

# KNOWLEDGE MAPPING: CONCEPTS AND BENEFITS FOR A SUSTAINABLE URBAN ENVIRONMENT

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Competition and globalisation are putting terrific pressure on organisations to provide a better quality service, to improve the speed to market, and to improve organisational agility and innovation. As organisations try to meet these challenges, they need to be innovative to produce the knowledge intensive services desired by their customers. As an organisation's knowledge base comes to light, it is valued as both organisational intellectual capital and a source of competitive advantage. However, as the amount and depth of organisational knowledge increases, it poses some challenges to an organisation. The key challenges for knowledge intensive organisations are how to identify, map, assimilate, disseminate, and apply knowledge; particularly the mapping of knowledge between different users with different perspectives and purposes. This is especially true with the move towards a sustainable built environment. The knowledge map is a picture of what exists in an organisation or a network. Therefore, it can be used as a tool to evaluate the organisation's knowledge stock; revealing strengths to be exploited and gaps that need to be filled. This paper is based, primarily, on a review of literature as part of an on-going study of Knowledge Management and Change Management within a Sustainable Urban Environment (SUE). It presents the concepts of knowledge mapping, some of its potential benefits, and the main challenges and issues associated with knowledge mapping initiatives within SUE. It also looks at the role of Information and Communication Technologies, which might be of assistance in this regard. The paper concludes that mapping and managing knowledge assets in SUE is an integrated and complex process. This involves social, cultural, financial, and technological considerations. The paper also notes that knowledge mapping can be of immense benefit in a wide range of activities in a sustainable urban environment. It is recommended that more research effort needs to be targeted on how to improve the process of mapping, communicating and using sustainability knowledge across and within organisations.

Keywords: Information Technology, Knowledge Management, Knowledge Mapping, Sustainable Urban Environment.

## INTRODUCTION

The growth of interest in Knowledge Management (KM) since the mid-1990s has been as much driven by practitioners as by academics. Practitioners have been concerned with methods of knowledge generation, capture, map, transfer and its application. Nonaka and Takeuchi (1995) acknowledged the distinction between tacit knowledge and explicit knowledge. For practitioners, tacit knowledge remains largely problematic in terms of methods of capturing and mapping. The view has emerged that the challenge of KM is to understand how to create practical solutions to support

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individuals, groups and organisations as they generate and capture multi-faceted knowledge so as to suit the particular requirements of their application context (Despres and Chauvel, 2000).

As Skyrme and Amindon (1997) noted, most research attention has been given to KM within the organisation, and knowledge mapping remains an emergent research issue. Speel et al. (1999) define knowledge mapping as the process, methods and tools for analysing knowledge areas in order to discover features or meaning and to visualise these in a comprehensive, transparent form, such that the business-relevant features are clearly highlighted. Knowledge maps are created by transferring certain aspects of knowledge into a graphical form that is easily understandable.

Knowledge mapping is the field within KM that aims to optimise the efficient and effective use of the organisation's knowledge. Davenport and Prusak (1998) note that developing a knowledge map involves locating important knowledge within the organization and then publishing some sort of list or picture that shows where to find it. Knowledge maps typically point to people as well as to documents and databases. At the Earth's summit in Rio de Janeiro in 1992, and the follow-up world summit on sustainable development in Johannesburg, September 2002, the concept of sustainable development has become the organisations guiding policy in international, national and local settings. Also, these summits shone the light on sustainability initiatives and arguably made sustainable development a common element of today's public dialogue (Doppelt, 2003).

Sustainable development is defined as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. Looking at each element separately, 'sustainability' means the capacity for an activity to be carried on indefinitely into the future, given the amounts and types of available resources, whereas 'development' implies that society will change or grow in some way. Hence 'sustainable development' suggests change and improvement that is compatible with environmental, social and other limits, both now and in the long-term future (Gray and Wiedemann, 1999). It is generally agreed that sustainability has environmental, economic and social dimensions.

Despite increasing the attention given to the sustainability issues, most experts would agree that progress toward sustainability has been, at best, modest. Some sustainable development efforts have made significant progress and generated important economic, social and environmental benefits. But far too often, people within and outside of the organisations involved in sustainability initiatives complain that change has been slow and disappointing, leading to wasted resources, frustration and cynicism about the sustainability movement (Doppelt, 2003).

