

EVALUATING INFORMATION SYSTEMS FOR COLLABORATIVE WELLNESS

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Abstract

We are refining a system for studying Collaborative Wellness (CW) developed by us for use in evaluating knowledge creation and information systems. CW is founded on reaching agreement between stakeholders on ways to address issues arising in complex environments and create the necessary knowledge to address these issues. Such a model is needed in the increasingly complex and dynamic environment now found in business and society. Creating, managing and disseminating knowledge is crucial to enabling organisations to adapt to change in their dynamic environments. Despite this, we found gaps in organisational knowledge creation theory for supporting fine grained studies of knowledge creation. The Collaborative Wellness System (CWS) is intended to address this situation. CWS treats collaborations of knowledge creators as social information systems. CWS has an adaptable framework of measures that may be deployed to suit the circumstances of a collaboration. The measures of CW record assessments of the usefulness of created knowledge relative to agreed stakeholder expectations. The system allows collaborative experiences to be shared and compared. CWS informs the development, application, tracking and refinement of improvements to existing information systems. The CWS presented in this paper has been validated in four case studies involving business and government agencies.

Keywords: Collaborative Wellness, Knowledge Creation, Group Collaboration.

1 INTRODUCTION

Information systems are becoming more complex. Our definition of complexity is not in the mathematical sense but follows that of Merali (2006) as one where systems emerge to address unanticipated events through the creation or reorganization of groups. From a knowledge perspective an unanticipated event is new knowledge. The organization must respond by creating new knowledge on how to deal with the event. The emerging complex environment is often characterized by collections of groups such as the one shown in Figure 1. Here, all the groups are working towards the same goal but each contributes to the general goal by socialising their knowledge contributions.

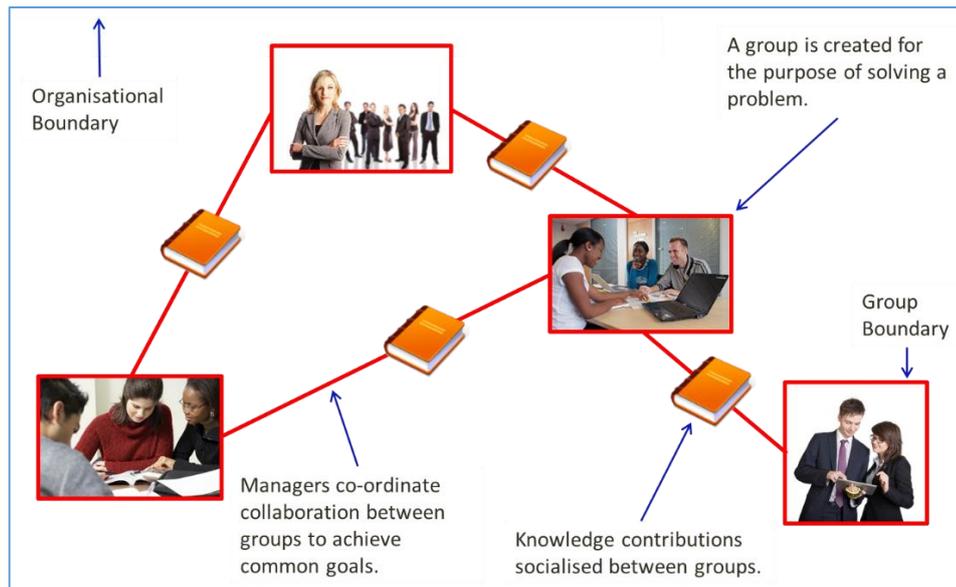


Figure 1 A Collection of Groups within an Organisation

The creation of new knowledge is through a human-centric information system composed of multi-level collaborations between both knowledge creators and their groups. Furthermore, requisite variety is needed to address anticipated needs of collaboration. The requisite variety will change as needs change in response to unforeseen events. This situation requires an organisation to quickly form collaborating groups with the purpose and requisite variety to address change. Collaborative wellness is an assessment of the gap between the current and desired states of the collaboration (Rose 2013, p. 429). This paper discusses using the concept of collaborative wellness to develop a Collaborative Wellness System (CWS) to aid an organisation in designing, implementing and improving knowledge creation collaborations and outcomes.

CWS was devised and refined over time from experiences in four case studies, one at a State Government Agency (SGA) involving the implementation of an inter-group on-line reporting system (Rose 2013). Two case studies were hosted by Woolworths Limited (Woolworths) with a focus on the implementation of new ideas in their logistics business (Rose, Hawryszkiewicz & Kang 2014). The fourth case study considered how CWS could be used in characterising issues in existing inter-department information systems of a Commonwealth Government Agency (CGA).

This paper begins with an outline of CWS's structure and relationships. It introduces the idea of knowledge creators interpreting their responsibilities to create, occupy and perform roles-in-use in a collaboration. Knowledge creators align their roles-in-use to changes in purpose. Furthermore, they adjust these roles-in-use to ensure compatibility in relationships with other knowledge creators and thereby realize collaborative wellness. The concluding remarks discuss the case study limitations, contributions and future research opportunities.

2 THE COLLABORATIVE WELLNESS SYSTEM

Our definition of collaborative wellness focuses on knowledge creation. Collaborative wellness must be achieved between and within groups. Figure 2 illustrates the collaborative wellness system for group knowledge creation within the context of an organisation. Here, stakeholders address an issue requiring new knowledge and agree on a way to address it. This agreement results in a joint value proposition that defines what needs to be done and how to achieve it.

