Evaluating a Virtual-Community Centric Collaboration Life-Cycle Model for Sustainable Coordination: A South African Public Sector perspective

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Abstract

This paper appraises a Virtual-Community Centric Collaboration Life-Cycle Model (VCCCLM) *inspired by the promise virtual communities present as an ideal platform to support coordination in a distributed collaborative work context. The appraised model promises a proactive, adaptive, reactive, and continuous coordination of activities of actors who must work together towards common goals across a segmented and distributed environment to mitigate duplication of efforts and incoherence while maximizing limited resource use. Thus, technological features that can support the coordination of widely distributed actors are validated. Drawing from the segmented, distributed South African Public sector as a case study with a specific interest in coordinating capacity-building interventions across its 226 municipalities, a collaborative scenario was deduced. To realize the evaluation, an expert review interview based on the given collaborative scenario aided by an Excel-based open-ended questionnaire as a validation tool was employed to ensure that the appraised model is relevant, comprehensive, practical, and useful to practitioners. The VCCCLM is aimed to streamline and ensure sustainable coordination of collaborative actions within the SA public sector where seamless coordination is inhibited by environmental factors such as size, multiple role players, and proximity. The appraisal results show that the model has great potential to support the coordination dynamics in the segmented and distributed SA Public Sector. The study brought forward some limitations from the feedback used to refine the model while taking cognizance of future work.*

Keywords

Collaboration; Coordination, Distributed environment; Context-aware; Virtual communities, Public sector

I. INTRODUCTION

Organizations are constantly faced with a dynamic and unstable environment that requires flexible and fast responses to changing and emerging business needs (Kohntopp & McCann, 2019; Mohsen, & Eng, 2016) As such, well-coordinated work processes are critical for organizational performance as they improve efficiency and produce high quality outcomes (Alalou et al., 2017; Steinau, Andrews, & Reichert, 2021). This is especially true for a workforce that is geographically distributed

and subject to many autonomic authorities like the South African (SA) public sector but must collaborate.

South Africa's complex governmental structure consists of three distinct spheres of government, including provincial and local governments, which have various forms of authority and responsibility. Although the spheres are distinct, they are also interdependent as they work together towards a common governmental goal (The Presidency Republic of South Africa, 2020). Since, Coordination necessitates the management of dependencies between actors, activities and resource (Malone & Crowston, 1994; Keegan et al., 2016; Bullinger-Hoffmann et al., 2021) all the spheres of government are required to observe the principles of cooperative government set out in Chapter Three of the 1996 Constitution of the Republic of South Africa. These principles call for a clear division of roles and responsibilities; a collective approach to policy; coordination of activities to avoid duplication and waste; effective use of resources; and constructive settlement of disputes. Thus, emphasizing the need for an effective and sustainable coordination service provision.

However, this is easier said than done. Coordination in a distributed environment is generally a difficult endeavour (Hinds & McGrath, 2006; Warshaw, & Bragg, 2016; Steinau, Andrews, & Reichert, 2021). According to literature, distributed teams, by their nature, have more coordination difficulties than collocated teams as they are usually denied the informal information gathered from physically shared workspaces (Warshaw, & Bragg, 2016). South Africa is no different as collaborating team members are geographically distributed and several factors conspire to make the collaboration environment very complex. The complexities associated with size, autonomy, structure, and geographical dispersal of role players provides unique coordination challenges. Thus, the coordination requirement necessitates a robust and dynamic operational model to account for the complexity that such an environment presents.

Although the SA public sector adopts a loosely coupled work style to minimize coordination overhead and react adequately to immediate localized environmental needs, it is still met with coordination challenges (The Presidency Republic of South Africa, 2020). According to Amir (2016), while the decomposition of activities enable collaborating members to function autonomously, members still need to be aware of each other's' specific actions to coordinate and take cognizance of uncertainties that may occur to prevent incidents that may jeopardize the realization of a given collaborative objective (Schmidt & Randall, 2016). Thus, the need for technological intervention to enable the attainment of sustainable coordination in a distributed environment cannot be overemphasized.

The adoption of collaboration support technologies has been recognized as a complementary approach to coordinate work in conjunction with the explicit division of labour within a distributed environment (Schmidt & Randall, 2016; Thomas et al., 2018). The support technologies, as established in theory and practice, aid in facilitating the working together of teams over geographic distances, through the provision of tools that assist communication, coordination and problem-solving processes (Dustdar & Gall, 2002; Bullinger-Hoffmann et al., 2021).However, these tools are often rigid, accounting for coordination practices that are limited to a given context and not cognizant of the dynamic work contexts and rapid/continuous environmental changes and developments (McManus &Wood-Harper, 2007; Schmidt & Randall, 2016). As a consequence, the need exists for a flexible solution capable of accommodating the dynamic coordination needs of a workforce that is distributed, but must work together to achieve a common objective.

Tellioglu (2008), emphasized the need for a collaborative work environment that considers socio-technical factors together with a guide to support collaboration (Bullinger-Hoffmann et al., 2021). It has been argued that virtual communities are the natural candidates to fill collaborative gaps in traditional, hierarchical organisations in an increasingly networked society (de Moor, & Weigand, 2006; Thomas, & Botha, 2010; Warshaw, & Bragg, 2016). Considering the distributed nature of the SA environment, as well as the number of decentralized and dispersed players, Thomas et al., (2018) argued that a virtual community (VC) presents a suitable platform for sustainable coordination support in a distributed environment. In effort to streamline coordination and account for the dynamic aspects of collaborative work in a distributed environment like the SA public sector a context-aware Virtual-Community Centric Collaboration Life Cycle Model (VCCCLM) was proposed from a virtual community lens to account for both proactive and reactive situations, predict occurrences and respond appropriately when uncertainties arise during a collaborative effort (Thomas et al., 2015a). Thus, this article appraises the life cycle model in terms of its applicability and usefulness in supporting coordination in the segmented distributed South African Public sector. The model's origin, context and description are expounded in the next section. This is followed by the evaluation approach employed, after which the results from the evaluation are presented. Next, a discussion based on the model phases is carried out followed by the model refinement. Finally, the evaluation constraints are highlighted and the article concludes.