It can be argued that, organisations within a Sustainable Urban Environment (SUE) are knowledge intensive. The key challenges for knowledge intensive organisations are how to identify, map, assimilate, disseminate, and apply sustainable knowledge to practical solutions. In particular, mapping of knowledge between different users with different perspectives and purposes is a key challenge. One of the focuses of this on-going PhD is how to identify gaps in the process of mapping and managing sustainable knowledge within and across organisations involved in sustainable development.

## **NEED FOR KNOWLEDGE MAPPING FOR A SUSTAINABLE URBAN ENVIRONMENT**

Organisations within urban environment can be knowledge intensive and operate based on projects in different sectors. Much of the knowledge within organisations in

urban environment is experience-based and tacit in nature. Some organisations have been successful at collecting and storing explicit knowledge in organisational databases, but are not always good at tracking and sharing tacit knowledge (Woo *et al.*, 2004). The distributed nature of organizations makes it very hard to get a clear and complete overview of the knowledge that is available within organizations. Also, there is a lack of effective communication of sustainability knowledge within and between organisations, and between corporate customers and their key suppliers.

Key barriers are related to how the individual uses knowledge and how organisations manage the coordination of knowledge mapping between individuals and other organisations. Therefore, professionals in urban environment find it difficult to access core knowledge for highly knowledge intensive activities, such as problem-solving, decision-making, etc. This situation calls for knowledge mapping to increase the visibility of knowledge sources and hence facilitate and accelerate the process of locating relevant expertise or experience.

Knowledge mapping aims to optimise the efficient and effective use of an organisation's knowledge base by addressing the question of how one can best establish the knowledge that is available within an organization. In summary, the evidence is that improving the uptake and mapping of sustainability knowledge across contexts or applications requires a systems approach to the process of generating, transferring, acquiring, storing, and using knowledge without excessive distortion (Senge, 1994).

## **AIM AND OBJECTIVES**

This paper draws from an on-going doctoral study entitled 'The contributions of Knowledge and Change Management to competitiveness in Sustainable Urban Environment'. The aim of this study is to explore the extent to which knowledge and change management contributes to competitiveness within a SUE. This calls for a robust methodology made up of a combination of tried and tested research approaches. The objectives of the on-going study are:

1. To identify the underlying philosophies of Knowledge and Change Management and their interplay from both a general and sustainable urban environment perspective.
2. To investigate and document the main challenges associated with implementing Knowledge and Change Management initiatives in SME's and large organizations from a sustainable urban environment perspective.
3. To examine and document the ways in which Knowledge and Change Management influence the overall performance of organizations from a sustainable urban environment perspective.
4. From a sustainable urban environment perspective to analyze the strengths and weaknesses of Knowledge and Change Management applications in developing an appropriate framework for knowledge mapping within and across organisation(s).
5. Use appropriate case studies to demonstrate and test the applicability of the developed framework via a sustainable environment project(s).
6. Develop appropriate training and educational programmes based on the research for use in appropriate Continuing Professional Development (CPD) and for appropriate modules to benefit undergraduate and postgraduate curricular.

7. To examine the Capability Maturity Model (CMM) and Six Sigma issues for Knowledge and Change Management from a sustainable urban environment perspective

This study is in its early stages. In this paper, much of what is presented is based on a thorough review of literature. The focus of this paper is on exploring the concepts and benefits of knowledge mapping; also to identify some of the main issues and challenges that need to be considered in the exploitation of knowledge mapping from a SUE perspective, which reflects on the fourth objective.

For the purpose of this paper, a knowledge map is a navigation aid to explicit and tacit knowledge, illustrating how sustainability knowledge flows within and across organisations. The knowledge map depicts the sources, flows, barriers and terminations of knowledge within and across an organization. Knowledge mapping helps to understand the relationships between knowledge stores and dynamics.

## **RESEARCH METHODOLOGY**

In achieving the aim and objectives of this research, a robust methodology is being developed. The focus of this on-going PhD study will be on implementing Knowledge and Change Management within a SUE perspective. As shown in Figure 1, the research process is identified broadly as having three key phases within its flexible boundaries. The three phases are namely, the literature review, the pilot study and the main study. The following sections briefly describe each phase.