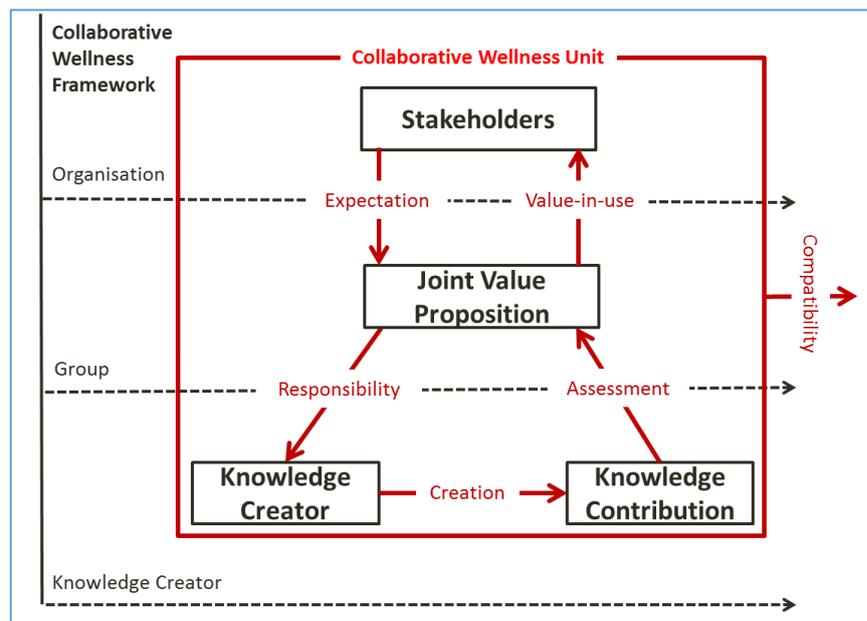


Figure 2 Collaborative Wellness System

From the perspective of CWS, the collection of groups shown in Figure 1 are collaborative wellness units linked through commonality in each group's joint value proposition. We call this social network of collaborative wellness units the Collaborative Wellness Network (CWN). Groups may share resources and have knowledge creators in common. Indeed, a knowledge creator in one group, may be a stakeholder in another group and vice-versa. The remainder of this section will consider the components of the collaborative wellness system in more detail.

2.1 Stakeholders and the Joint Value Proposition

Multiple stakeholders may agree to create a joint value proposition as an "aggregation or bundle of benefits" (Osterwalder & Pigneur 2010, p. 22) for designing or implementing a new human centric information system. We assume this joint value proposition depends upon knowledge creation for its fulfilment. The joint value proposition is created to "get either a functional, social, or emotional job done, or help him/her satisfy basic needs" (Osterwalder 2012, p. 1). Joint value propositions may be successively deconstructed into "elementary value proposition(s)" that "describe different aspects of a value proposition" (Osterwalder & Pigneur 2003, p. 431). From this perspective, the value proposition applied to a knowledge creator is an elementary value proposition deconstructed from the group's joint value proposition. Furthermore, the group's joint value proposition is an elementary value proposition deconstructed from the organisation's joint value proposition.

As stakeholders experience the strengths and weaknesses of joint value propositions, they may reconsider, refine, adapt or abandon the service (Maglio & Spohrer 2013). In this way, CWS is dynamic, it changes and adapts as joint value propositions change, and activities vary according to the needs of current knowledge creation.

2.2 The Knowledge Creator.

We distinguish a knowledge creator as being a type of knowledge worker who either has been or is currently engaged in knowledge creation activities associated with product or process “innovation” (Norman & Verganti 2014, p. 82). The term “knowledge workers” was coined by Drucker (1994, pp. 5-6). Knowledge workers bring “their expertise to develop products and services. They require flexible work environments to come up with ideas, evaluate them and put them into practice” (Hawryszkiewicz 2010, p. 8).

In our practical work we concentrated on small group collaborations of knowledge creators to study knowledge creation processes. A small group varies in size according to their purpose, but typically can have between four and 20 members. Patel, Pettitt & Wilson (2011) nominated an optimum small group size of 6-8 members. Observations by Slater (1958) pointed to a small group size of 5 as being “most effective in dealing with an intellectual task involving the collection and exchange of information about a situation, the coordination, analysis, and evaluation of this information” (pp. 137-8).

2.3 The Knowledge Contribution

During collaboration, knowledge creators perform the “SECI” process (Nonaka, Toyama & Hirata 2008, p. 19 Fig 2.1) to socialise and refine knowledge into a knowledge artefact or knowledge embedded in a new product. A participant-observer with expertise in the joint value proposition uses phronesis to assess the usefulness of the knowledge relative to the joint value proposition. Once assessed, this knowledge becomes a knowledge contribution.

The usefulness of a knowledge contribution varies according to its relationship to other knowledge contributions, changes in the joint value proposition, and according to the collaborative wellness of the collaboration. Usefulness may need to be re-assessed according to changes in these relationships and dependencies.

2.4 Introducing the Role-in-use

Discussion has been about a static interpretation of responsibility incorporated in a defined role. However, experience shows knowledge creators adapt to changes in circumstance. Adaptions may include a re-assessment of commitment to the group’s purpose, their approach to occupying roles, the skill sets they bring, their interpretation of role requirements, and the way they perform assigned roles.