II. VIRTUAL-COMMUNITY CENTRIC COLLABORATION LIFE-CYCLE MODEL (VCCCLM) OVERVIEW

Latching onto the premise that virtual communities offer an ideal platform for sustainable coordination in a heterogonous and distributed environment a behavioral model in the form of a

context-aware lifecycle model is proposed. This is further substantiated by the requirement element, as identified in Thomas et al., (2015b, 2018). The model incorporates and exploits the operational functions of the envisioned virtual community infrastructure. Through these operations, concealed or obscured opportunities for collaboration could be identified or revealed. This would facilitate better management, as well as streamlining and structuring coordination efforts in a distributed environment, for instance the public sector. In effort to attain rigour to facilitate better management, streamline and structure coordination efforts in a distributed environment while maintaining a balance between flexibility and adaptability of the ever changing/varying possible collaborative contexts, the proposed model leveraged on the principle of articulation work, project management and the design science research process constructs respectively. Basically, articulation work this case represents the additional effort required to manage the distributed nature of collaborative work (Raposo et al., 2001). Like project management which advocates breaking down project work to manage complexity (Lilliesköld & Taxén, 2004) articulation work suggests identifying the work objectives; mapping objectives into tasks; selecting and distributing task among selected participants, and the eventual management of the tasks executions while taking cognizance of dynamics to constantly demands renegotiation to align actions during a collaborative effort.

Furthermore, to account for uncertainties in terms of the dynamic properties, changes or needs in the environment the model subscribed to the design science research construct which advocates for awareness of a problem in the real-world context to motivate development, implementation and evaluation of a solution (Peffers et al., 2007). By drawing on this knowledge, a suggestion for a collaboration opportunity is made. Thus, in order to identify collaborative opportunities, adequately negotiate agreements and coordinate activities, the awareness of participants' actions, accomplishments, needs and changes in the environment were deemed necessary. The employed technique for the model behavior identifies the relationships between inputs and outputs, to create a graphical representation that exploits and leverages both the linear-sequential and responsive process approaches (Balaji et al., 2012; Thomas et al., 2015a), as experienced in waterfall and agile process design methodologies, to create a lifecycle model capable of meeting several unique environmental needs. Essentially, the appraised model provides guidance on how things should happen during collaborative acts by exploiting the value virtual communities promise as a vehicle for sustainable coordination.

The VCCCLM model approach suggests a continuous process that starts with the identification of needs from the environment, developing and implementing plans, monitoring and reviewing implementations. The lifecycle model streamlines requirements, people, processes, and tools that

provide coordination support by enabling traceability across process definitions, their enactments and supporting artifacts. Five principal stages are involved, viz. the initiation, planning and design, implementation, and the assessment, as well as the monitoring and reporting phase, which is a continuous process, as illustrated in Figure 1.

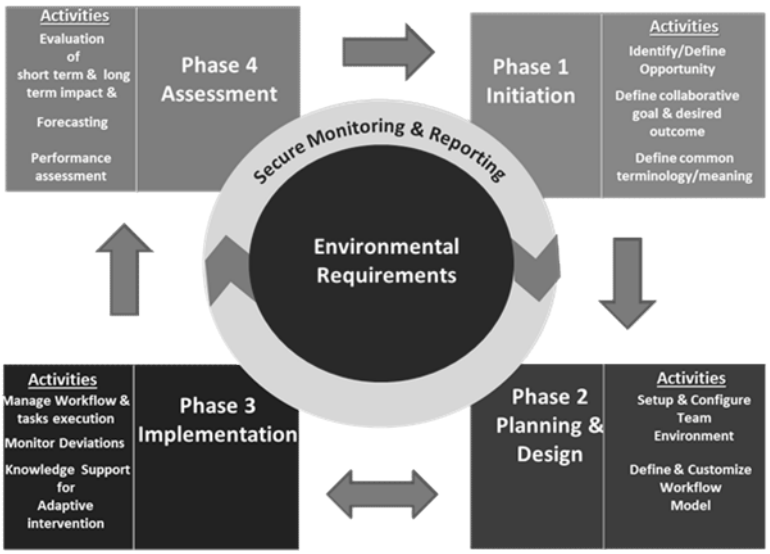

Figure 1. The Virtual-Community Centric Collaboration Life Cycle Model (Thomas et al., 2015a; 2018)

The 6th component at the core of the model is the environment responsible for providing the input that initiates the process. In essence, the entire process entails some form of interaction to accomplish a task, with the resultant feedback utilized to test for effectiveness, allowing for the implementation of corrections to remain in accord with the request requirement. The model activities explore the symbiotic relationship between the subjective and objective coordination mechanisms.

The awareness of needs is central to the VCCCLM, represented by the environmental requirement component. Basically, the needs awareness that eventually results in opportunities for collaboration must be realized prior to initiation. The environmental requirement elicitation component focuses on understanding and documenting needs to a level of detail in order to allow for analysis and opportunity identification. The initiation phase follows with the analysis and interpretation of requirement to define an opportunity to collaborate, set goals and parameters. The planning and design phase provides specification and configuration of people and artifacts that characterize the project transformation plan. Thus, it includes all the activities necessary to acquire and establish resources needed to carry out the project. The implementation phase follows suit by executing plans, processes, or procedures in accordance with specifications defined in the master plan or reference template to produce outputs while managing changes that may occur. The evaluation phase

determines whether the collaboration requirement has been satisfied to eliminate or whether some redress action is still required. The monitoring and reporting phase occur prior and during phases of the project to, inter alia, monitor environmental changes, requirement status, resources, schedule, quality, risks, exceptions and overall project status. The research method employed to appraise the model is elaborated in the next section.

III. THE EVALUATION APPROACH

Drawing from the segmented, distributed South African Public sector as a case study with specific interest in the capacity building training interventions process targeted at 226 municipalities distributed across 2 798 km in nine provinces, a coordination problem is identified. In effort to address the problem, an empirical study was carried out to understand the case study status quo (Thomas et al., 2015b). The study established that while efforts have been made to achieve problem-free coordination in the South African public sector, they have frequently fallen short of this state. Essentially, the existing mechanisms, including information/knowledge-sharing among role players and supporting tools for communication and processing (query, reasoning), are inadequate. Thus, the approaches are predominantly manual, with sporadic, limited and ineffective IT-based interventions.

The challenges associated with geographic dispersal of documents, their manual integration and the limited application support impact on coordination as there is limited overview regarding activities and resources. Thus, resulting in conflict bookings, duplication, incoherence, overextension of staff and, possible opportunities to work together are hidden from various stakeholders with similar interests, among other things. From that standpoint a set of requirements to address the problem of coordination within the distributed South African public sector were identified. How the model appraised in this article met the requirements as elaborated in Thomas, et al., (2015a).

This paper aims to evaluate the applicability, functionality and utility of the context-aware collaboration life-cycle model. The purpose of the evaluation is to ensure that the proposed model is relevant, comprehensive, practical and useful to practitioners. Thus, the goal of the evaluation is to determine whether the proposed model and its components will assist with coordination in a real-world setting. To realize the evaluation, an expert review interview based on a given collaborative scenario aided by an Excel based open ended questionnaire as a validation tool was employed.

