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Trans-disciplinary Research: An Academic-Practitioner Partnership Effort on Investigating the Relationship between the Cooperative Model and Sustainability

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Abstract

This article details novel research methodology developed through a researcher-practitioner partnership and employed in a three-phase research effort that explored relationships between the co-operative model and sustainable development. Firstly, a basic understanding of the characteristics of the co-operative model was established using the co-operative principles as a framework, and their complementarity to sustainable development was examined by comparing them with sustainability theory, principles and best practices (defined through seminal journal articles on the topic). Secondly, relationships between sustainability theory and the ideas and operations of currently functioning co-operatives were investigated, namely, whether co-operatives had integrated sustainability into their organizations. Thirdly, an integrated analysis that examined the relationship between co-operatives, the co-operative principles and sustainability concepts was conducted, and output from this work was used to build a visualization (referred to as the 'Co-operative Star'), specifically designed to communicate a synthesis of research findings to diverse audiences. This study specifically focused on co-operatives and sustainability; however, the analytical techniques developed and employed have applications for other research involving comparisons between concepts and large bodies of literature, and it is particularly useful for comparing theoretical works (such as academic literature) with texts that discuss operations and practices (such as websites and reports).

Keywords: co-operatives, research methodology, sustainability, text analysis, trans-disciplinary

Investigación Transdisciplinar : Un Esfuerzo de Colaboración Investigadora Profesional en la Investigación de la Relación entre el Modelo Cooperativo y la Sostenibilidad

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Resumen

Este artículo detalla una nueva metodología de investigación desarrollada a través de una colaboración entre una persona investigadora y una personal profesional, utilizada en un investigación en tres etapas que exploró las relaciones entre el modelo cooperativista y el desarrollo sostenible. Primeramente, se establecieron las características del modelo cooperativista, utilizando los principios cooperativistas como marco de referencia, y examinando su complementariedad con el desarrollo sostenible comparándolas con la teoría, los principios y las mejores prácticas de sostenibilidad (definidas a través de artículos seminales sobre la materia). Segundo, se investigan las relaciones entre la teoría de sostenibilidad y las ideas y operaciones de cooperativas actualmente en funcionamiento, es decir, si las cooperativas han integrado la sostenibilidad en sus organizaciones. Tercero, se llevó a cabo un análisis integrado que examina la relación entre las cooperativas, los principios cooperativistas y los conceptos de sostenibilidad, y el resultado de este análisis se usó para construir una visualización (llamada ‘Co-operative Star’), específicamente diseñada para comunicar una síntesis de diferentes hallazgos de la investigación para diversas audiencias. Este estudio se centró específicamente en cooperativas y sostenibilidad; sin embargo, las técnicas de análisis desarrolladas y empleadas son de aplicación a otras investigaciones que impliquen la comparación entre conceptos y una gran cantidad de literatura científica, y es particularmente útil para comparar trabajos teóricos (como literatura académica) con textos que discuten operaciones y prácticas (como páginas web e informes).

Palabras clave: cooperativas, metodología de investigación, sostenibilidad, análisis de contenido, transdisciplinariedad



Interdisciplinary collaboration is fundamental to sustainability research, as the domain crosses sectors and levels of government and implicates a diversity and plurality of civil society actors for any effective implementation. Defined in the early 1970s by Jantsch (1972) as taking disciplinary knowledge and making it useful for socially relevant issues, trans-disciplinary study has also been described as an approach to problem solving suited to settings where disciplinary modes prove inadequate; a process or activity that produces, integrates and manages knowledge in technical, social and scientific areas (Klein, 2004). Trans-disciplinary research maintains a focus on application; it is associated with a notion of creating change and the desire to contribute to solutions (Wickson et al., 2006), and the production of useful knowledge. Its characteristic features, therefore, include a problem focus (research originates from and is contextualized in ‘real-world’ problems), synthetic methodological practice (the research involves iterative, reflective processes that are responsive to the particular questions, settings, and research groupings) and collaboration (between researchers, practitioners and external actors) (Russell et al., 2008).

This article details a research methodology developed by a research-practitioner team for a project on behalf of the International Co-operative Alliance (ICA). The first phase of research involved establishing a basic understanding of the characteristics of the co-operative model (in this case, defined through the co-operative principles) and whether their complementarity and compatibility with sustainable development (also interchangeably referred to as sustainability for the purposes of this analysis). This involved an in-depth literature review of seminal journal articles on sustainability theory, principles and best practices. The second phase investigated the relationship between ideas and operations of a selected sample of co-operatives and sustainability theory, specifically examining whether co-operatives had integrated sustainability into their organizations. The third phase integrated ideas and approaches of the first two phases, and examined the relationship between co-operatives, the co-operative principles and sustainability concepts. Analysis from the third phase included a visualization referred to as the ‘Co-operative Star’, built to synthesize complex analytical outputs and communicate conceptual relationships to diverse, public audiences.

Although this research focused specifically on exploring the relationship between co-operatives and sustainable development, it is important to note that the methodology is not limited to this specific project. The methodology could be used for empirical, insightful comparisons in the conceptual composition and focus of different sets of text-based data; therefore, these analytical techniques have many potential applications in the social sciences. The intention of this paper is to document the methodological approach for the purpose of advancing social science research techniques that seek to draw comparisons and relationships within and between large bodies of text data. The paper does discuss interpretations of the analyses specific to this research project on co-operatives and sustainable development; however, its main focus is the methodology. A more detailed discussion on the interpretation of the results and relationship between co-operatives and sustainable development are in the report entitled, *Co-operatives and Sustainability: An Investigation into the Relationship* (Dale et al., 2013).