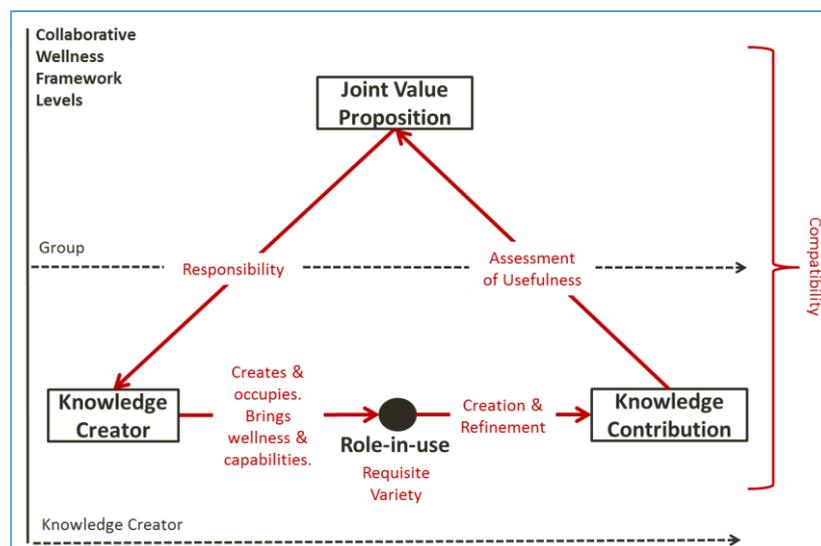


Figure 3. The Role-in-use

We introduce the concept of the role-in-use to cater for these adaptations. Here, a knowledge creator considers their responsibilities and exercises free will to accept their assigned role in the confidence of possessing the skills necessary for meeting the group's purpose as expressed by the joint value proposition. In accepting, they commit to fulfilling their part in the collaboration's purpose and create, occupy and perform a role-in-use according to their interpretation of the purpose. More formally, the knowledge worker believes they have the traits necessary to satisfy the requirements of requisite variety in their role-in-use. The knowledge creator ensures compatibility with other roles-in-use through negotiation with other knowledge creators.

The joint value proposition determines the "requisite variety" (Nonaka & Takeuchi 1995, p. 82) of the group and the knowledge creator determines the requisite variety of their roles-in-use. At the start of collaboration, the requisite variety is considered to be satisfied. The emphasis therefore is on tracking changes in requisite variety relative to the joint value proposition as collaboration progresses. The role-in-use as shown above, is a dynamic construct that is changed by the knowledge creator as they adapt to changing circumstances. Figure 3 is a detailed view of the knowledge creator level shown in the CWS of Figure 2.

2.5 Role-in-use Alignment

Knowledge Creators in an "energised" Ba (Nonaka, von Krogh & Voelpel 2006, p. 1191) have a shared sense of purpose aligned to the objectives of Ba. In the CWS perspective, we assess this shared sense of purpose using the concept of role-in-use alignment. There are two inter-related components to this alignment. The first component is an assessment of a knowledge creator's capacity and capability to perform their responsibility through their role-in-use. This assessment concerns the knowledge creator's available traits relative to the requisite variety of the role-in-use and a wellness assessment as to how they can and do perform their role-in-use. Together, we call these assessments the knowledge creator's degree of requisite variety. Assessments are made at a particular point in time. They are subjective, qualitative and concerned with tacit knowledge and "tacit knowing" (Polanyi & Prosch 1975, p. 34). Therefore, neither the required requisite variety of the role-in-use nor the knowledge creator's available traits can be precisely described. Requisite variety may change as the collaboration adapts to new situations, such as a change in purpose. Furthermore, there may be a mismatch between the requisite variety of the role-in-use and that required in the designed role owing to misinterpretation by the knowledge creator and/or a lack of clarity in setting out the responsibilities of the designed role.

The second component of role-in-use alignment is the performance of the knowledge creator in their role-in-use. This is an assessment of the effect of the knowledge creator's wellness upon the application of their traits in performing their role-in-use and their social relationships with other knowledge creators and their roles-in-use. The assessed usefulness of the knowledge contribution is considered an indicator of this second component. Role-in-use alignment is assessed relative to the joint value proposition.

2.6 Defining Collaborative Wellness

Collaborative wellness is based on a gap assessment formed by comparing the current state with the desired state expressed in the joint value proposition. A precise definition of collaborative wellness requires a pragmatic answer to the question of how can a state be described with sufficient precision to be both useful and performed in a timely manner; and how can a state be compared to another state?

The solution adopted is to conceive collaborative wellness as being the synthesis of three gap assessments namely the degree of requisite variety bought by knowledge creators to their roles-in-use, the alignment of the roles-in-use relative to the joint value proposition, and the usefulness of knowledge contributions in fulfilling the joint value proposition. These assessments do overlap to a certain extent and are interdependent. To overcome issues of subjectivity, Davenport (2005) suggests that several peer groups may be involved in the assessments to increase the number of responses in the process and perhaps to introduce other perspectives if necessary.

We say that collaborative wellness is high if the assessed gap discussed above is small. That is, high collaborative wellness occurs when stakeholders are satisfied that the collaboration has achieved, or is on course to achieving its joint value proposition. Conversely, a low collaborative wellness occurs when a collaboration cannot satisfy its stakeholders.

3 CWS STRUCTURE AND UNDERLYING THEORY.

Our early case studies adopted a structural perspective for studying information and knowledge flows within a defined structure that we now call the “Collaborative Wellness Framework (CWF)” as shown in Figure 2. While this structure was useful and yielded insights that benefitted the hosts of the case studies, it also created artifices that hid some interactions in that some patterns visible in the raw messaging were lost in subsequent analysis.

Collaborative wellness and its system aligns with the theory of Organisational Knowledge Creation (OKC) (Nonaka et al. 2014). In OKC, knowledge creation occurs through the “SECI” spiral process (Nonaka, Toyama & Hirata 2008, p. 19 Fig 2.1) in which an individual’s “tacit” (Nonaka, Reinmoeller & Senoo 1998, p. 673) knowledge is socialised and transformed into explicit knowledge. This knowledge creation activity is shown in CWS at the knowledge creator level of Figure 3.