To account for the complexity of the system in reality, the scenario-based approach is used to provide an external description of the envisioned functions and operations of the proposed solution. The collaboration scenario presented, originates from the cooperative work practices derived from the case study analyses. By means of a walkthrough process of the model and scenario with subject

domain experts, a feedback was realized to validate the model. The scenario is developed to depict use requirements and represent how the model will be used in practice. It focused on discussing the full actions and workings of the model comprehensively, mimicking the use of the Coordination support model as it will apply in practice. The collaborative scenario is presented in appendix A. Essentially the scenario represents 3 role players (Skill coordinators) from 3 different municipalities from different provinces across the SA public sector that will need to collaborate to maximize their resource use and take advantage of economies of scale among other things. A first draft of the scenario was developed and used for a pilot study, which was then refined into the version employed for the interviews with the experts shown in Appendix A.

The sampling approach employed to select the participants (domain experts) is purposeful. As such, participants were not randomly selected, but rather for reasons like their experience in the public sector service, the operational, managerial and executive roles they assume, which reflect an oversight function with the responsibly to coordinate action across departmental or organizational boundaries. The participants selected represent a cross sectional balance in the domain of interest, which in this study is the distributed environment exemplified by the SA public sector service. As such, participants with the requisite experience are regarded as subject domain experts. The representation presents participants from the local government, provincial, and national government respectively. In addition, participants who have in the past worked in the public sector and still engage in various capacities with the various different spheres at different levels of granularity are also included. Twelve participants, each with in excess of 6 years of experience in their domain, from the local municipalities as well as provincial and national government were engaged to assist in evaluating the proposed model through interviews. The respondents evaluated the proposed components of the model and provided feedback as to their perceptions of the utility, feasibility, functionality and applicability of the model relative to resolving the defined problem. The diagram in Figure 2 below portrays the distribution and intersections of the practitioners employed, representing the distribution of expertise of the selected participants.

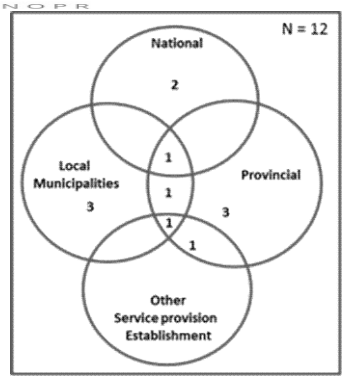

Figure 2. Distribution of Domain Expert Participants

All twelve participants have experience in public service. The biographical information of the participants is presented in the results Section. This selection of participants' sample aided in the assessment of the model, in order to provide credible results, as the experts examined the components of the model and its usefulness from the perspective of how it will be applicable in their respective domains.

Of the twelve participant interviews, seven were conducted face-to-face; two were accomplished using Skype and the remaining three were conducted telephonically. PowerPoint 'broadcast-slide-show' function was used to achieve visual presentation to remote participants. An email requesting participation in the interview was sent to all the targeted participants. Upon agreement of participation, appointments were made for interviews with each respondent. A brief of the model, with a description of its components, was sent to participants a week prior to the confirmed date of the interview. On the day before commencing the interview, the respondents were asked to complete a consent form. The interview was initiated with a briefing of the proposed model, explaining its components and its envisioned operation and function. Thereafter, the participants were presented with the scenario and were asked to comment on the applicability and usefulness of the model to the situations presented.

IV. THE MODEL EVALUATION TOOL

The validation tool was designed in a Microsoft Excel format, consisting of three worksheets. The first worksheet provided instructions as to how to use the evaluation tool. The second was used to capture the biographical information of the participants, while the third contained the components, requirements and activities of the model under assessment in an open-ended questionnaire like form. Figure 4 illustrates the questions structure of the validation tool.

During the interview the participants were asked for observations, critiques and commentaries relative to the tool document or to certain aspects of the model component. However, most of the comments made by participants revolved around the Overall relevance of the Proposed Model and Its Components as elaborated in appendix B. The sessions were recorded, in the face-to-face settings; as was the telephone-based sessions which was a little more challenging. The comments made during interviews were recorded and eventually transcribed. The interview transcripts were analyzed using the qualitative content analysis method and data was coded in sentence or multi-sentence combinations and tagged to an identified dimension as shown in appendix B.

The participants were also asked to rate the relevance of the proposed components of the model, using the questionnaire contained in the validation tool, which was sent together with the concise model description and consent forms. The relevance ratings were achieved using the Yes/No select options as shown in Figure 3.

5		Relevance	Comments
6	An **initiation phase**, with the capability to define/identify collaborative opportunities and to set up goals and objectives, as well as to explain common vocabulary, is useful.	Please select Yes No	
7	The **planning and design phase**, which defines project specifications in terms of what should be done by whom, how and when, is useful.		
8	The ability to monitor actions, progress and deviations from plans at the **Implementation phase** is necessary.		
9	The **Assessment phase**, which determines whether short or long term goals and objectives set have been met, is necessary.		
10	The **secure monitoring and reporting** component that continuously tracks changes in the environment, is necessary		

Figure 3. Extract of the Validation Tool

The participants were asked to rate the components, activities and actions of the model based on a simple Yes/No rating. 'No' signified that the respondent disagreed with the utility and applicability of a proposed component in a collaborative exercise, denoting that it is irrelevant. Conversely, 'Yes' indicated that the respondent agreed with regard to the functionality and suitability of a proposed component, thus making it relevant. Furthermore, a comment column was provided for the respondents to allow observations, critiques and remarks relating to a proposed component or action(s). The findings and discussion from results of the validation tool provided in appendix B are presented next.

V. FINDINGS AND DISCUSSION

The findings and discussion in this section is premised on the evaluation and analysis of the field findings in appendix B which aligns to the model components depicted in figure 1 section II, that begins with the source of any collaborative project the "environmental needs awareness component", followed by the initiation right through the "needs assessment phase".

As far as the environmental needs awareness component is concerned, while participants responded positively to the prospect of identifying collaborative opportunity based on knowledge which is generated, drawn and accessed from multiple sources from the environment, they re-emphasized the importance of having the access control given their autonomous nature and limiting action of prospecting collaborators while having the ability to determine their interest. More so, the importance of allowing integration with their varying existing needs assessment tools to facilitate continuous awareness of opportunity for collaboration and establishing progress tracking measures while taking cognizance of information overload at the initiation phase came to fore. Thus, the potential of personalized information sharing to improve coordination of collaborative activities cannot be overemphasized.

