activity-Oriented Design Methods (AODM) theory, Greenhow and Belbas (2007, p. 385) attempted to operationalise the theory and make it more accessible to researchers. This effort still has limitations, some of which are addressed through this paper.

With all the reviewed literature and data collected; Figure 5 represents the E-collaboration activity system model. Table 3 below support Figure 5 by showing the details for each element:

Table 3: Elements of the two activity systems

ACTIVITY SYSTEM NAME	TOOLS	SUBJECT	RULES	COMMUNITY OF PRACTICE	ROLES
* People and organizational	* Material for academia such as material or information from a library facility	* Students * Researchers * Academics * Educational organizations * Anthropologists	* Obtain permission from the people involved * Follow the set curriculum	* Focus area owners * Area owners: Business and research	* Communicate * Co-ordinate and * Arrange
* Technology innovation	* Collaboration tools such as e-mails, telephones and blogs.	* IT professionals * Systems experts	* Technology guidelines * Best practice	* Application designers * IT researchers	* Develop applications * Assess, test, review work conducted

The diagram and elements featured for the e-collaboration activity system can be easily adaptable to environments where the collaboration is being implemented. There are elements that may require adjustments such as the subjects, which will differ from one environment to another. As indicated earlier by Horwath and Morrison (2007), an outcome is one of the essential ingredients towards collaboration which is achieved through two dimensions.

The output of each activity system contributes to the overall result which is indicated as follows:

Activity system name: people and organizational

- Increase and improve the quality of academic output.

Activity system name: technology innovation

- Better technologies in use; and
- well tested and reviewed systems.

Activity system name: combined systems

- Enhanced e-collaboration; and
- matured e-collaboration.

Each one of the two activity systems presents comprehensive objects for its intended outcome. This proposed e-collaboration system model brings together two dimensions for an enhanced and improved e-collaboration experience.

The development of an e-collaboration activity system model can also be seen as a LLs platform. This is where knowledge can be developed and future innovation can be developed.