The “SECI” spiral is driven by “phronesis” (Nonaka et al. 2014, p. 139 Fig 1), that is, practical wisdom. Tacit and explicit knowledge together with phronesis form a “knowledge triad” in “multi-layered networks of Ba” (p. 139). This is shown in CWS by the knowledge creator participating in a “SECI” process within the Collaborative wellness Unit (CWU). Created knowledge is assessed for usefulness by the application of phronesis. The assessed knowledge is termed a knowledge contribution. Value is realised from the use of the knowledge contribution by stakeholders in a co-creation collaboration. These collaborations dynamically overlap and separate in multiple “Ba” layers. “Ba” is a “moving context in motion” of knowledge creation (Nonaka et al. 2014, p. 138; Nonaka, Toyama & Hirata 2008, p. 34). Our perspective has shifted to a focus on the collaborative wellness network formed from linked collaborative wellness units.

4 THE RESEARCH QUESTION

Organisational Knowledge Creation (OKC) Theory stresses the importance of a collaboration having clearly defined objectives (Nonaka, Toyama & Hirata 2008; Von Krogh, Nonaka & Rechsteiner 2012). Furthermore, OKC mandates managers to orchestrate Ba, that is “energise” it, to ensure that each individual is synchronized with and aligned to the intentions of Ba with a shared sense of purpose (Nonaka, von Krogh & Voelpel 2006, p. 1191). The introduction of the role-in-use and role alignment to assess the degree of energising and alignment to the purpose expressed by the joint value proposition allows us to formulate the following research question:

In small group collaborations that create new knowledge, do acceptable outcomes result from achieving requisite variety in roles and aligning roles to the collaboration’s joint value proposition?

We formulated two hypotheses to test by case study. Both hypotheses must be true to answer the research question in the affirmative:

H1: Achieving requisite variety is a necessary condition for role-in-use alignment. (Applies to State Government Agency (SGA) with 13 knowledge creators and Woolworths Study 1 with 9 knowledge creators).

H2: Improving role-in-use alignments is a necessary condition for improving the usefulness of knowledge contributions. (Applies to Woolworths Case study 2 with 13 knowledge creators).

5 CASE STUDIES

Our case study experiences at Woolworths (Rose, Hawryszkiewicz & Kang 2014) showed that knowledge creation and value co-creation utilising this knowledge occurred simultaneously on multiple levels and indeed between levels. Using this experience, we devised CWS shown in Figure 2 with an elaboration for roles-in-use shown in Figure 3. The case studies are experiments in which role alignment is an independent variable and the usefulness of knowledge contributions the dependent variable. Additionally, the case studies were used to evaluate how the Collaborative Wellness System can be used in the discovery, performance, evaluation and communications of results. Four case studies have been conducted as noted in the introduction. One at a State Government Agency (SGA) (Rose 2013). Two case studies at Woolworths (Rose, Hawryszkiewicz & Kang 2014) and the fourth case study at a Commonwealth Government Agency (CGA).

5.1 Approach and Research Design

The approach and research design for the State Government Agency (SGA) case study was detailed in the paper by Rose (2013) and for the two Woolworths studies by Rose, Hawryszkiewicz & Kang (2014). The Commonwealth Government Agency (CGA) case study followed the same approach and research design as previous studies and this is summarised in Figure 4 below.