Concerning the initiation phase, all participants interviewed agreed to the applicability and utility of the envisioned coordination support action in this phase, relative to the scenario. Generally, participants maintained that it is, for instance, important in the context of scarce resources, as there is a need to look at joint opportunities to minimise costs through engaging a single service provider. It was noted that if the tool is to be powerful it has to build in flexibility, and be robust enough, along with being able to adapt and meet several contexts as the model indicates. The idea to personalize opportunities and to customize the features given a specific collaborative context was a welcomed idea. Furthermore, the ability to know dates, times and general calendar-related factors, was deemed critical, as was having a common set of understanding, through a shared vocabulary and consensus as to the meanings of terms. The use of private and shared workspaces by participants to coordinate activities, as long as it was complemented with periodic face-to-face meetings, was well received. In addition, communication and notification flexibility in the initiation phase was welcomed.

The planning and design phase which was exemplified in the scenario as a virtual workspace utilizing a myriad of tools to set up and configure teams, and define workflows was welcomed. The participants highlighted the importance of the activities in this phase. Participants especially accentuated the relevance of managing complex and multiple projects concurrently, using a capable task and project management tool. They noted the importance of automation and of having support configuration templates, while taking cognizance of the varying supply chains, management processes and procedures utilized by municipalities. The evaluation findings indicate that support for autonomy was welcomed as each organization will have their own Activity Workspace to manage their activities. Participants liked the idea and capability of scheduling, documenting and deploying a plan, as well as having shared and controlled access to tools and document.

In the implementation phase, the participants reflected that the phase activities are useful and practical in the portrayed scenarios. The tracking of on-going activities and the capability to manage deviations was welcomed. In the scenario, the need for transparency to monitor tasks is stressed. Participants noted that monitoring in order to ensure that things are proceeding on track is very important. For instance, it was noted that because in Local Government different things occur, with alterations according to political correctness and executional demands, having the ability to monitor and redefine workflow is necessary. Managing the elaborate signing off process securely at strategic points in the project, complemented with face-to-face meetings, was advocated. Also highlighted was monitoring deviation and documenting the reasons for such deviations, towards fulfilling the function of a knowledge base aimed to simplify future actions and decision making. Deemed crucial were the requisites for notifications of changes, communication of feedback and reminders to approve or take action within a workflow. The ability to detect supply chain rules that initiate, for example the tender process, and thereafter that track the rules and activate, create, reuse and adapt and eliminate duplications, was welcomed. Thus, process awareness which, inter alia, determines whether a project is operating within its defined parameters and delivering expectations was well received.

In the assessment phase the ability to collect and analyze data systematically to determine whether, and to what degree, the objectives have been or are being achieved for decision-making was considered valuable. Participants noted the importance of reflecting on goals set and on the achievement of the desired outcome. The establishment of short-term execution points was accentuated to overcome ambiguities. Additionally, considering that all municipalities are required to adhere to the service delivery and implementation plans and budgets, the ability to monitor compliance was welcomed. Participants maintain that the significance of collecting and analyzing information is tacit, for a periodic and targeted reporting in an audit capacity to ensure continuous development, while minimizing duplication. Furthermore, the need for integration to prevent duplication was deemed critical. Participants indicated the importance of having systems that talk to each other, where dynamic simulations and reporting can be realized in order to assess whatever was required. Overall, merging disparate information sources into a shared repository was welcomed. Thus, the monitoring and evaluation support capability was tagged as relevant.

Regarding the continuous monitoring and reporting dimension, the ability to monitor projects and to provide feedback, which allows for structure and work process adjustment to facilitate improvement in the was well embraced. The facility to monitor and summarily to see performance, providing information relative to the status quo and identifying trends that can be leveraged, was stressed. All

respondents indicated that the monitoring and evaluation ability is applicable and important for sustainable coordination. As gaps were noted during the evaluation process of the model, the feedback validated the practicality, feasibility and utility of the monitoring phase towards model improvement. The modifications recommended to fine-tune the model, based on lessons learnt during the evaluation process as predominantly seen in section 4.2, are presented in in the next section.

VI. THE VCCCLM MODEL ADAPTATION

The Overall, the model was well received by the domain experts, who applied it as given in the depicted scenario. However, although the model was deemed comprehensive and applicable, some concerns were raised leading to some revision on the model. Figure 10 showcases the adapted model accounting for the modification made. Changes to the model as a result of the concerns are captured in the white rectangular boxes and pointed black arrows. Predominantly, the concerns related to the technology and skills-readiness of intended users to engage the model functions in order to collaborate and streamline coordination successfully. Additional issues involved the willingness of practitioners to collaborate and whether the model was intended to replace the traditional face-to-face approaches. Regarding concerns on whether the model replaces the traditional face-to-face encounter, it was made clear that the model merely complements the face-to-face encounter by extending and facilitating the shared service resources employed in a face-to-face encounter in the most basic form, in addition to archiving and knowledge sharing. To address the readiness concern, as shown in Figure 10, a new dimension was introduced to the model. The dimension is reflected in the ‘preparedness component’ introduced. Two major aspects are introduced, viz. the readiness assessment and improvement, as well as the need for general education, training and awareness activities. This reflects the readiness assessment which represents a systematic way of analyzing the ability of the organisation to undertake such collaborative support intervention. The approach should address the issues, in order to afford the opportunity to remedy or overcome these gaps either before, or as part of the implementation plan. The technology readiness assessment assesses the maturity of critical infrastructure in terms of the hardware and software technologies to be used in the systems. Complementarily, the skills readiness assesses the level of skill gap that needs to be bridged to meet the operational requirement needed to run a successful intervention.

The readiness and improvement activities reflect the need to define a baseline infrastructure and skill level requirement for municipalities and practitioners, in order to measure the gap and bridge it. This

approach can aid in the redistribution of budget, towards infrastructure development, which can be achieved in stages, extending practitioners to a level they can take advantage of the model envisioned services. As noted by a participant, instead of continuously allocating budget for infrastructure for every single municipality, perhaps a better investment is looking towards leveraging existing shared infrastructures like cloud computing, which will help to streamline integration.