Research Context

The United Nations declared 2012 as the International Year of the Co-operative, recognizing the contribution co-operatives have made in terms of poverty reduction, employment generation and social inclusion (United Nations, 2013). This action stemmed from a growing recognition that adopting co-operative approaches in businesses and organizations can potentially have a positive influence on social well-being of communities, and thereby possibly a role in sustainable community development (Derr, 2013). However, sustainability is a complex topic that requires integrative thinking about the social, economic and ecological imperatives (Dale, 2001), and it is, therefore, difficult to say to what degree large-scale adoption of the co-operative model can contribute to more sustainable development pathways. Accordingly, determining the role of co-operatives in sustainable development involves determining the key elements of both sustainability and the co-operative model, and studying if and/ how in what ways they intersect.

In preparation for their November 2013 Global Conference and General Assembly in Cape Town, South Africa, ICA engaged a researcher-

practitioner partnership, consisting of the authors of this paper, from the consisting of the authors of this paper, from the Canada Research Chair in Sustainable Community Development program at Royal Roads University (2004–2014) and the Sustainability Solutions Group. The research was very time-constrained (approximately six months) given that the conference deadline for presentation, and the project's objective were to capture a global picture of the co-operative sector; therefore, the research team decided to focus on an overall sectoral scan, limited to web-accessible materials. These consisted of website pages that summarized the history, values and operations of co-operatives and their annual reports. The research approach was consequently limited in terms of being able to only assess communications aspects of the co-operatives (i.e., what they 'say' they are doing) rather than ground-truthing whether their practices on-the-ground align with sustainable development using, for example, detailed case study methodology. However, the research provided a broad impression of the values and interests co-operatives communicate to their members, communities and the greater public; thus, it served as an insightful preliminary investigation into the intersections between co-operatives and sustainable development.

Methodological Considerations

This project presented several methodological challenges about how to map individual co-operative materials to concepts on sustainability and sustainable development, and then, how to examine the strength of these comparisons. One option was a qualitative comparison between the co-operatives materials and concepts around sustainability. However, sustainability is multi-faceted, complex and nuanced (Redclift, 1993; Robinson & Tinker, 1997) and thus such a qualitative research approach would be heavily affected by observer bias (Greenhalgh & Taylor, 1997) and assessing the degree to which a co-operative website or report related to sustainability would be highly subjective. In addition, a thorough qualitative analysis can be time consuming, and considering the project aimed to capture the global context in a six month time frame, this limited the amount of data, i.e., number of co-operatives that could be included in the study and

yet, still remain confident that a representative sample had been selected for data analysis.

To overcome the methodological challenges, the research design included two imperatives. First, a method for describing sustainability and sustainable development in a manner that allows for a comparison with text-based data (i.e., co-operatives materials) was needed. Second, a method for gauging the reliability, strength and nature of the comparison was necessary. To satisfy these requirements, we developed a novel methodology that employed computer assisted qualitative data analysis software (CAQDAS), specifically NVivo (v. 10), and regression modeling of conceptual occurrences within bodies of text. CAQDAS allows researchers to interrogate large data sets and quickly provides an impression of its contents (e.g., the amount of instances of a certain phrase) (Welsh, 2002), and thus it was a useful tool for this research as it facilitated analysis of large amounts of text-based data. The regression modeling allowed us to mathematically characterize the relative prevalence of certain concepts and then focus on the key concepts in the data, elucidating the concepts germane to sustainability, the concepts central to the co-operative sample perspectives and values, and comparison between the two groups of concepts.

All aspects of the research, that is, the research questions, the design, the methodology, and coding frameworks and meta-analysis, were iteratively led by a trans-disciplinary research team, comprised of three researchers, one of whom was from the Canadian Co-operative Association, two practitioners and an internationally recognized co-operative expert working directly in the community. A preliminary scoping meeting was held between the team and two key leaders from the International Co-operative Alliance.

Delimiting the Boundaries

Characterizing Co-operatives and Sustainable Development

The first phase involved investigating whether the features and design of the co-operative model aligned with the concepts, and practices of sustainability. To conduct this analysis, two questions needed to be addressed. What characteristics govern the features and design of the co-operative model? How to capture and define the quintessential concepts of sustainability? We addressed the former question by using the seven co-operatives principles, as

defined by the International Co-operatives Alliance (ICA) (n.d.). The principles are included in Appendix A.

The co-operative principles are said to have roots tracing to the establishment of a co-operative in 1844 (Rochdale, England), which has been adopted as the model and inspiration for the modern co-operative movement (Nilsson, 1996). These principles have developed and been updated since their inception (Fairbairn, 1994); however, the fundamental ideas and ideals around these principles have served as a guiding framework for the values and structure of co-operative for over 150 years (Fairbairn, 1994). Therefore, the principles serve as a useful framework for characterizing the main features of the co-operative model, and thus were considered valid and reliable for use in this research.

Identifying the main concepts around sustainability and sustainable development was challenging. Sustainability and sustainable development is a complex, multi-faceted, normative domain of inquiry that has diverse perspectives and disciplinary lenses (Vos, 2007). The definition of sustainable development adopted by the team is one that the majority of Canadian scholars accept as a working definition across the country through the Canadian Consortium on Sustainable Development Research (<http://www.ccsdr.crcresearch.org/index-hp.htm>), that is, sustainable development can be regarded as a process of reconciliation between the ecological, social and economic imperatives (Robinson & Tinker, 1997). The data collection was then organized thematically into ecological, economic and social categories.