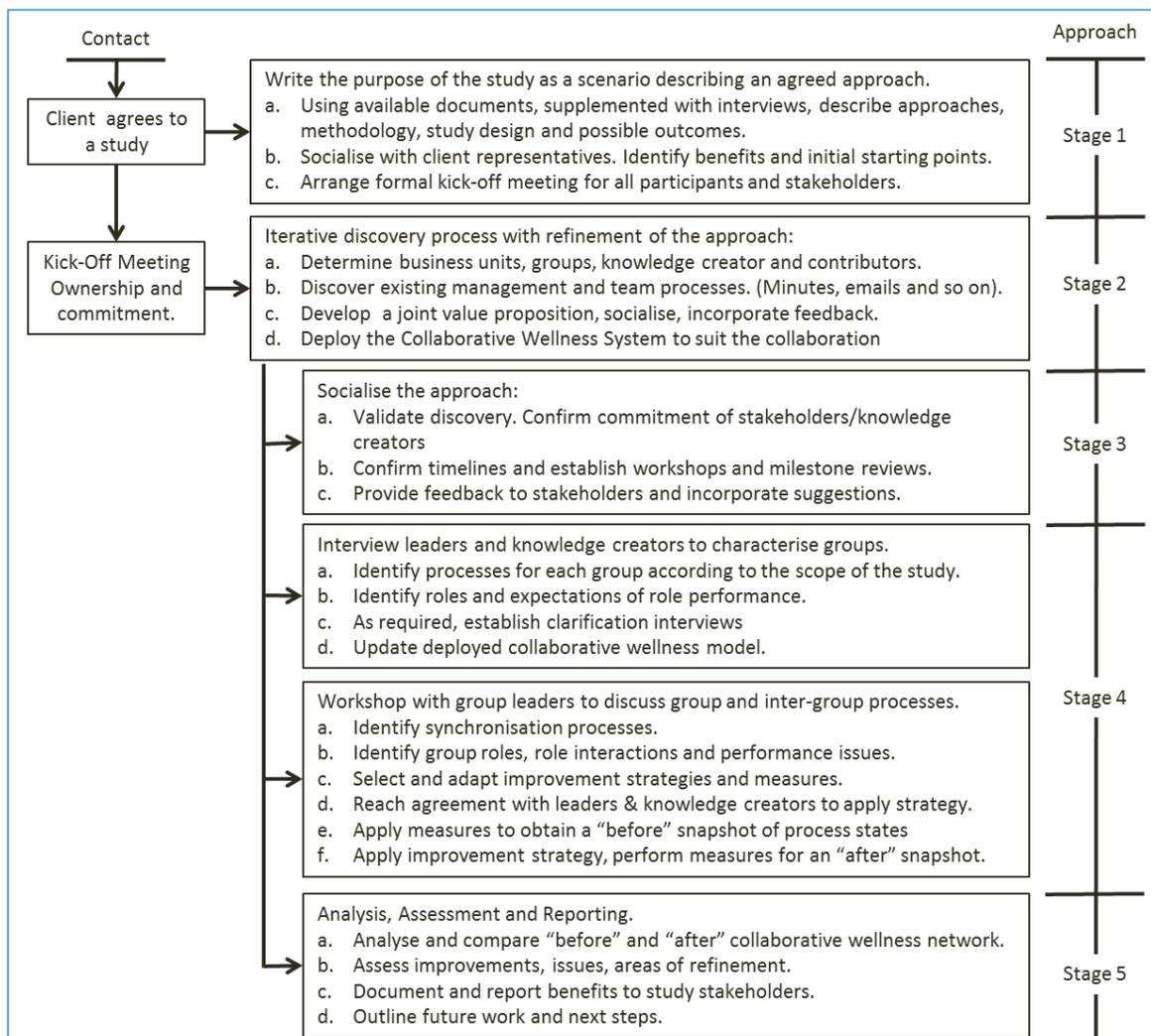


Figure 4 Research Design of Case Study Staged Approach.

The agreed joint value proposition for CGA was to categorise and recommend solution approaches for the top three issues nominated by each of the eight teams in the IT Delivery Services department engaged with the external facing departments of CGA. The structure of the two departments studied at CGA was of “loosely coupled organisations” (Rose 2013, p. 425 Fig 2) with a reliance on negotiated co-operation in service arrangements. In the SGA study, the focus was on how to implement an inter-team reporting process. In the CGA study, after consideration of the issues, some were combined and the joint value proposition was focused was on characterising the remediation of 22 distinct issues across existing inter-department information systems.

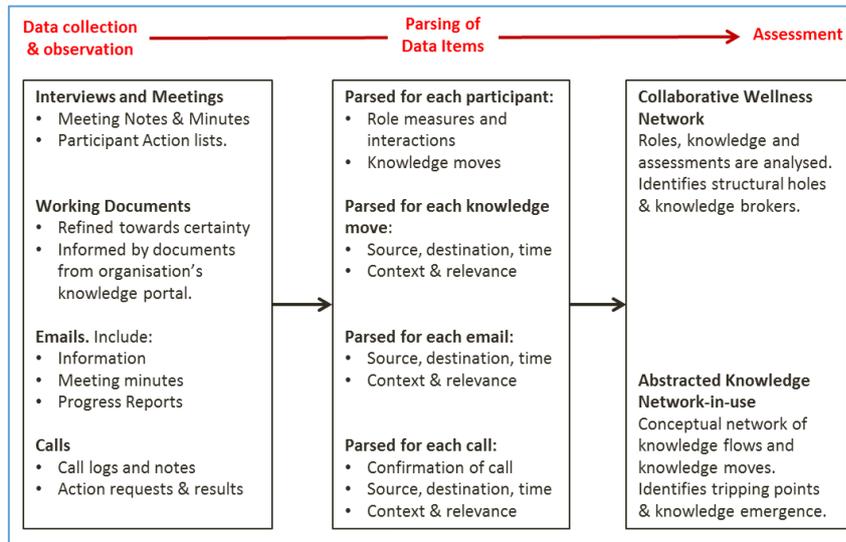


Figure 5 Case Study Analysis

The heart of analysis in all the case studies was the method of assessing knowledge contributions. This assessment is based on techniques used in linkography to identify “design moves” (Goldschmidt 1990, p. 292). Goldschmidt (1995) extended linkography and its parsing process to the group level. The collaborative wellness system (CWS) extends Linkography's parsing to all message interactions irrespective of media format and times between communications. The design moves in linkography become knowledge contribution assessments in CWS and their links trace not only the development of ideas during collaboration but also identify who conceived the original idea and how the SECI process was performed, for example, through face-to-face socialisation, email exchanges and/or individual reflective thinking.

The case study design and methodology is pitched at a fine granularity of detail. It is both manual and qualitative and depends upon the expertise of the participant-observer. Furthermore, the activities of collaboration are interdependent, for example, the collaboration's joint value proposition must be clearly stated to ensure the expectations of stakeholders are understood by knowledge creators. If this is not the case, the knowledge creator's role-in-use will not align to the purpose and knowledge contributions will be less useful and overall collaborative wellness reduced as the gap between current and desired state widens. The methodology used in the case studies supports a learning-by-doing approach that aids detailed tracking and impact analysis when re-assessments are necessary.

5.2 Results and Discussion

The case studies provided different contexts in which to perform the same experiment of varying or observing the variation of the alignment in roles-in-use and then studying changes in the usefulness of knowledge contributions. In this light, we decided to map all of the discovered issues of the four case studies to CWS, which is summarised by issue counts in Figure 6 below. The relationships in the collaborative wellness unit (CWU) are directed links that correspond to process steps in the collaborations being studied. Therefore, issues once located in CWU indicate where remediation is

required. In Figure 6, tracking anti-clockwise from the issue identifies its impacts, while moving clockwise from the issue identifies likely sources of the issue. The stakeholder entries reflect our assessment from studying the mixed vendor storage project in the second Woolworths case study that not all crucial stakeholders were engaged in the project. In the SGA study, we found that lack of arrangements for implementing inter-group processes inhibited developing joint value propositions. While high rates of utilisation affected the knowledge creators and their knowledge contributions. In the case of the first Woolworths' study, the conflict in purpose resulted in 16 ideas not being quantified. The CGA issues were found mainly to be associated with issues in deriving value propositions and co-creation of value-in-use.