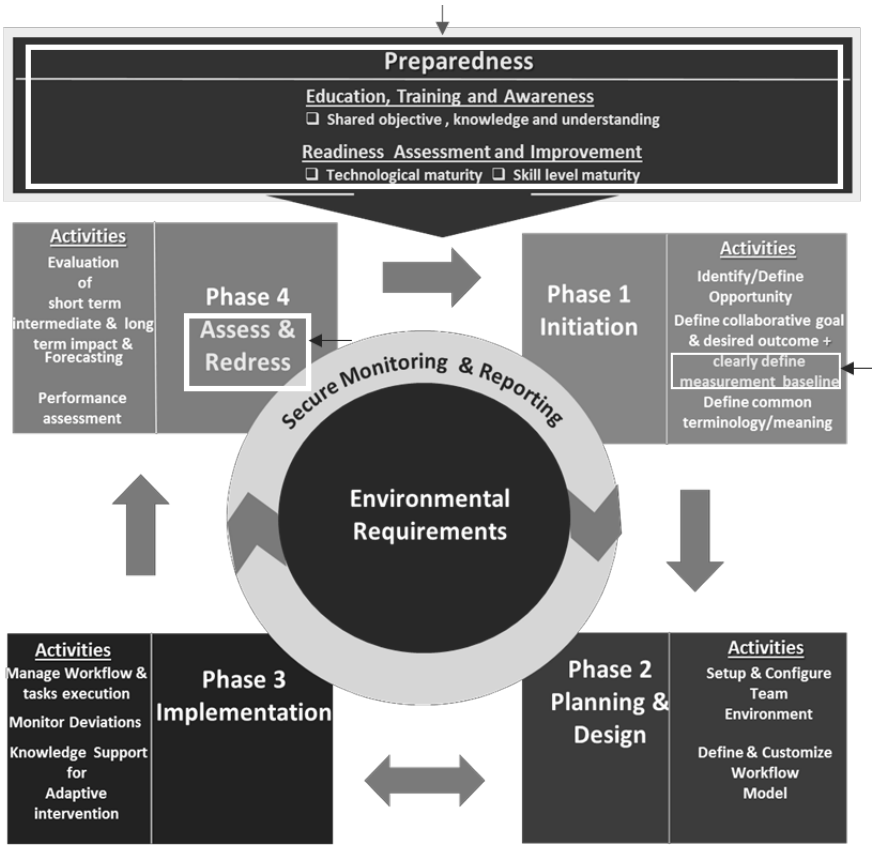

Figure 10. The Refined VCCCLM Model

Furthermore, the concern which reflects the willingness of participants to collaborate can be leveraged through Education Training and Awareness (ETA). This is because emphasis on the problem from the findings suggests a lack of understanding or common goal being the root of the problem. If role players are made to understand the shared value and incentives of collaboration, as a cost saving mechanism, rather than conceived of as a competition or replacement of a job then it is likely that they will be willing to collaborate.

Another suggestion from the evaluation occurred in Phase 1, where it was suggested that the activity should make explicit the need to form a measurement baseline to support and facilitate efficient analysis. A question, for instance “how much have we improved?” can thus be answered. The other alteration that was made in the model was the assessment phase being renamed “assess and redress”.

The need to make an adjustment afterwards, if the objective were not completely met, was brought forward, which led to the assessment phase being changed to the asses and redress phase. This is in an effort to highlight the evaluation made at this phase resulting in the forecasting of future activities, ensuing in the planning for their achievement.

VII. CONCLUSION

This article provided details on the purpose of the proposed model, along with the processes followed, pertaining to the validation thereof. Methods used during the validation were explained. Furthermore, the results of the evaluation exercise were presented and analyzed. It appears that the functions and action of the proposed model covered the majority of the coordination mechanisms envisioned in the public sector environment. However, the constraints faced during the validation process were noted and the means used to circumvent these challenges were explicated. Overall, it can be concluded that the findings from the evaluation reveal that the model has been proven to be useful and applicable. The findings obtained during the evaluation of the model were used as feedback to refine the model. The refined model was presented, founded on the concerns that participants shared during the evaluation. Pertaining to these respondent concerns, an important initial step in collaborative support interventions requires a level of preparedness especially when there is basic infrastructure availability disparity between possible collaborators. This was explored, along with the technology and skill readiness concepts. Additional activities highlighted were also reflected respectively in the affected phases.

The virtual community centric collaboration life-cycle model represents a model that aims to manage coordination as it provides guidance on how things should happen during collaborative acts by streamlining the coordination of multiple collaboration instances. Thus, it possesses the intended functionality of supporting and promoting sustainable coordination in the SA public sector. Overall, the model which is informed by lessons from the environment, provide attention points that aim to streamline coordination in a distributed environment.

However, A primary limitation of this study is that it considers a single work setting, so it is unclear whether the findings will generalize to other distributed settings. The lack of an empirically validated model through actual use is deemed an issue towards generalizability that looks to establish an IS design theory for coordination support in a distributed environment. Therefore, what is required is the application of summative evaluation that extends beyond a scenario-based evaluation to an actual system implementation and monitoring in the field. Practical implementation of the model would require encompassing the initiation of a project, from the requirements elicitation, through the post

implementation phase, to the evaluation phase. Future work suggests the application of the model through the implementation of an actual supports system to manage collaboration and to streamline coordination in a real-life context. Possible directions for future research include a detailed practical implementation of the proposed model and increasing the evaluation scope of the artefact towards generalization.

Besides, the model highlights the role of technopreneurship in the public sector. It encourages the development of new technologies and solutions that address coordination challenges. This technopreneurial motivation can drive continuous improvement and adoption of advanced coordination mechanisms, ensuring the model's relevance and applicability.

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APPENDIX A

Scenario

Rick, Martha and Stu are training coordinators for their respective municipalities (A, B and C). They are responsible for identifying the training needs of their personnel and for organizing their training. As they only meet every quarter to update on events, they often find out too late that they have identified training needs which their personnel have in common. In order for them to save costs and to streamline coordination, they recognize that they need to find a way to make visible the many hidden opportunities to work together. Rick then mentions to Martha and Stu that there is a community platform he has heard of where they can register and find other interested partners to work with if it happens that they share similar interests. Stu indicates that he heard the site provides the flexibility and option to specify interests and to set notification priorities and delivery channels to prevent unnecessary information overload or intrusion when recommendation updates are received.

Rick continues that the platform offers a shared workspace where people can meet, discuss, organize tasks, assign roles, gain permissions and specify communication structures in addition to their goals and objectives, as they would in their quarterly meetings. They all wish to be able to define groups to handle different projects simultaneously; configure and schedule their tasks and resources for execution while tracking resource conflicts and overload. Stu hoped that they can manage multiple projects at the same time, each with their own calendars, tasks, discussions, shared files, common access to shared service providers and other contact lists, all the while keeping track of legislative requirements. In addition, they wished to setup teams dynamically; create and reuse/modify their work templates; integrate external tools; and access external data sources; performing demonstrations, initiating chats and conference calls, as well as tracking discussions and commentary as the need arises. In addition, they all wish to share with other users and to invite other business partners to collaborate, either as observers or as contributing participants as they are mostly geographically dispersed and should use any suitable communication device as the situation warrants.

Martha indicates that it would be useful to be able to identify where a participant belongs in the entire workflow and how he/she contributes to the entire plan. At the same time, it would be good to be able to make announcements and to have an overview of what is happening in a summary view. They all hoped that the platform will support task execution as specified in the execution calendar timeline; track and monitor any deviations from the plan from different perspectives and that it could manage approval/signoff points. Stu hoped that it will also allow changes to the plan if the situation arises; that it will recommend solutions, and inform relevant participants to take action or to negotiate. In addition, it should continually track and assess ongoing projects and measure progress, success and eventual impact based on defined metric. Rick indicated that it would be valuable if the community allows training participants to stay in touch and to share knowledge, or to engage in social interaction if they wish.