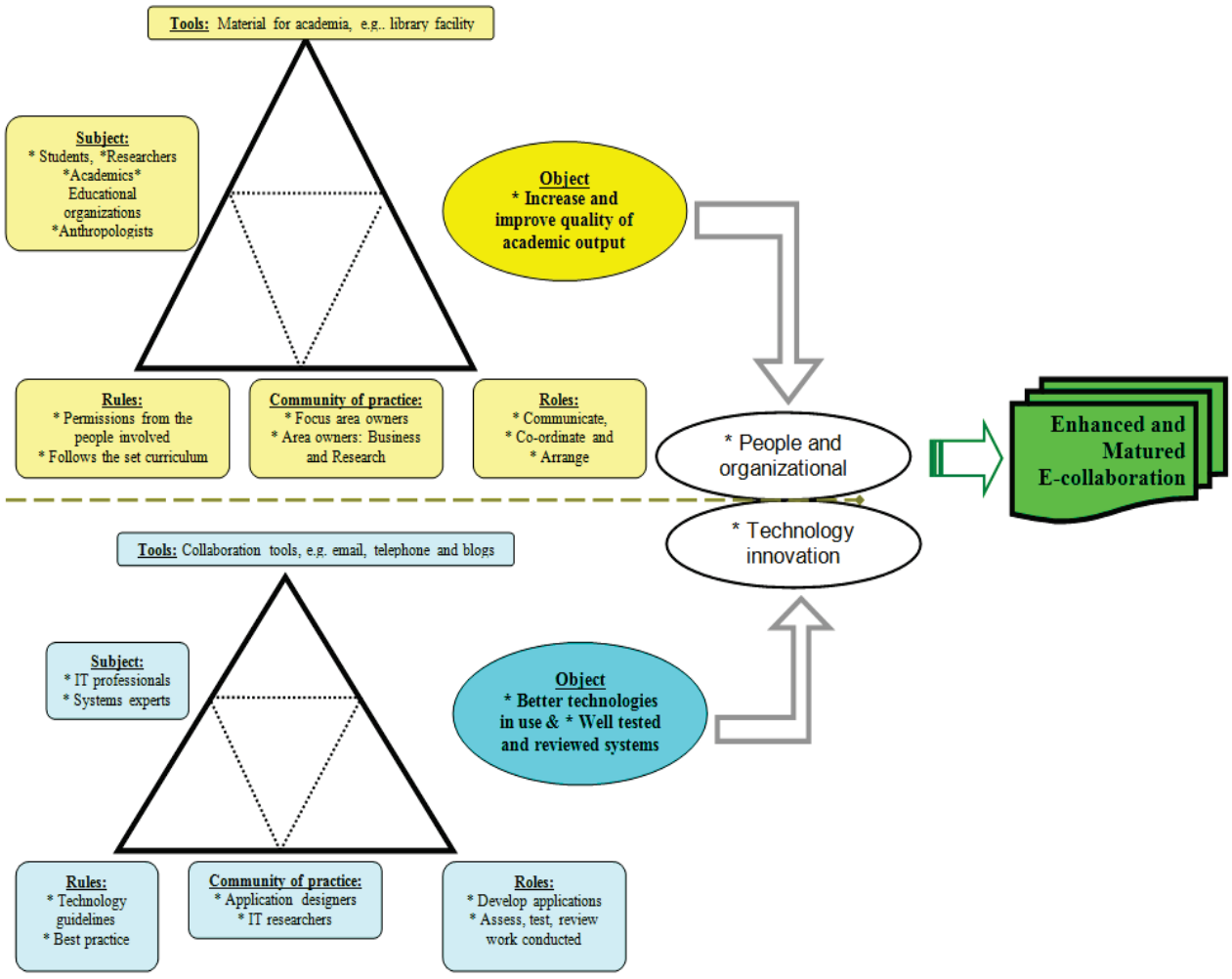

Figure 5: E-collaboration activity system model

Figure 5 above, shows a diagrammatic representation of the two activity systems leading to enhanced and matured e-collaboration. A conversation then ensues, following the introduction of the model and other discussions also gain momentum in the next section.

Initiating a Conversation on the Proposed Activity Systems

Initiating a conversation on the proposed activity system is valuable for the future of research and advancement in knowledge. Each of the resultant activity systems is practically evaluated guided by the findings observed, collected, and discussed.

The intention of this section is to further investigate and establish value from the e-collaboration activity system proposed. In a study of AT to examine information systems, Er and Lawrence (2011) indicate that there are two methods of producing and submitting a story, these are:

- using a laptop; and
- phoning into a copy-taking service and read out the story for transcription.

The two methods demonstrate the practical efforts of using technology that supports the practical use of AT for examination. Relating to this paper, practical applications of the e-collaboration activity system are grouped into the two systems identified in the previous section. The next sections elaborate this further.

People and organizational

- People as individuals or as organizations are affected by activities that occur in their environment.
- A comprehensive understanding of the elements involved in activity systems presents opportunities to improve methods and systems of collaboration.
- ARIs provide environments for collaboration that can easily produce activity systems for improved understanding.
- The guiding processes developed in the activity systems afford the collaborator with a clearer view of key elements involved.

Technology innovation

- Technology platforms are normally a linking factor for collaborators.
- When technology is not properly understood or implemented, challenges emerge that may cause the inefficient use or loss of resources without results.
- Basic technologies such as e-mail, telephones and SMS should not be ignored or undermined since the data collected signal their prevalence among collaborators.
- Social networks need to also be incorporated in the implementation.
- Innovation is derived once operations have become stable and there is an improved environmental understanding.
- Innovation should always be an intended outcome when systems are working well.
- Considerations for future technological communication methods also present innovative ideas.

Overall discussion

- The practical applications of the e-collaboration activity systems indicate that there is more that can be achieved in collaboration using activity systems.
- Both the activity systems can work together towards the improvement of e-collaboration.
- Separating the activity systems into multiple components to focus enabled collaborators to focus on specific outcomes and later consolidate the outcomes.

The e-collaboration activity system presents the next level for consideration where the AT is comprised of multiple activity systems.

This needs to be an ongoing conversation by ARIs and other stakeholders to insure continued improvement and upgrades to the activity systems.

Conclusion and Future Work

This paper presents an e-collaboration activity system that serves as a guideline that can be used for ARIs. This can also be considered for businesses and non-academic organizations.

It is shown that there is a definite close relationship between the AT and collaboration. The literature reviewed, empirical data collected, findings, and reflections support this argument.

The development of the activity systems during research projects based on experiences can present a significant improvement in how research is conducted, with positive outcomes.

Preliminary findings support the existing literature on e-collaboration and ARIs. This paper also shared practical applications for the AT focused on ARIs.

Regarding future work and research, the following is recommended:

- Future work should include applying the e-collaboration activity system model for other non-academic environments.
- Researchers should adapt the activity systems to one type of institution focusing on specialized areas and other services.
- Other researchers should consider developing activity systems which comprise more than two individual systems with multiple outcomes.
- Open source projects should be initiated to develop and improve e-collaboration technologies.
- The LLs factory framework should be advanced for other types of environments and industries that are non-academic.

The final conclusion of this paper is that there should be multiple theoretical dimensions worth exploring to support an investigation. E-collaboration and LLs are broad areas of research and investigation that should improve the body of knowledge as proven by the proposed model in this paper.

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