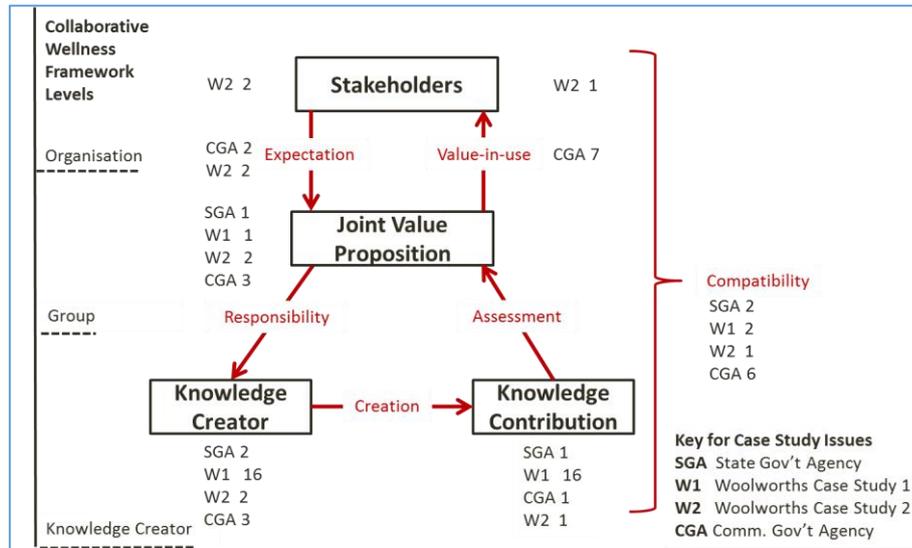


Figure 6 Identifying Impacts of Case Study Issues on the Collaborative Wellness Unit

The annotated CWU above will be used as an aid to discuss the research question. Answering the research question in the affirmative requires that the two hypotheses be true. The hypotheses act as perspectives to view activities and infer causalities in the case studies. The case studies provided different contexts in which to perform the same experiment of varying or observing the variation of the alignment in roles-in-use and then studying changes in the usefulness of knowledge contributions.

5.2.1 H1: Requisite Variety in the First Woolworths Case Study

The first Woolworths' case study had the purpose of devising cost extraction ideas for application in their logistics business unit. The findings reported a conflict of purpose over the method of quantifying the ideas' savings. Knowledge Creators, who were operational managers in the logistics business, "were concerned that the estimates would impact their forward operational budgets. Greater certainty was required in the estimates, but was not feasible within the agreed structure and timing of the study" (Rose 2013, p. 429). Despite the depth of experience and expertise available to the study, "only 4 of 20 cost extraction ideas could be quantified in terms of costs and benefits to Woolworths' business case requirements within the timeframe of the study" (Rose, Hawryszkiewicz & Kang 2014, p. 211). In CWU terms, the conflict in purpose occurred as there were two joint value propositions in play, each having separate stakeholders. The impact to the knowledge creator was an inability to quantify 16 ideas which decreased the usefulness of the 16 knowledge contributions.

Considering requisite variety, the researcher while having the experience and skills to devise engineering estimates did not possess the knowledge required to produce an estimate in the form and to the accuracy of a Woolworths' business case. Adopting the requirement for greater accuracy in estimates, created the situation where the researcher could not satisfy the changed requisite variety of his role-in-use and consequently put his role-in-use out of alignment relative to the purpose. In

consequence, the usefulness of the unquantified ideas decreased. Following negotiations with the study facilitator, it was agreed that unquantified ideas would be accepted in the final presentation with explanations of issues encountered. This change in the joint value proposition mitigated the impact of the conflict in purpose. The requisite variety of the researcher's role-in-use was reduced by not having to produce accurate estimates and the researcher was able to bring his existing traits to satisfy the reduced requisite variety. The researcher's role-in-use was re-aligned, and the unquantified ideas were more useful relative to the changed joint value proposition.

These matters were discussed at the final presentation of the case study and led to an agreement to undertake a second case study to investigate how to facilitate the introduction of new ideas into the Woolworths' logistics business unit (Rose, Hawryszkiewicz & Kang 2014). Resolving the conflict of purpose improved the participants' ability to meet the requisite variety of their roles-in-use and satisfied one of the necessary conditions for an "energized" Ba (Nonaka & Toyama 2005, p. 432).

5.2.2 *H1: Requisite Variety in the Second Woolworths Case Study.*

The second Woolworths' case study examined the experience of introducing new ideas in the logistics business. It was found that there were structural holes in the discovered collaborative wellness network. These were caused firstly, by difficulties in finding and engaging with knowledge domain experts and secondly by the difficulty in accessing closely held tacit knowledge within the confines of groups (Rose, Hawryszkiewicz & Kang 2014, p. 222 Table II). Existing structures inhibited access to knowledge necessary for knowledge creators to achieve the requisite variety required of their roles-in-use. This affected their performance and placed their roles-in-use out of alignment relative to the joint value proposition. This is reflected in the counts for the second Woolworths' study for the knowledge creator and knowledge contribution in Figure 6.