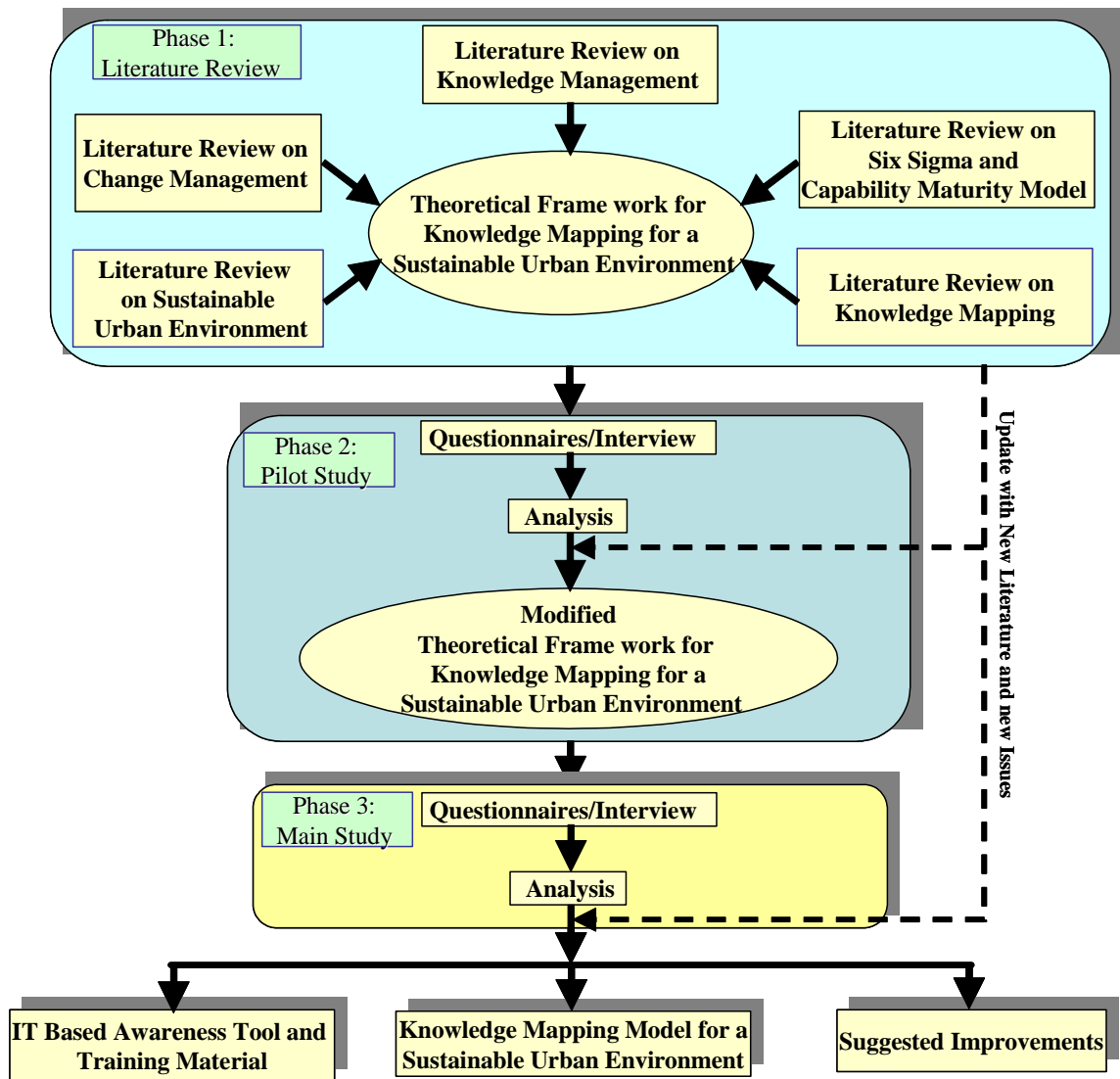
### **Phase One: Literature Review**

The development of the research work started with the literature review. A thorough review of extensive literature is ongoing in the areas of Knowledge Management, Change Management, Knowledge Mapping, Sustainable Urban Environments, Six Sigma, and the Capability Maturity Model. Good sources have been identified in journals, books, internet databases, periodicals, government reports, workshops, seminars and conference proceedings. The review of literature consists of the background study, issues, challenges, critical success factors, benefits and gaps in the respective areas and will result in a theoretical framework. The literature review is an on-going process, which will be carried out simultaneously along with a pilot study and a main study to capture new issues and gaps in the literature.