For the purposes of this research, we identified 50 seminal articles relating to sustainable development, chosen to reflect the major contributions of leading researchers on the three imperatives. We necessarily excluded monograph length work, but did select articles by researchers that had also authored seminal books in the field. We began by compiling a list of researchers identified by the trans-disciplinary team as influential thinkers in the three imperatives of sustainable development. Next, we determined which authors these people cited in their work, a type of snowball sampling. We also used Google Scholar to make a list of the authors who had cited work by people in the initial list of influential thinkers, and thus developed a collection of the research that had influenced these thinkers and of the

research influenced by their work. We looked up citation metrics for all the authors that had been identified by this point in determine the impacts of sustainable development research in the academy. From this point, we were able to construct a list of 25 authors who had been instrumental in shaping sustainable development theory and practice in different ways, and to identify the most influential ideas by these authors. We chose two articles by each, chosen as representative of seminal works or concepts. Because many of these articles were co-authored, the full list of 50 articles represented work by 105 different authors.

Identifying Key Concepts

In order to characterize and compare sustainability literature and co-operative principles, key concepts for both were distilled from their respective texts. Key concepts from sustainability literature were distilled using NVivo to identify relative prevalence of different concepts within the text. It is important to note that this analysis aimed to distill sustainability *concepts* rather than simply words in text; thus, derivations and related words (i.e., ‘sustainable’ and ‘sustainability’) were grouped together and treated as a singular concept. In addition, it is important to note that, although CAQDAS has the ability to accurately analyze text for certain codes and symbolic identifiers (i.e., letters), it can not completely capture the context and nuances of language (Bhowmick, 2006). Consequently, the output of the NVivo analysis contained terms without any conceptual meaning, such as numbers and grammatical terms. Therefore, the data output was manually filtered to ensure that only terms that are meaningful as concepts or ideas were captured.

Since the co-operative principles as defined by ICA do not comprise a large body of text, examining relative prevalence was inappropriate for identifying their key concepts. Co-operative principles’ concepts were identified by analyzing (using NVivo) the text for ‘generalizations’, i.e., examining how terms related to one another and (roughly) grouped by meaning (for example, the meanings of ‘democratic’ and ‘elected representatives’ bear a relationship). This analysis was then used to map concepts against each principle.

As with the sustainability literature, the co-operative principles analysis aimed to capture concepts that represented the principles, rather than simply words taken from text. However, because the co-operative principles were not text-rich, there was limited output. Therefore, to address this issue, concepts list for each co-operative principle were expanded with two to five synonymous concepts, identified through iterative discussions among the research team and the use of online thesauruses.

In addition to identifying synonyms, certain terms within a co-operative principle concept list were grouped together to form what is referred in this study as an ‘ontology’. Ontologies serve as hierarchical concepts that encompass associated, derived and synonymous concepts. For example, the ontology for co-operative principle one captures the ‘idea’ that co-operatives emphasize inclusive membership and participation, and thus it encompasses the concepts of ‘participation’, ‘inclusive’, and ‘membership’. Developing these ontologies allowed the team to conduct substantive comparisons between co-operative principles and sustainability concepts, as it allowed for more conceptual (rather than word-based) comparisons, reducing the influence that differences in language and usage of terms can have on conceptual comparison.

Conceptual Comparison

In order to conduct an in-depth comparison of co-operatives principles concepts with sustainability concepts, an understanding of which sustainability concepts were most heavily emphasized in the literature and how strongly they were emphasized (i.e., relative to one another) was required. This was done by graphing the concepts as scatter plots, arranging the concepts along the x-axis according to their occurrence in the literature (from highest to lowest) and plotting occurrence values (i.e., number of times concept appeared in the text) on the y-axis. Scatterplots were created for each of the three defined sustainability imperatives– social, economic and ecological – to be able to investigate whether certain principles had relationships that varied in strength depending on the aspect of sustainability to which they were compared. Each scatter plot was then fitted with a negative power regression model to capture the trends in conceptual

occurrence within the different data collections; the resulting trends are referred to in this study as ‘concept curves’. Negative power regressions were specifically selected to characterize concept curves as these demonstrated the best-fit models for these types of plots (social - $R^2=0.994$; ecological - $R^2=0.981$; economic - $R^2=0.979$).

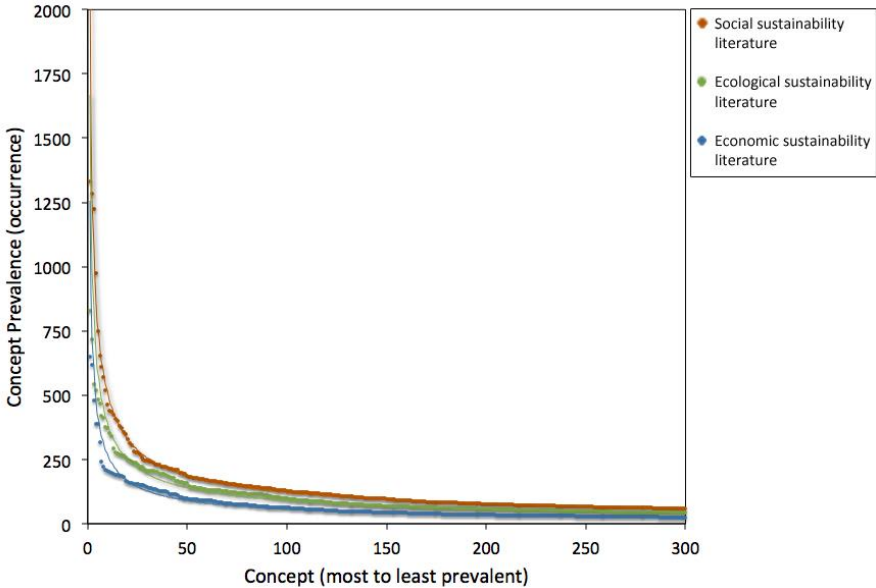


Figure 1. Concept curves developed from social, ecological and economic sustainability literature data

Caption: The x-axis represents concepts derived from sustainability literature, arranged according to their prevalence in the literature (from highest to lowest). The y-axis displays the number of occurrences of a particular concept. Trend lines take the form of negative power regressions.