Since Martha would like to deal with some private information, she would like secure access to her local data centre and a private workspace to run her activities, regardless of her location. In addition, she would like to store, share and manage her documents securely as well as search, aggregate and analyze data, among other things.

Based on your experience and given the accompanied scenario, how relevant do you think the envisioned actions in the work tool are?

APPENDIX B

THE MODEL EVALUATION RESULTS AND ANALYSIS

The result of the evaluation is presented in this section. Qualitative data pertaining to the applicability and usefulness of the conceptual model were collected. The results for the summative evaluation of the conceptual model serve as valuable formative input in the model improvement, alteration or redesign. This section encompasses biographical data of the experts, along with the ratings relating to the relevance of the model from the validation tool and interview comments regarding the utility, feasibility, functionality and suitability of the model.

As far as the Biographical Data of the Experts is concerned, a total of twelve domain experts were interviewed. Their biographical information is presented in Table 1 appendix B. A total of seven male and five female South African experts participated in the interviews, from varied levels of government, in an endeavour to cover as comprehensive a range of perspectives as possible. Certain respondents were very active in the public service; others had previous experience in government and were engaged in various forms of consulting roles, or on loan to government departments. One fulfilled the role of a service provider to other government departments, at the national level.

The practitioners evaluated the model, in terms of the envisioned functionality and suitability in their everyday operations, job functions and practices. The length of experience of these experts in the public service ranged from 6 years to 28 years. A frequency count on the number of participants who rated the proposed components of the model is presented in Table 1 appendix C.

The participants were asked to rate in what way they viewed the proposed components to be relevant. They were also asked to provide additional comments or viewpoints on the components as they felt necessary. The results from the participant ratings are presented as a count of frequencies of the ratings in each phase and of the overall components. The interpretation commences with the initiation phase, followed by the assessment and then a general overview of the component ratings is provided. In each case, the frequency count is outlined, with comments made by participants in each phase highlighted.

A. Phase 1: The Initiation Phase

Each of the twelve participants rated the actions in this phase, with respect to the scenario, as relevant and useful. Although on two separate occasions, participants who chose to fill in the questionnaire remotely after the presentation, called for confirmation on what personalisation meant. One of the participants (P7) commented on the personalisation action (see Figure 1, line 17), in her form stating it was relevant to the scenario, but insisted that personally, she is glad it is optional as she deems it of little importance. Reference to comments per participants can be seen in the appendix C in their corresponding anonymized forms or interview transcript. The participant accentuated that she does not mind using email, or even sifting through it, and considered its usefulness to be relative to the willingness and capability of a person to peruse through correspondence.

However, P7 emphasised that it is good to be provided with the choice. P7 maintained that context based specification, as per Figure 5, Line 20, is crucial if participation was to be realised. P7 further asserted that not everyone likes to use ICT elements. Others strongly maintained that it is essential. Although P8 added a condition to her comment that "*as long it does not mean belonging to a particular person*; *as it will restrict collective ownership and buy in from relevant stakeholders*, this it is a yes". At this point the researcher reaffirmed that the personalisation referred to was in terms of the technology enabling, dynamic insertion, customisation and suggestion of content in a format that is relevant to individual users based on their specified preferences and interest. The statement reassured her stance on its usefulness.

In a general reference to the phase, participant 8 (P8) suggested the need to make explicit the requirement of clearly specifying the measuring metric at the initiation of a project, in order to support effective post project test analysis when evaluation commences. Participant 5 (P5) emphasised the need to take cognisance of mobile devices, and how they can be extended to support such collaborative platforms, while noting their limitations. According to the overall, general ratings from the participants in this phase it can be concluded that the proposed components are considered useful and applicable to managing collaboration and to streamlining coordination. A summary of the participant ratings is provided in Figure 4.

13	Phase 1: Initiation		
14	In order to leverage economies of scale the intiation phase consists of activities which include: defining and identifying collborative opportunites from environmmental requirements and providing a shared environment to support the subsequent specification of the goals and objectives of the desired outcome, as well as agreeing on common terminologies and meaning.		
15	Possible support actions	Relevant	Not-Relevant
16	Is it relevant to have a system that will help to define and identify opportunities for collaboration?	12	0
17	In order to leverage economies of scale the initiation phase consists requirements and providing a shared environment to support the su	12	0
18	Is the ability and flexibility to use any communication/notification means necessary?	12	0
19	Is it necessary to have a system that provides a virtual environment to set up goals and objectives by supporting meetings, discussions and problem-solving?	12	0
20	Is it relevant to be able to specify the dates and locations for the events that you are interested in?	12	0
21	Is establishing a shared vocabulary of terms, concepts and their meanings relevant to understanding project specific functions?	12	0

Figure 2. Ratings in the Initiation Phase

B. Phase 2: Planning and Design Phase

The response of the participants with regard to their perceptions of the utility and applicability of the planning and design activities to support collaboration and streamline coordination is provided in Figure 5. As is evident in Figure 5, each participant referred to all actions in the phase as relevant towards coordination support. P5 further emphasised the obligation for role clarification for effective coordination. Relative to Line 26, P7 suggested the need to ensure that agreements to participate and to be a part of the team allocation are in place. P6, relating to Line 27, in Figure 3, emphasised the need to ensure compliance with the relevant legislation. P10 accentuated the importance of being aware of the challenges associated with the supply chain. P7, asked the question 'how seamless?' regarding Line 27 in Figure 2 and stressed that, for instance, such seamless operation must take cognisance of the procurement policies. Participant 11 (P11) maintained the imperative of having a centralised lookup database for service providers and of ensuring the transparency of operations.

All participants strongly believed that the activities proposed for in this phase are of essential importance, with the verdict indicating that the planning and design phase components are relevant. Therefore, it can be concluded that the actions in the phase are useful and applicable towards coordination support in a distributed environment.

	Phase 2: Planning and Design		
The planning and design phase sets the project supporting structure and specifications that that serve as a reference model/template to guide resource deployment and the execution of collobrative projects. This ensures that requirements are enforced during execution. The activities in this phase include: setting up teams, roles, reporting structures and working procedures, among others.			
	Possible support actions	**Relevant**	**Not-relevant**
	Is the ability to dynamically define groups to handle different projects simultaneously; organize and configure teams, tasks and resources for execution while tracking conflicts necessary?	12	0
	Is the ability to look up and invite service providers seamlessly, as well as to check their accreditation and requirements important?	12	0
	Is it necessary to be able to map tasks, schedule the order of execution and possible resource deployment in a calendar or process view form?	12	0
	Is the ability to create, reuse and adapt templates for both design and execution relevant?	12	0
	Is the ability to seamlessly create and securely manage/share files or documents important?	12	0

Figure 3. Ratings in the Planning and Design Phase

C. Phase 3: Implementation Phase

The results of the perceptions of the users towards the requirements and activities for the implementation phase are presented in Figure 4. Every proposed action was rated as relevant. P11 emphasised checking for compliance to established rules, continuing by advocating the need to document reasons for deviation(s) from the plan, when they occur, to serve as input for decision making. Based on the feedback it can be concluded that the requirements and activities of implementation are deemed functional and apposite to managing coordination in a distributed environment.