The "Vendor Pack Resizing" project (Rose, Hawryszkiewicz & Kang 2014, p. 221 Table 1) tackled a problem that originated in one business unit and impacted Technical Services (TS) in a cascade manner as the changed pack size was propagated by update processes throughout stock holdings. Remediation by TS was time consuming and expensive. A collaboration was established between TS and business unit representatives to devise a solution with minimal impact to both business and IT processes within an environment of budget constraint. The first knowledge contribution of TS was based on corporate system remediation. The assessment of usefulness was subject to disagreement because although it would solve the technical issue for TS, it was considered to be too costly by business representatives. In this situation of disagreement, all roles-in-use were out of alignment with the collaboration's purpose. Further, TS representatives' roles-in-use concentrated on functionality and were incompatible with business roles-in-use that focused on cost.

TS reframed their approach to seek a solution within the cost constraints mandated by business representatives. TS involved staff familiar with the remediation process to bring new perspectives to the group. A new knowledge contribution was considered where a work-around in the user application would give sufficient warning of the problem occurrence to correct the issue before it impacted the corporate system. In reframing the approach, the existing group collaboration had increased the requisite variety of the group's role-in-use. The requisite variety was achieved by including knowledge creators with a different perspective based on remediation to examine the problem. That is, the requisite variety was met by introducing new perspectives and thereby energising Ba (Nonaka & Toyama 2005) that led to improving the sense of shared purpose. All roles-in-use were now aligned since the approach considered both technical and cost issues.

5.2.3 *H1: Requisite Variety in the State Government Authority (SGA) Case Study*

In the SGA study, high utilisation was found to inhibit achieving requisite variety. Some "groups and knowledge workers had high levels of utilisation because of a focus on fulfilling assigned business purposes. This resulted in experts having little time to participate in planning and implementing change" (Rose 2013, p. 429). Here, knowledge creators had decided not to expend the effort required

to adapt to changes in the requisite variety of their roles-in-use and consequently their roles-in-use were out of alignment with the joint value proposition. High utilisation inhibits the ability of knowledge creators and groups to adapt to changes in requisite variety and therefore their ability to maintain role-in-use alignment.

We found that group boundaries must be matched to that required in the design of new information systems. The SGA study was concerned with devising strategies to facilitate the introduction of a new inter-group process. However there “were no formal arrangements in place to share knowledge ... and there was effort expended in duplicating knowledge and repeat processing of data” (Rose 2013, p. 429). Duplicating knowledge and repeat processing increased the utilisation of participants. The two groups involved in the study were structured as closed boundary, co-located small group collaborations.

We recommended the groups, for the purposes of the inter-group processes, be structured as loosely coupled, open co-located groups. An appointed boundary spanner would have “two responsibilities: firstly, to socialise the changes through workshops and thereby secure co-operation; and secondly to oversee change implementation and remediate difficulties before they impacted the program” (Rose 2013, p. 429). Our recommendations were in line with OKC’s acknowledgement that “while Ba needs boundaries, these must be open” as “meaningful context-sharing requires boundaries ... but these must be permeable to allow for connections with other Ba.” (Nonaka, Toyama & Hirata 2008, pp. 37-8).

5.2.4 H2: Role-in-use alignments in the Second Woolworths Case Study

After completing the SGA study and Woolworths’ first study it was evident that the researcher as a participant-observer played a more active part than originally intended. The researcher’s active role stemmed from the belief, bolstered by experience, of the importance of commitment and delivering on agreed joint value propositions. However, the qualitative assessments and the researcher’s role-in-use raised a concern about the introduction of bias and the need for greater objectivity. The “Transport fuel reduction idea” (Rose, Hawryszkiewicz & Kang 2014, p. 221 Table 1) collaboration addressed this concern by ensuring independent assessment and endorsement by Woolworths of findings through publication. The outcome of the study was the publication of a finding that “11 per cent fuel saving was achieved during the tests. The test project, with its promising results, is in line with Woolworths’ sustainability goals” (p. 224). The researcher in a boundary-spanning role energised the Ba of the collaboration by ensuring distribution of information and maintaining the sense of shared purpose.

5.2.5 Case Study Results.

The case studies were qualitative in nature. They used the same approach and research design over a two year period to conduct the same experiment in different organisational contexts. Our concerns of bias were mitigated by sharing assessments and incorporating different viewpoints to the point of seeking independent assessments in the second Woolworths’ study with an endorsement by Woolworths Limited. The study activities could be tracked using the collaborative wellness system as discussed above and showed assessments consistent over the studies for similar circumstances. In this light we say that in the context of the research studies the two hypotheses, namely, achieving requisite variety is a necessary condition for role-in-use alignment and secondly, improving role-in-use alignments is a necessary condition for improving the usefulness of knowledge contributions are true. The research question is answered in the affirmative and in small group collaborations that create new knowledge, acceptable outcomes do result from achieving requisite variety in roles and aligning roles to the collaboration’s joint value proposition.

6 CONCLUSIONS AND RECOMMENDATIONS

We conclude from the case studies that using the Collaborative Wellness System benefits the study, tracking and improvement of organisational knowledge creation processes in knowledge creation collaborations.

6.1 Limitations

The time constraints of the studies and the specialised nature of activities in the processes of the State Government Agency, Commonwealth Government Agency and Woolworths' logistic business unit mean that our recommendations and conclusions need careful consideration before application to other contexts. In one respect the time constraints reflect the conditions imposed on external engagements by businesses and from this viewpoint were constructive in understanding how to scope the joint value propositions. However, we are confident that the research can be broadened in both scope and scale to distribution systems covering both physical product and information artefacts in applications such as disaster relief logistics and managing carbon abatement projects.