Figure 1 shows that the most prevalent concepts (i.e., those that are highlighted and focused in the text) appear toward the left of a concept curve. The curve drops steeply as it initially travels along the axis from the origin to the right, and then gradually levels as it reaches where the x-axis represents concepts that appear infrequently in the text. Where the curve is relatively level, plotted concepts are relatively low in occurrence and hold

the same or similar occurrence levels to many other concepts found in the text. Therefore, these concepts can be considered not as heavily emphasized in the literature.

Because the steeper portions of concept curves represent concepts and ideas that are more emphasized in the data, the strength of relationship of a particular concept to a body of literature can be calculated by examining where it is positioned relative to the curve's steepness. This was measured by using the derivatives of the regression equations to calculate rates of change for various points along the concept curves. Using derivative formulas, tangential slopes were calculated for a given point on the curve, which in turn, was used to determine where a concept was positioned relative to the concept curve's steepness (Figure 2). This approach allowed us to measure with a high level of precision, degrees of emphasis or prevalence of a particular concept among the comprehensive suite of concepts in a body of text.

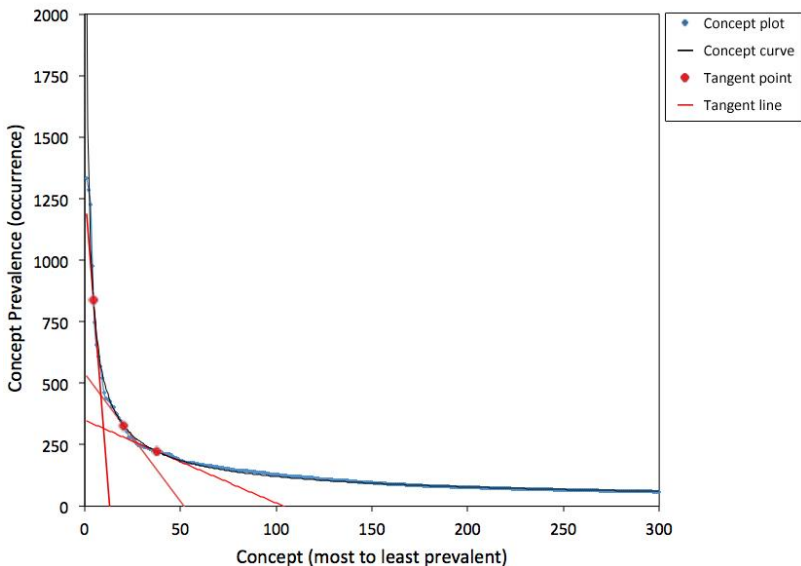


Figure 2. Social sustainability concept curve and tangent lines

Caption: The figure provides a visual representation of how slope values were calculated for concepts using the concept curves. Examples of lines tangent to concept curves are displayed in red, and red circular markers represent points of tangency.

Once derivative formulas were obtained for each of the sustainability concept curves, concepts derived from the co-operative principles were examined in terms of where they position relative to the curve's steepness. NVivo was used to examine the occurrence of the co-operatives principles concepts in the each group of sustainability literature, and corresponding slope values were calculated using derivative formulas of the respective concept curves. Because concept curves represent negative power regressions, slopes calculated from lines tangential to these curves are negative. However, absolute values were used when displaying and interpreting results (see Appendix B) because positive values made for a more intuitive analysis. For example, when analyzing concepts from co-operative principle 3 against the sustainability literature scan, 'participation' corresponded to a slope of -1.36 and 'equitable' to a slope of -0.06. These results show that 'participation' was more heavily emphasized in the literature; therefore, for clarity sake, the results are expressed as 1.36 (participation) and 0.06 (equitable), ensuring that more emphasized concepts are associated with slopes with (numerically) higher values.

Concepts with corresponding slopes of 1 and above were considered of particular interest because the point of the concept curve where [slope = 1] represents the concepts reaching a state of 'one-for-one'. This means that slopes below 1 represent concepts that are no longer unique in level of occurrence and (thus) are not particularly highlighted or emphasized among the body of concepts. In contrast, slopes above 1 represent values that hold unique levels of occurrence, and the higher the slope, the more a concept is emphasized or highlighted. In this way, [slope = 1] served as threshold for analysis as it allowed us a precise understanding of where the concept curve 'levels off' into concepts that are not emphasized in the literature. Please refer to Appendix B for further detail.

Relationship between Co-operatives Principles and Sustainability

The analysis demonstrated that co-operative principles had the strongest relationship to the social imperative concepts, especially when analyzing the ontologies. This is not a surprising observation considering that co-operative model emphasizes inclusion and equitability, key elements of social justice

(Bell, 2007), which in turn is a necessary condition of social sustainability (Dempsey et al., 2011). In contrast, the co-operative principles did not (for the most part) exhibit as strong a relationship with ecological or economic concepts. The exception to this was co-operative principle five, which had a strong relationship to the ecological imperative concepts. Co-operative principle five refers to the importance of education and knowledge/information sharing, and thus, a potential explanation for this relationship could be due to the emphasis sustainability research places on the importance of continual learning in environmental management and governance (e.g., Berkes, 2004; Dietz et al., 2003; Rammel et al., 2007).