	Phase 3: Implementation		
Implementation enforces specifications provided in the planning and design phase while monitoring deviations from plans and accounting adaptviely for problems (exceptions) that may occur.			
	Possible support actions	**Relevant**	**Not-relevant**
	Is the ability to monitor deviation from established plans, during the course of execution relevant?	12	0
	Is it necessary for a system to have the flexibility to reorganize tasks and redefine a workflow definition or specification, as well as support human interventions during the course of execution?	12	0
	Is an execution system that can adapt dynamically to situations relevant?	12	0
	Is the ability to track and detect conflict during resource distribution and deployment relevant?	12	0
	Is automating predefined tasks, tracking the resources, performers, as well as approval and sign-off points important?	12	0

Figure 4. Ratings in the Implementation Phase

D. Phase 4: Assessment Phase

The feedback of the participants regarding their viewpoints relative to the activities in the assessment phase of the collaborative project is presented in Figure 5. All the participants indicated that the each of the activities in the assessment phase is relevant. Participant 11 commented on the need to track individual performances over time to challenge and reveal weaknesses from service providers. P11 also stressed the importance of customised analysis and reporting tools to account for various needs. P7 suggested the need to make explicit the redress phase, in case performance is flawed. The results denote that having monitoring and assessment activities is useful and applicable to coordination support in a distributed environment.

	Phase 4: Assessment		
	Assessment evalautes whether goals and objective set out at the initiation stage were met resulting in changed requirements, while documenting changes for future overall impact assessment.		
	Possible support actions	Relevant	Not-relevant
	Is the ability to track and assess performance relevant?	12	0
	Is the ability to evaluate both short term and long term impacts of events relevant?	12	0
	Is having secure access to multiple data sources for analysis and forecasting relevant?	12	0
	Is the ability to integrate visualization tools and issue specific assessment tools necessary?	12	0
	Is having access control to local resources even towards consolidated data analysis relevant?	12	0
	Seamless search, categorization, and storage of information is relevant.	12	0

Figure 5. Ratings in the Assessment Phase

The ability of the system to customize reports was appreciated, with statements such as, *"it should have an option for me to be able to plot my own requirement. We don't need to just keep a system that is very generic and specifics can't be put in or analysis can't be done to suit your needs because analyses that are general may not necessarily give the required result."*P11 Thus, ensuring the relevance of customization capability.

E. Phase 5: Continuous, Secure Monitoring and Reporting Phase

Figure 6 shows the ratings of the participants as to the possible actions of the continuous monitoring and reporting component. All the participants rated these activities as relevant to continuous monitoring and reporting. P11 stressed the importance of documenting and consolidating the lessons learnt throughout the life-cycle of the collaborative project. Overall, it is indicated from the results that the phase is functional and applicable towards coordination support. The participants contend that report visualization should be based on preference, and therefore, should be customized to the needs of the users. As they customarily report to different departments, a paperless system like this where councilors who require information may log in to a computer, punch certain keys and then draw whatever they are looking for, is desirable. P1 stated: "we won't be having all these reporting issues. If we can have that kind of a system, there should be no reason why... they won't know challenges and weaknesses".

F. Overall Comments on Proposed Model and Its Components

Once the phases had been processed, participants were asked to comment on the overall relevance and comprehensiveness of the phases. Figure 7 indicates the ratings of the participants as to the overall applicability and usefulness of the components which they all deemed relevant. The frequency count of the ratings of the participants on the proposed components, and their possible actions confirms that the collaboration life-cycle model is practical, useful and applicable towards managing and streamlining coordination in the South African public sector. It is deemed that the model has great potential, as its usefulness and applicability was acknowledged from the multiple perspectives of the various domain experts.

	Phase 5: Continous and Secure Monitoring and Reporting		
	To account successfully for dynamic changes in the environment there is an encompassing secure monitoring and reporting component that continuously tracks the activities and changes in the environment which, in turn, facilitates subsequent colloboration and improvement.		
	Possible support actions	**Relevant**	**Not-relevant**
	Is the continuous tracking and monitoring of performance and changes in the environment as well as requirements necessary?	12	0
	Is the ability to monitor and report at different stages in an entire collaboration process relevant?	12	0
	Is support for various but streamlined and targeted reporting necessary?	12	0
	Is collecting and analyzing information systematically as a project progresses relevant?	12	0

Figure 6. Ratings Regarding Continuous Secure Monitoring and Reporting

Participant 6 (P6) stated *"It's nice to see you seem to have covered all the relevant areas from what I can see. It's quite a nice idea to build it in with workflow. Auditors will love it*". Participant (P12) concurred saying "*They are all relevant and necessary issues to be covered, especially when it comes to project management and workflow process."* This provides an indication of the potential value the model holds, towards the management and streamlining coordination in a distributed environment. However, while the participants were positive about the contribution the proposed model they raised some concerns which the feedback was used to adapt the model accordingly as presented in section 6. Details of the overall benefits and concerns are elaborated in the next sub section.

		Relevant	**Not-Relevant**
	An **initiation phase**, with the capability to define/identify collaborative opportunities and to set up goals and objectives, as well as to explain common vocabulary, is useful.	12	0
	The **planning and design phase**, which defines project specifications in terms of what should be done by whom, how and when, is useful.	12	0
	The ability to monitor actions, progress and deviations from plans at the **Implementation phase** is necessary.	12	0
	The **Assessment phase**, which determines whether short or long term goals and objectives set have been met, is necessary.	12	0
	The **secure monitoring and reporting** component that continuously tracks changes in the environment, is necessary	12	0

Figure 7. Ratings Regarding the Overall Component Functions

VI. SUMMARY DOMAIN EXPERT INTERVIEW RESULTS – Benefits and Concerns

Comments on the collaboration life-cycle model and its components were obtained through interviews with the experts. A summary of the general comments from the perspectives of the experts engaged is analyzed and presented in these sub sections in terms of in terms of the benefits and concerns.