### **Phase Two: Pilot Study**

Prior to the main field study, a pilot study will be undertaken. The pilot study gives the researcher an opportunity to identify challenges and to modify the research method before embarking on the main study. The pilot study also helps the researchers to refine their data collection plans, with respect to both the contents of the data and the procedure to be followed (Yin, 1994). Data for the pilot study will be collected through interviews and /or questionnaires. The choice of research method is affected by considering the scope and depth required. The questionnaire provides for breadth of coverage, while case study allows for more depth of coverage. The interviews are to be employed within the case study. Collected data will be analysed. The results derived from the data analyses will enable the researcher to modify the theoretical framework developed based on the literature review in Phase One. Furthermore, new literature related issues and the challenges of mapping key knowledge assets within a sustainable urban environment perspective will be updated.

Figure 1: Research Process Diagram



### Phase Three: Main Study

The main study is planned to involve a qualitative research approach. The study will consider context as an essential part of phenomenon; the method such as a grounded theory, ethnography and a case study will be explored. A grounded theory study will seek to generate a theory which relates to the particular situation forming the focus of the study. This theory is ‘grounded’ in data obtained during a field study, particularly in the actions, interactions and processes of the people involved. The second method that may be adopted is an ethnography study that provides description and interpretation of the culture and social structure of a social group. The main purpose and the central virtue of an ethnography approach are often considered to be its production of descriptive data free from imposed external concepts and ideas. Ethnography is a distinctive approach; it can be linked with either the case study or a grounded theory approach (Robson, 2002). A case study is a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence (Yin, 1994). A well-established research strategy, where the focus is on the case (which is interpreted very widely to include the study of an individual person, a group, a setting

and an organisation) in its own right and taking its context into account, is termed a case study.

The advantage of employing multiple methods is to permit triangulation.

Triangulation is regarded as a strategy to overcome problems of validity and bias (Arksey and Knight, 1999). It serves the two main purposes of confirmation and completeness. The task of the data collection is to identify issues related to knowledge mapping, six sigma and capability maturity model implementation for the knowledge mapping process. The collected data will be analysed using the **Statistical Package for the Social Sciences (SPSS)** and the **Non-numerical Unstructured Data Indexing Searching and Theorizing (NUD\*IST)** software. The results derived from the data analyses will enable us to develop a model for mapping key knowledge assets from a SUE perspective. The outcomes of the research will be Information and Communication Technology (ICT) based awareness and training tool, a knowledge mapping model for a sustainable urban environment, and suggested improvements for knowledge and change management initiatives from a SUE perspective.

## **KNOWLEDGE MAPPING CONCEPTS**

According to Webster's Collegiate Dictionary, to "map" is "to represent" ... "to delineate" ... "to assign to every element of a ... set an element of the same or another set"; and "to be located near the corresponding element". In those terms, Knowledge Mapping within SUE represents knowledge content in the domain of "sustainability", with the full expectation that such knowledge changes over time, and that its representations must also change over time.

Knowledge mapping in a SUE context is in its infancy and has the potential to address a number of challenges that organisations are currently facing, e.g. the new demand for communication of sustainability issues and knowledge, efficient utilisation of sustainable knowledge, coordination of human resources, increased accountability and new team-based modes of knowledge production within and across the organisations. A knowledge map illustrates how sustainability knowledge flows within and across organisations. The knowledge map depicts the sources, flows, barriers and terminations of knowledge within and between organizations, and between an organisation's customers and their key suppliers.

A concept can be defined as any unit of thought, any idea that forms in our mind. Often, nouns are used to refer to concepts. Relations form a special class of concepts; they describe connections between other concepts. Modifiers or attributes may be attached to concepts and relations to restrict or clarify their scope. One of the most important relations between concepts is the hierarchical relation, in which one concept is more general than another concept.