Co-operatives are often formed around business enterprises (Smith et al., 2004) and, therefore, one might predict that their relationship with sustainability (if any) would be to some degree associated with the economic imperative; however, this analysis found the relationship between the principles and economic concepts to be the weakest relationship. Further investigation of the economic sustainability literature provided a potential reason for this lack of relationship. Much of the economic sustainability concepts were derived from discussion on macro-scale issues, such as global consumerism, effects of rapid economic growth, and problems with market-based solutions for environmental issues (e.g., Rammel et al., 2003; Stutz, 2010; Wilk, 1998). In contrast, the co-operative approaches economic well-being from the individual and community level, meaning that the co-operative model focuses on economic equity among co-operative members. Their approach is more concerned with the social implications of economic relationships, and accordingly, this analysis shows the co-operative principles hold a much stronger relationship to social sustainability concepts than economic sustainability concepts. Further research is needed to verify this preliminary analysis.

A particularly high relationship exists between co-operative principle 7, i.e., “concern for community” (ICA, n.d.) and concepts in all three sustainability groups (see Appendix B). This is due to the fact that concepts derived from principle 7 include ‘sustainable development’ and ‘community’. Considering this was a comparison between co-operative principles and sustainability, principle 7 analysis could be considered redundant in terms of the research objective, i.e., it relates ‘sustainability’ to

‘sustainability’. In addition, it is important to note that, although co-operative principle 7 does make specific reference to ‘sustainable development’, it does not detail how to achieve sustainable development. As mentioned above, sustainable development is a complex and nuanced topic, and requires ‘unpacking’ to characterize (as this research has done through conceptual distillation), whereas co-operative principle 7 presents ‘sustainable development’ in a broad sense without much detail characterizing the concept. Therefore, we consider co-operative principles concepts 1 to 6 provide a much more insightful analysis in terms of illuminating the relationships between the co-operative model and sustainable development.

Sustainable Development and Co-operatives

The second phase was designed to complement the theoretical exploration by providing a practical component to the research and examining ‘real-world’ data, i.e., materials collected from co-operatives. Using similar techniques as those performed in the first set of analyses (applications of concept curves), this component of the research examined the relationship ideas and interests of co-operatives from around the world have with concepts on sustainability.

Co-operatives Sample Collection

Data was collected from co-operatives websites, and consisted of webpage text that described the organizations’ values, objects and operations (i.e., ‘about us’ pages) and the organizations’ annual reports. Three different types of co-operatives were selected for this study, and accordingly, data was collected and categorized into three samples. The first sample was randomly selected and consisted of 93 co-operatives identified through ICA’s association list. This sample was compiled by transferring the associations list to an Excel spreadsheet, selecting an association and then selecting a co-operative member of the association through the use a random number generator. The second sample consisted of 86 co-operatives identified as ‘sustainability leaders’, meaning that they have been recognized by other organizations and associations to be involved in sustainability practices.

These co-operatives were identified through a snowball sampling method initiated through a survey of staff of co-operatives to identify whom they perceived to be co-operative leaders in sustainability. Because the second sample consisted of organizations that were recognized for sustainability practices, it served as a control group, as we expected their ideas, values and interests to align with sustainability concepts. The final sample consisted of a list of 64 co-operative associations and federations at the national level, identified as those with readily accessible websites. This sample was included in the study to determine whether co-operative groups at the associative or federation level hold values and/or interest in sustainability.

Websites and annual reports were treated as separate samples, which resulted in six samples in total, i.e., two for each of the three co-operatives samples identified above, for three reasons. Firstly, annual reports were not available for each of the samples, thus creating asymmetry in webpage materials and reports. Secondly, total verbiage for webpage materials was much lower than annual reports; therefore, in a consolidated sample, co-operatives with reports would be weighted much more heavily when distilling key concepts from the materials. Thirdly, websites and reports are different vehicles for communicating with different target audiences, i.e., one is intended for the general public and the other is focused more toward members and stakeholders; therefore, we analyzed them separately.

Strength of Comparison

Key concepts and ideas were distilled from co-operative materials to allow for conceptual comparison between sustainability and co-operatives data. This was performed using NVivo and manually verifying the lists to ensure they represented conceptual content. It is important to note that, because this study sampled co-operatives from around the world, some of the materials were in languages other than English. In order to consolidate concepts distilled from the samples, all materials were translated to English (or English versions were found) prior to NVivo analysis.

After concepts list for each of the six samples were created, they were 'characterized' through the use of concept curves, i.e., plotting according to occurrence and fitting with negative power regressions. Key concepts for each of the samples were identified by capturing all the concepts on the

steeper portion of the curve, specifically by identifying concepts that corresponded to a derivative calculated slope greater than and equal to 1 (see 3.3 Conceptual Comparison). The occurrences of these key concepts were then identified in the three imperatives literature, i.e., social, ecological, and economic, using NVivo (results were checked to ensure for contextual correctness). Finally, ‘strength of comparison’ values were calculated by dividing the cumulative number of co-operatives materials concept occurrences in the sustainability literature by the cumulative number of key sustainability concept occurrences in the sustainability literature, as seen in Equation 1:

$$[\text{Strength of Comparison Value}] = \frac{[\text{Occurrences of Key Co-operative Materials Concepts in Sustainability Literature}]}{[\text{Occurrences of Key Sustainability Concepts in Sustainability Literature}]}$$

It is important to note that each concept curve identifies a different number of key concepts corresponding to a slope of 1 and above. This could cause issues for the analysis because it creates unequal numbers of concepts for each sample resulting in searches that might favour samples with larger numbers. For example, the concept curves for the associations’ sample website materials identified 61 concepts corresponding to a slope greater than 1, whereas the sustainability leader websites had 72. This means that the sustainability leader sample will have a higher number of concepts to search within the sustainability literature, which could lead to a higher cumulative number of occurrences purely because there are more search terms (rather than due to conceptual relevance). To avoid this form of ‘weighting’, concept lists were standardized, meaning they were conformed to the same number prior to calculating occurrences. Standardization involved adjusting all concept lists (both from co-operative materials and sustainability literature) to lowest number of concepts of slope greater than and equal to 1 observed in any of the lists, which corresponded to 58 concepts as found in the co-operative websites random sample. Defaulting to the lowest number of concepts ensured that all concepts used in the analysis

were key concepts, i.e., they corresponded to slopes greater than or equal to 1 on their respective concept curves.