A. Benefits

During the interviews the participants commented on the conceptual model and its components, which each of them identified as useful and applicable to streamlining coordination of collaborative projects. All of the participants agreed that the proposed model and its components are functional, practical and appropriate. According to the specified scenario they remarked that the components of the model are well defined, with consideration being paid to all the necessary aspects which frequently require attention. The value envisioned from the model is presented verbatim, below:

P3 asserts "*the model is clear and it is quite generic in terms of its phases: so conceptually I think it is very clear and it's sound, I think it works. Working with municipalities, I certainly think it's*

relevant to have an online system, I like how I can advertise what my interest is and lets me decide the information to receive".

P2 *" as long as we wont have to spend all day sieving through the messages"* showed the importance of personalization.

P1 contends *"the purpose of the Intergovernmental Governmental Relation (IGR) Act is what you are trying to give effect to by strengthening the Intergovernmental relationship, which is about collaboration, so it's very important."* Essentially, structures for coordination exist as part of the IGR Act, which the model can leverage.

P1: "*Based on the scenario it should be intended for both centralised and decentralised approach to skills development in the public sector."*

P2 remarks: *"the idea you are coming up, with, collaborating to share training provider is a good idea. We should train for the broader society, track development of personnel so that they can fit in anywhere by standardizing. Your model, reminds me of the shared services we have in Gauteng province, because it has to minimise cost as well"* thus, re-emphasizes the need to leverage economies of scale.

P2 "*Training is good, but without monitoring and evaluation it is useless*."

P5 maintains "*Instead of spending money on travel and accommodation, this kind of model will help save costs as it will help aggregate similar trainings together for a more efficient collaboration by bringing in just one trainer rather than multiple for the same purpose. You save a lot of money for the government, and have record of who has and has not been trained."*

P4 asserts "*all of model aspects are important, as they reflect project management phases*."

P8: *"The model accommodates my current situation right now. It captures all the relevant problems such as accountability which makes it useful."*

P11 comments *"the system is very practical; as a tool it can share the information with us for what we trying to do; to do an impact assessment. which mostly relate to what we call return on investment. We want to know whether the money that we spend on training really makes an impact. Is there any performance, improvement, and whether we should we use same service provider you know, as you say here"*. The statement further accentuates the importance of the model support for monitoring and evaluation.

Furthermore, according to P6, "*in terms of auditing, it makes it a lot easier for using this system a lot of people will be willing to, as you've touched the main points. I think it is a great initiative you are undertaking, I like the idea - all we need is to convince people on how it will benefit them*"

Questions regarding the readiness of the public sector, specifically municipalities, to embark on such a project, however, came to the fore. The concerns encountered during the interview process are discussed in the next section.

B. Concerns

The concerns in this section came to fore in terms of the willingness to cooperate, technological readiness and maturity as well as integration and not particularly the appraised model capability but its successful implementation. In reference to the willingness to cooperate, along with technological readiness, P2 asks *"Are the municipalities ready for that yet?"* This respondent maintains that it will be a difficult endeavour, given that usually, *"the bigger municipalities want to remain bigger and want to ensure the smaller remain smaller,"* a sentiment that indicated the impediments to cooperation. P4 emphasized the lack of cooperation and the unwillingness to compromise in the municipalities, asserting: *"They usually want nothing to do with the other municipality, which affects*

cooperation and brings a barrier on the technology, as municipalities work in silos… P6 avers *"municipalities see themselves as independent entities"*. P6 accentuated the need for a higher authority to guide such an undertaking, establishing consequences for non-compliance.

Another issue brought to fore was the for integration, Concerning municipalities that are self-sustainable, P10 points out "*there many systems that need to be integrated together...they are just all scattered around, (Silo mentality) driven by political ambition, with heads just wanting to outshine the other...in as much as we want to see the consolidation and integration, there is the human nature that needs to be taken care of, which is mostly associated with political ambition. Hopefully we can get value administratively... we are still battling to understand systems that provide M & E, detects supply chain rules, then initiates, say the tender process... and tracks the rules and activities, creates, reuses and adapts - that will save costs!*

Corresponding with P10, P5 points out that *"there is a lot government can save if we can track and eliminate duplications and track deviation."* As far as monitoring and evaluation are concerned, P1 emphasises the need to be able to integrate any analytical model, for any specified need context under study. Thus, it was clear that the value of Education, Training and Awareness (ETA) dimension on understating the value of cooperation and integration across the sector was important to make the proposed model successful.

Technological readiness and maturity, together with skills, was a definite concern; however, they were not exclusive concerns. P4 noted that "*in some cases the infrastructure is not there to begin with."* P3 acknowledged the relevance of the model premise stating that "*I think it's relevant to have an online system*". However, P3 continued that "*My concern though, is the extent to which practitioners will use such online collaboration tools, given the ICT infrastructure capability challenges in, especially, the local municipality where it is difficult to have… basic email support. For example, many …municipalities are battling with basic ICT systems. I'm not sure whether having an online system of collaboration, will be effective. While the tool is very appropriate for well-developed context, so it will work well in the global north and the metropolitan areas. It might be challenging for areas that really need to collaborate, such as the district and the local municipalities"*. This denotes that a level of technological maturity is required to be successful.

Although not explicit in the model description, it was made clear that the model looked to leverage on cloud computing technology for IT cost savings, thus, mitigating the burden of high capital expenditure that goes with ICT on premise infrastructure installation, management and maintenance. This denotes that a level of technological maturity is required to be successful. Hence, technological readiness assessment to enable the workings of the model should be carried out to determine the level of intervention required.

Whether the system was to be seen as a replacement for a face-to-face approach was discussed. It was made clear that the system is aimed to function in a complementary capacity to leverage the face-to-face approaches. P11 remarks "*don't forget physical human interaction,"* which was also emphasized by P3 as important.

It can be concluded from the feedback of the interviews that the model and its components can be useful and fully embedded into the environment, if certain requirements are met. The recommendations and suggestions for improvements were noted and included to refine the conceptual model, as explicated and clarified in section VIII.

APPENDIX C

Table 1 Biographical Data of Expert Participants

PARTICIPANT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
Country	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
Occupation:	General Manager-IS	Executive Director Cooperate services + regional manager of public works	Senior Manager	Deputy Director IT	IT Manager	Director-FIS	Senior Manager: Local Government Support and Capacity Building	Senior Manager: Capacity Building Coordinator	Skills Development Facilitator	Director : Skills development and employment equity	Senior Training specialist	Senior manager: municipal ICT
Years of experience at public sector:	6	17+	19+	9+	6+	14+	20+	28+	7+	10+	6 +	15
Public sector department:	Provincial	Municipal + Provincial	Municipality	Provincial	Provincial	Provincial	National	National	Municipality	Municipality	National	Provincial

APPENDIX D

The supporting primary data for this paper is available at the link in Appendix C

https://www.dropbox.com/sh/hjv3e5v2ml2t166/AACP0cauO3faM3M_i26U31LTa?dl=0