6.2 Research Contribution

CWS with its concepts of the collaborative wellness unit, role-in-use and role-alignment provide researchers with the precision required to study dynamic knowledge creation processes. CWS aligns with Organisational Knowledge Creation theory's "dynamic fractal organization" (Nonaka et al. 2014, p. 139) and would support research into this new paradigm. CWS can be leveraged for researching interactions between Ba "spaces" as called for by von Krogh & Geilinger (2014, p. 156). CWS provides a framework for storing and comparing experiences of knowledge creation collaborations.

6.3 Contribution to Business

CWS has been used for tracking, reporting, evaluating and informing the improvement of knowledge creation collaborations. In particular, the collaborative wellness unit has been found to be effective in communicating discovered issues and the recommendations on how to remediate them to business stakeholders. When CWS is used to monitor and report on systems, the collaborative wellness unit provides an intuitive visualisation for business reporting and data analysis because it links issues to their business context. Using the methodology of CWS provides business with a rigorous and structured approach to validating vendor value propositions against business requirements.

6.4 Future Research

Our practical experience is reflected in the choice of an organisation for the collaborative wellness framework (CWF) (Figure 2), and that all of the linked CWU's would be in this single framework, that is, within the boundaries of the same organisation. However, in many situations, each CWU unit may be in different types of CWF reflecting the reality of a distributed collaboration. Furthermore, knowledge creators and stakeholders within a single CWU may also be distributed. This opens opportunities to explore the effects of different spaces on collaborative wellness. The CWS can also be considered a recursive structure, so for example, the stakeholders of Figure 2 may be groups of stakeholders. Introducing recursion opens research possibilities for using CWS in collaborations such as clusters and other meta-organizations (Gulati, Puranam & Tushman 2012). The third avenue of research is studying the use of CWS in collaborations that span geographical and cultural boundaries.

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References

- Davenport, T.H. (2005). *Thinking for a living*, Harvard Business School Press, Boston, Massachusetts.
- Drucker, P. (1994). *Post-Capitalist Society*, Butterworth Heinemann, Oxford, UK.
- Goldschmidt, G. (1990). Linkography : Assessing design productivity, *Cybernetics and System '90*, Proceedings of the Tenth European Meeting on Cybernetics and Systems Research, University of Vienna, Austria, 17-20 April 1990, 291-198.
- Goldschmidt, G. (1995). The designer as a team of one, *Design Studies*, 16 (2), 189-209.
- Gulati, R., Puranam, P. & Tushman, M. 2012, Meta-organization design: Rethinking design in inter-organizational and community contexts, *Strategic Management Journal*, 33 (6), 571-586.
- Hawryszkiewicz, I.T. (2010). *Knowledge management*, Palgrave MacMillan, London.
- Maglio, P.P. & Spohrer, J. (2013). A service science perspective on business model innovation, *Industrial Marketing Management*, 42 (5), 665-670.
- Nonaka, I., Kodama, M., Hirose, A. & Kohlbacher, F. (2014). Dynamic fractal organizations for promoting knowledge-based transformation: A new paradigm for organizational theory, *European Management Journal*, 32 (1), 137-146.
- Nonaka, I., Reinmoeller, P. & Senoo, D. (1998). The "ART" of knowledge: Systems to capitalize on market knowledge, *European Management Journal*, 16 (6), 673-684.
- Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company*, Oxford University Press, New York
- Nonaka, I. & Toyama, R. (2005). The theory of the knowledge-creating firm: subjectivity, objectivity and synthesis, *Industrial and Corporate Change*, 14 (3), 419-436.
- Nonaka, I., Toyama, R. & Hirata, T. (2008). *Managing flow: A process theory of the knowledge based firm*, PALGRAVE MACMILLAN, UK.
- Nonaka, I., von Krogh, G. & Voelpel, S. (2006). Organizational knowledge creation theory: Evolutionary paths and future advances, *Organization Studies*, 27 (8), 1179-1208.
- Norman, D.A. & Verganti, R. (2014). Incremental and radical innovation: Design research vs. technology and meaning change, *Design Issues*, 30, (1), 78-96.
- Osterwalder, A. (2012). The value proposition canvas, (1), http://www.businessmodelgeneration.com/downloads/value_proposition_canvas.pdf.
- Osterwalder, A. & Pigneur, Y. (2003). Modelling value propositions in e-Business, In Proceedings of the 5th international conference on Electronic commerce, Pittsburgh, Pennsylvania, USA.
- Osterwalder, A. & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*, Wiley.
- Patel, H., Pettitt, M. & Wilson, J.R. (2011). Factors of collaborative working: A framework for a collaboration model, *Applied Ergonomics*, In Press, Corrected Proof.
- Polanyi, M. & Prosch, H. (1975). *Meaning*, University of Chicago Press, USA.
- Rose, J.F. (2013). Tracking interactions in collaborative processes, 9th European Conference on Management Leadership and Governance, eds M. Semmelrock-Picej & A. Novak, Academic Conferences and Publishing International Limited, Reading, UK, Alpen-Adria Universität Klagenfurt, Austria, 423-431.
- Rose, J.F., Hawryszkiewicz, I. & Kang, K. (2014). When and how to facilitate the introduction of new knowledge processes in organisations, *VINE*, 44 (2), 210-227.
- Slater, P.E. (1958). Contrasting correlates of group size, *Sociometry*, 21 (2), 129-139.
- von Krogh, G. & Geilinger, N. (2014). Knowledge creation in the eco-system: Research imperatives, *European Management Journal*, 32 (1), 155-163.
- Von Krogh, G., Nonaka, I. & Rechsteiner, L. (2012). Leadership in organizational knowledge creation: a review and framework, *Journal of Management Studies*, 49 (1), 240-277.