Relationship between Co-operatives Materials and Sustainability

The strength of comparison analyses produced 18 values, three values for each of the six samples representing comparisons to (respectively) social, ecological and economic sustainability concepts. As seen in Figure 3, the sustainability leader data demonstrated a stronger relationship (for the most part) to sustainability concepts than the website and annual reports. This observation aligned with our expectation that the sustainability leader co-operatives would serve as a control group, as they consist of co-operatives that were identified with a committed involvement in sustainable development.

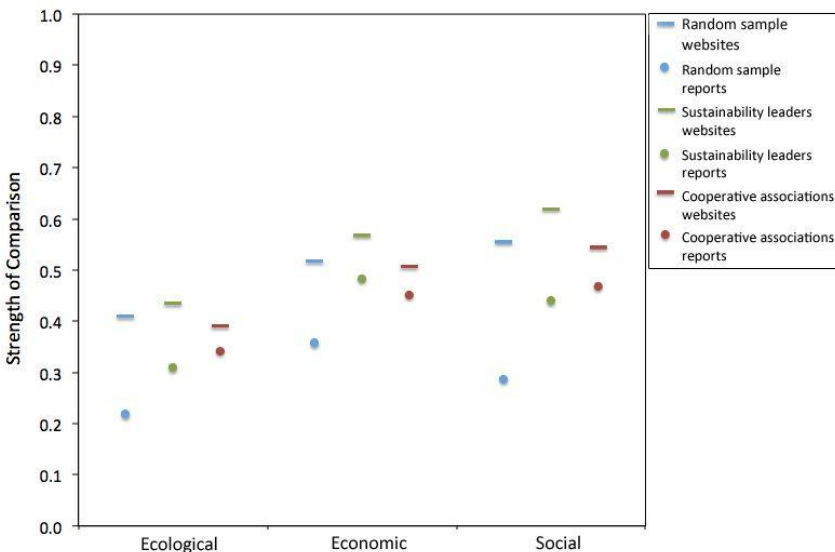


Figure 3. Strength of comparison between co-operatives materials and sustainability concepts

Caption: Strength of comparison values range between 0 and 1. A value of 1 indicates the maximum possible strength of conceptual comparison and a value of 0 indicates no conceptual relationship.

Figure 3 exhibits that websites showed a stronger conceptual relationship to sustainability concepts than corresponding annual reports. Potential reasons for this might be due to the differences in intended target audiences and communication objectives for each of the material types. Websites are designed to speak to broad, public audiences, and thus they are appropriate spaces for discussing high-level aspects of an organization (i.e., objectives and values), which would include any interest in and/or concern for sustainability. In contrast, annual reports contain greater detail on the co-operative's operations and finances, and thus would not have the same level of emphasis on broader interests, visions and values, and are more accountable to shareholders. As sustainability becomes more important and accepted around the world, an organization's interest in sustainability would be worth promoting in terms of cultivating public favour toward the organization (Gunningham et al., 2004). Therefore, since websites serve as the 'main connection point' to the broader public, it follows that co-operatives would emphasize topics and ideas that would promote the organization's public image, such as a concern for local and global sustainability.

Similar to the first analyses, the strength of comparison analysis showed that for the majority of the samples, a stronger relationship existed between co-operatives and the social imperative, rather than the ecological and again, surprisingly, the economic imperative. In addition, because the first analysis indicated co-operative principles show the strongest relationship with the social imperative, this outcome indicates that co-operatives are being guided by their co-operative principles, when investing in local sustainable community development.

Bringing Together the Findings

The analytical techniques employed in this research produced a large amount of data that required in-depth interpretation from the research team, in terms of understanding which conceptual groups (i.e., concepts of a particular co-operative principle) exhibited strong conceptual relationships and what the implications were of certain concepts demonstrating stronger relationships than other. However, since this research was to be presented at the ICA

Conference to a very diverse audience in Cape Town, South Africa, we clearly needed a way of more concisely communicating outcomes.

Building the Co-operative Star

The final analysis led to the construction of what we called the ‘Co-operative Star’ (Figure 4). The Co-operative Star was built with the understanding that visualizations can reduce the cognitive requirements for processing complex information and enhance a person’s ability to gain meaning from abstract data (Keim et al., 2008). This visualization was designed to communicate the complex relationships our data revealed between co-operative principles, co-operatives communications materials (i.e., websites and reports), and sustainability.

Because its purpose was to communicate our research outcomes in a concise manner, it was strategically designed and constructed to capture major research findings, in particular, that the data demonstrated the strongest relationship between cooperatives and social sustainability. As noted earlier, the similarities in relationships could indicate that the co-operatives ethic and interests are effectively being guided by the co-operatives principles, which in turn, aligns the co-operatives closely with the social imperative of sustainability. The Co-operative Star aims to both communicate this research finding (and further interrogate this line of inquiry) by displaying the co-operatives principles as proxies for the social imperative. Accordingly, the analysis and visualization captures conceptual relationships of co-operatives websites and reports with concepts derived from the co-operatives principles, ecological and economic imperatives literature.