Eppler (2001) has pointed out in relation to the concept of mapping knowledge; that it generally consists of two parts: a ground layer which represents the context for the mapping, and the individual elements that are mapped within this context. The ground layer typically consists of the mutual context that all employees can understand and relate to. Such a context might be the visualised strategic model of an organisation, the competency areas of an organisation, the supply chain of an organisation, or a simple organisational knowledge flow map. The elements which are mapped onto such a shared context range from experts, project teams, or communities of practice to more explicit and codified forms of knowledge, such as white papers or articles, patents, lessons learned, or databases. Knowledge maps group these elements to show their relationships, locations, and qualities.

A knowledge map with respect to SUE refers to directories of knowledge sources, assets, structures, applications, or development stages. These knowledge maps will address the issues of what relevant knowledge is, how to judge its quality, how to make sense of its structure, and how to go about applying or developing it.

Knowledge mapping is defined as the process of associating items of knowledge in such a way that the mapping itself also creates additional knowledge. Emphasising this process, Eppler (2001) classified knowledge maps into five types: knowledge source map, knowledge asset map, knowledge structure map, knowledge application map and knowledge development map. These maps can serve as visualized learning or development roadmaps which provide a common corporate vision for organizational learning. Besides these five types of maps, one can also imagine maps which combine some of the above types in one single map. The following section describes the potential benefits of knowledge mapping for SUE.

### **POTENTIAL BENEFITS OF KNOWLEDGE MAPPING AND IMPLEMENTATION FOR A SUSTAINABLE URBAN ENVIRONMENT**

Organisations must put in place strategies for knowledge mapping to reap the benefits. Organisations within a SUE are knowledge intensive, the need for increased transparency and reduction of complexity has often been created by the use of knowledge mapping tools. Knowledge mapping is a multi-faceted approach for creating structure out of an overabundance of potentially useful information. It is a method for coordinating, simplifying, highlighting, and navigating in complex knowledge contexts (Wexler, 2001). It also suggests that effective knowledge mapping can produce economic, structural, organisational and knowledge returns for organisations.

A knowledge map makes important knowledge about an essential business activity available to the organisation in an organised, explicit, and usable form. Its main benefit is better coordinated, more efficient, purposeful, and consistent work. But because the knowledge map depicts a complete picture of a set of processes, it has the potential to provide many benefits to the organisations within SUE, as summarized in Table 1. The knowledge map creates a shared context for employees whose work is interdependent, though the individual employees themselves may be separated by distance, organizational structure, and even language.

Knowledge mapping can identify the organisations critical knowledge sources and locations. This can be people, relationships, artefacts etc. Also, it identifies current and future knowledge gaps within and across the organisations.

Knowledge mapping can identify barriers to the flow of sustainable knowledge within and across organisations. It also helps make knowledge quicker and easier to find and access. It identifies the utility of critical sustainable knowledge, and also highlights where the important knowledge is, and where the redundant knowledge resides within and across organisations in SUE.

**Table 1:** Potential Benefits of Knowledge Mapping for a SUE

<b>Function</b>	<b>Benefits</b>
To identify knowledge gaps	Identifies what knowledge is needed to support overall organisational goals, team and individual activities. Also, focuses acquisition efforts on knowledge needed to satisfy clients needs and to win new clients.
To identify knowledge assets	It provides the inventory of knowledge assets allowing them to become more visible and therefore more measurable, accountable and gives a clearer understanding of the contribution of knowledge to organisational performance. Also suggests potential re-use or better use of valuable knowledge.
To identify knowledge flow	It provides a map of knowledge flow within and across the organisation. It also highlights both issues and best practices to share it.
To identify untapped knowledge	It reveals pockets of knowledge that are not being used for organisational advantages.
For team building	Process of knowledge map development reduces barriers between individuals and groups. It helps to create shared understanding, mutual trust, and process improvement.
Context for existing knowledge resources	Provides contexts for existing knowledge and information resources. It also increases reliability, meaning, depth and value of knowledge.
Knowledge accessible in time	Makes essential knowledge resources accessible in a timely way. It improves efficiency and quality of access to the knowledge.
Business functions	Provides a multi-faceted picture of current business functions. Encourages a holistic approach to issues, informed problem solving, a richer repertoire of decision choices, and foundation for innovation.
Understanding of the context	Gives employees an understanding of the context and meaning of their work. It enhances decision-making, improves morale, improves cooperation and collaboration.
Organisational restructure	Knowledge maps assist in communicating the results of restructuring, re-engineering, organizational change, mergers and downsizing programs, etc., to those involved.
To connect experts	Knowledge maps can connect experts with each other or help novices identify experts quickly. As a consequence knowledge maps can speed up the knowledge seeking process and facilitate systematic knowledge development since they connect insights with tasks and problems.