It is important to note that the key concepts for each of the co-operative principles were distinct as they were derived from small bodies of text; however, concepts from the literature were much broader and (at this stage) existed only in the form of a modeled regression that conceptually characterized the literature (i.e., concept curve), rather than a concise list of terms. Therefore, in order to conduct this analysis, concept lists that followed the form and format of the principles lists were derived from the ecological and economic curves. This was done by collecting the concepts on the left-hand areas of the curves, and through discussion between the

research team, these collections were distilled into smaller lists by identifying common or ‘overarching’ integrator concepts. In addition, as a validation measure, distillation involved identifying concepts from the collections that have also demonstrated their pertinence to economic or ecological sustainability within the 10-year course of case study research led by the second author through her Canada Research Chair program (<http://www.crcresearch.org/community-research-connections/crc-case-studies>).

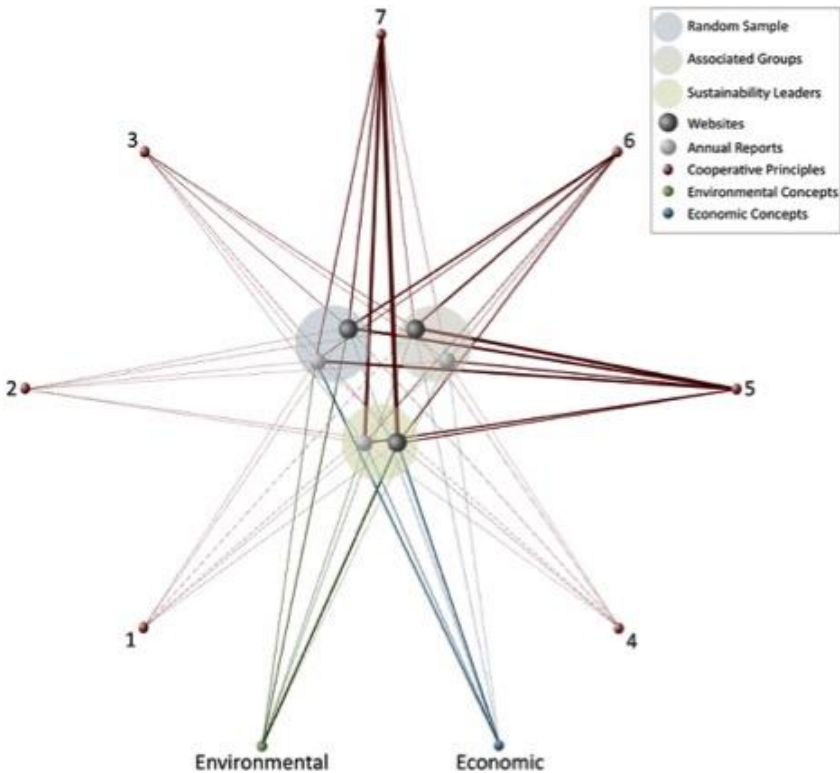


Figure 4. The Co-operative Star

Caption: Weighting of lines display level of strength in conceptual relationship between materials (website text and reports) created by co-operatives and concepts derived from co-operatives principles and sustainability literature.

Once concept lists for the ecological, economic and social imperatives were made consistent in terms of form and format, slopes values for each relationship (e.g., random sample website to co-operative principle one, sustainability leader annual reports to economic sustainability concepts, etc.) were then consolidated into a single index value calculated using mean, median, and maximum values. Index values were calculated using a series of descriptive statistics rather than just a single average as concepts for each grouping (i.e., the different principles, economic, and ecological) varied in number, and thus a series of descriptive statistics captured a more comprehensive picture of the range and number of high and low comparison concepts than would using a single average (i.e., mean) value. Index values were used to set the weighting for the connecting lines in the Co-operative Star, and thus weighting depicting the strength of relationship between co-operatives materials and concepts of the principles and sustainability.

The Co-operative Star is a comprehensive visualization that aims to capture and communicate main ideas generated from the study. Because it incorporates information from large sets of analytical outputs and expresses this information in a simplified integrative way, the visualization does not capture many of the details and nuances in conceptual relationship required for in-depth analysis; however, it does provide some interesting, broader insights. For example, particularly strong relationships can be seen with the co-operative sample to principles 5 and 6, which respectively correspond to education and collaboration, and this might allude to co-operatives holding a particular value for and/or interest in knowledge sharing and forming networks of practice. Another example, the economic and ecological imperatives and co-operative principle 7 (i.e., “concern for community” (ICA, n.d.)) concepts held a stronger relationship with leader co-operatives than the random sample and co-operatives associations, implying that the sustainability leaders potentially have a stronger interest and/or involvement in practices that would address concerns around their greater community and their environment (as we would anticipate).

Conclusion

This article describes in detail a novel research methodology used in a study exploring the relationship between two very broad themes co-operatives and

sustainability for a public sector large international organization. It is our belief that this research could not have been as rich nor as widely endorsed by its users if it had not been developed using a researcher-practitioner iterative collaboration model. By modifying more traditional research methods and ground-truthing them with practitioners and experts from cooperatives, they were refined and enlarged for research outcomes linked to the production of useful knowledge. Clearly, the data visualization developed for the project reflected the value of this kind of collaboration to reach diverse and plural audiences (i.e., ICA's 2013 Global Conference and General Assembly) that translates research outcomes and mobilizes the knowledge in a more meaningful way.

Although this study specifically focused on co-operatives and sustainability, the concept curve technique has applications for other research involving comparisons between concepts and large bodies of literature, and it is particularly useful for comparing theoretical works (i.e., academic literature) with texts that represent operations and practice (i.e., website and reports). Further application and improvement of this analytical technique could lead to methodologies that can efficiently, comprehensively and empirically examine potential conceptual relationships between scholarly thought and on-the-ground work, allowing for a better understanding of connections (and areas of disconnect) between theory and practice.