Many large organizations are fairly opaque; people can only see what happens in their immediate area. The knowledge maps help to create transparency within organisations. Mapping knowledge helps to build trust, an essential characteristic of a knowledge-sharing culture. A published knowledge map, whether online or on paper, makes knowledge about the aims, processes, and roles involved in complex work explicit and gives it its own existence, separate from particular individuals or groups. This paper argues that knowledge mapping may provide a fruitful solution to the problem of how to manage and co-ordinate the increasingly complex issues of sustainability knowledge for organizations. A model for “knowledge mapping for a sustainable urban environment” may provide a possible answer to the challenge of how to locate new forms of useful knowledge, and the flow of knowledge within and across the organisations, including new directions for training employees, stimulating and facilitating knowledge sharing, and establishing useful links with external stakeholders (Hunt, 2003).



## **CHALLENGES AND ISSUES ASSOCIATED WITH KNOWLEDGE MAPPING FOR A SUSTAINABLE URBAN ENVIRONMENT**

**Organisational Dynamics:** Knowledge mapping should start by deciding on the specific scope for and purpose of mapping knowledge, as well as the level of detail of the knowledge map (Soliman and Spooner, 2000). In creating graphical representation of an organisation's knowledge assets a major challenge becomes the handling of the dynamic aspect of the organisation's environment, as well as of the dynamic character of the knowledge base itself. Some knowledge loses its value over time, other knowledge may be replaced with superior knowledge, and some knowledge may simply be forgotten. This calls for a dynamic and multi-functional approach to knowledge mapping. Wexler (2001) suggests a number of generic knowledge mapping approaches that may be combined to capture such dynamism. These include competence maps, concept maps, strategy maps, causal maps, and cognitive maps. An important functionality of the knowledge map still is to enable the user to browse "knowledge holdings", both inside and outside of the organisational boundaries (Duffy, 2000). A dynamic, evolving map not only remains current, it keeps the valuable mapping process going (Seeman and Cohen, 1997).

**Knowledge Sharing Across Boundaries:** Quintas (2002) states that organisations must increase the capability to share knowledge between domain experts and across internal and external boundaries. Meeting these challenges would produce great leverage, since it would release more of the untapped value in the existing knowledge and will make its communication across the spectrum of users a more realistic proposition. This is also at the heart of using knowledge more creatively and facilitating knowledge based innovations.

**Knowledge Representation:** Capturing and representing knowledge that is in people and in an organization are the fundamental building blocks of knowledge mapping implementation (Kim et al., 2003). It is also noted that a significant and time consuming problem for knowledge-based system developers is how to efficiently elicit knowledge from experts and transform this elicited knowledge into a machine usable format. A way of increasing the sensitivity of knowledge mapping is to pay attention to the different forms of relevant knowledge on a higher level of abstraction. A complete map should include both explicit and tacit knowledge within and across the organisation.

**Criteria for Mapping Knowledge:** Several authors in Huff and Jenkins' (2002) compilation of articles on the subject point out that there are very few methods for helping the organisation decide what are good maps for guiding it into the future. One of their reflections is that the criteria for constructing future-oriented maps must not be too closely tied to frameworks that emphasise the existing intellectual resources of the organisation, such as, for instance, is done in the resource-based view of the organisation, since this would risk hampering renewal and creative growth. In other words, there is a risk that knowledge mapping increases the path dependency of actions, including the utilisation of intellectual resources, by favouring reuse of existing knowledge at the expense of developing new solutions and insights.

**Tacit Knowledge Map:** Despres and Chauvel (1999) point out in relation to knowledge mapping that "individuals and organizations function within information environments of their own making". This implies that the ways that knowledge is generated, sought out and used, are building blocks for a "tacit" knowledge map,

which can be reconstructed in an active knowledge mapping activity. However, this also has implications for how the functionality of a knowledge map should be seen. A knowledge map must build in a definitive amount of divergence as well as convergence of focus: i.e. an ability to maintain attention to other areas than those that are currently focused on, as well as enable a specific focus on certain sub-fields.

**Transparency of Knowledge Maps:** Miscommunication in maps is hastened when the map-makers and map-users do not share the same language, or do not see eye to eye on what are the goals at the centre of the knowledge map. Knowledge maps are abstract. They capture representations. These representations, to be useful, must be shared and understood. Knowledge maps increase the probability of successful communication when map-makers and map users share the same symbols or representations or the ‘legend’ which accompanies the knowledge map is sufficiently clear, simple and useful (Seeman and Cohen, 1997).

**Organisation Culture and Leadership:** Organisation culture and leadership form the foundation for successful knowledge management implementation (Kim et al., 2003). The absence of active management involvement is likely to mean that the knowledge mapping process will be handicapped by insufficient time, money, and talent. That ‘support vacuum’ also signals to potential users that the mapping process and map are not an essential part of the work of the organisation. An effective knowledge map can change the culture and behaviour of an organization, if management supports and demonstrates that change.

**Infrastructure:** Infrastructure such as ICT and the Internet is also crucial. Organizational knowledge is inherent in diverse locations, including written documents, corporate databases, the human brain, and organisation memory. Explicit knowledge is chiefly extracted from documents or databases and tacit knowledge from human resources while executing business processes. Explicit and tacit knowledge can be transformed into objects in the knowledge map. A knowledge map not only represents knowledge and knowledge streams within an organization, but also provides a well-organized basis for KM systems. The knowledge map plays a key role in the KM project because it gives a knowledge profile, navigation aids among knowledge, and an expert finder.

## **THE ROLE OF INFORMATION TECHNOLOGIES IN KNOWLEDGE MAPPING**

There are several issues with the current use of ICT tools in the interest of knowledge mapping. The challenge for ICT is to facilitate a dynamic process of knowledge creation and representation, not a static process of information management. Current ICT based knowledge mapping focuses only on explicit knowledge, which can be expressed in words and numbers and easily shared, and fails to deal with tacit knowledge. Most knowledge management tools are designed to extract profits through knowledge economies of scale by combining or reusing existing knowledge, not to create new knowledge (Dierkes *et al.*, 2001). To foster knowledge creation, mapping, and access, ICT is needed that both facilitates an efficient and effective knowledge conversion process and increases the speed and ease of accessing the critical sustainable knowledge assets.

For knowledge mapping several tools have been devised. These tools can provide a bridge between human knowledge and machine knowledge. Some of the knowledge mapping tools are Ontology’s, Frame, Petri net, Cluster maps and webs, Mind maps,

Computer generated associative networks, Concept circle diagrams, Concept map, Semantic networks, Thesauri, Conceptual graphs, Visual thinking networking and Topic maps to name a few.

## **CONCLUSIONS AND FURTHER WORK**

This paper has highlighted some of the key issues in the application of a knowledge map for mapping sustainability knowledge within and across the organisations. A background to knowledge management, knowledge mapping and a sustainable urban environment has been given through the course of a comprehensive literature review. The proposed research aim and objectives, research methodology, and potential benefits of knowledge mapping for organisations from a SUE perspective have been discussed. In addition to this, key challenges and issues associated with knowledge mapping for a SUE have been identified and discussed. The role of ICT, with regard to knowledge mapping has also been discussed.

Knowledge maps provide a visual orientation for managers or experts who wish to locate, evaluate or develop knowledge in an organizational context. It condenses information about knowledge sources, assets, structures, applications, or development needs in an accessible way.

A thorough review of literature has revealed that there are very few empirical studies directed towards this area. This paper concludes that mapping and managing knowledge assets in SUE is an integrated and complex process. This involves social, cultural, financial, and technological considerations. Therefore, it is recommended that more research effort needs to be targeted on how to improve the process of mapping, communicating and using sustainability knowledge across and within organisations. The rapid development of ICT and its potential to combine graphic interfaces with database applications, provide useful opportunities for the development of appropriate knowledge maps for use in urban environment.

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