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Appendix A

Concepts derived from co-operative principle concepts, separated by commas.

Note: Items in parenthesis provide detail on conceptual contexts use to guide analysis.

Principle	Derived concepts
1	voluntary, open (accessible), discrimination (lack thereof), gender (inclusive), accessibility, inclusive, social diversity, ontology (encompasses accessibility, inclusive and social diversity)
2	democratic, decision making, accountable, equality, rights (human rights), self-governance, ontology 1 encompasses democratic, decision making, accountable), ontology 2 (encompasses equality, rights)
3	equitable, participation, membership, contribute, inclusive, sharing, stakeholder (inclusive), ontology (merge participation, inclusive, membership)
4	independence, democratic, autonomy, self-governance, ontology (encompasses all)
5	education, training, information (knowledge sharing), public (informing and outreach), leadership (and leader), ontology (encompasses all except leadership)
6	cooperation, working together, coordination, partnership, levels of government (, networks (social and professional), collaboration, ontology (encompasses all except levels of government)
7	sustainable development, community, policies, sustainability

Appendix B

1. **Voluntary and Open Membership.** Co-operatives are voluntary organisations, open to all persons able to use their services and willing to accept the responsibilities of membership, without gender, social, racial, political or religious discrimination.
2. **Democratic Member Control.** Co-operatives are democratic organisations controlled by their members, who actively participate in setting their policies and making decisions. Men and women serving as elected representatives are accountable to the membership. In primary co-operatives members have equal voting rights (one member, one vote) and co-operatives at other levels are also organised in a democratic manner.
3. **Members' Economic Participation.** Members contribute equitably to, and democratically control, the capital of their co-operative. At least part of that capital is usually the common property of the co-operative. Members usually receive limited compensation, if any, on capital subscribed as a condition of membership. Members allocate surpluses for any or all of the following purposes: developing their co-operative, possibly by setting up reserves, part of which at least would be indivisible; benefiting members in proportion to their transactions with the co-operative; and supporting other activities approved by the membership.
4. **Autonomy and Independence.** Co-operatives are autonomous, self-help organisations controlled by their members. If they enter into agreements with other organisations, including governments, or raise capital from external sources, they do so on terms that ensure democratic control by their members and maintain their co-operative autonomy.
5. **Education, Training and Information.** Co-operatives provide education and training for their members, elected representatives, managers, and employees so they can contribute effectively to the development of their co-operatives. They inform the general public - particularly young

people and opinion leaders - about the nature and benefits of co-operation.

6. **Cooperation among Co-operatives.** Co-operatives serve their members most effectively and strengthen the co-operative movement by working together through local, national, regional and international structures.
7. **Concern for Community.** Co-operatives work for the sustainable development of their communities through policies approved by their members.

Appendix C

Below is the output from the co-operative principles conceptual comparison to sustainability literature data. Concepts are displayed with the slope values they correspond with on the social, ecological and economic sustainability concept curves. Slope values below 0.05 are expressed as '<0.05', and the absence of a concept is identified with 'N/A'.

Principle	Concept	Social	Ecological	Economic
One	voluntary	0.08	< 0.05	< 0.05
	open	< 0.05	< 0.05	N/A
	discrimination	< 0.05	N/A	N/A
	gender	< 0.05	< 0.05	< 0.05
	accessibility	0.45	0.12	< 0.05
	inclusive	< 0.05	N/A	N/A
	social diversity	0.71	< 0.05	0.21
	ontology	6.37	0.54	0.28
Two	democratic	0.20	< 0.05	0.21
	decision making	0.17	< 0.05	< 0.05
	accountable	0.23	< 0.05	< 0.05
	equality	0.06	< 0.05	< 0.05
	rights	0.31	0.40	< 0.05
	self-governance	N/A	< 0.05	N/A
	ontology 1	2.68	0.25	0.33
	ontology 2	1.41	0.47	< 0.05
Three	equitable	0.06	< 0.05	< 0.05
	participation	1.36	0.09	< 0.05
	membership	0.16	< 0.05	< 0.05

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	contribute	< 0.05	< 0.05	N/A
	inclusive	< 0.05	N/A	N/A
	sharing	0.12	< 0.05	< 0.05
	mutuality	< 0.05	< 0.05	
	stakeholder	< 0.05	< 0.05	< 0.05
	ontology	6.37	0.54	0.28
Four	independence	< 0.05	< 0.05	< 0.05
	democratic	0.20	< 0.05	0.21
	autonomy	< 0.05	< 0.05	< 0.05
	self-governance	N/A	< 0.05	N/A
	ontology	0.50	0.09	< 0.05
Five	education	0.11	< 0.05	0.09
	training	< 0.05	0.69	< 0.05
	information	1.02	2.23	0.17
	public outreach	< 0.05	N/A	< 0.05
	leadership	< 0.05	< 0.05	< 0.05
	knowledge	0.33	2.23	0.15
	ontology	8.50	15.00	1.62
Six	cooperation	< 0.05	0.17	< 0.05
	working together	< 0.05	< 0.05	N/A
	coordination	< 0.05	< 0.05	< 0.05
	partnership	0.12	< 0.05	< 0.05
	levels of government	< 0.05	< 0.05	N/A
	networks	0.85	< 0.05	1.69
	solidarity	< 0.05	< 0.05	< 0.05
	interdependence	< 0.05	< 0.05	< 0.05
	collective	0.18	0.14	< 0.05

	collaboration	< 0.05	< 0.05	< 0.05
	ontology	10.40	1.90	4.50
Seven	sustainable development	58.00	0.37	30.00
	community	137.00	3.20	0.13
	policies	35.00	265.00	26.00
	sustainability	1350.00	60.00	83.00