Knowledge Mapping in a Not-For-Profit Firm: A Case Study

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Abstract

The ability to create, identify, capture, and share knowledge across an organization's value chain is the goal of Knowledge Management (KM). This is especially true of tacit knowledge. The development and implementation of KM initiatives typically requires the substantial resources of large commercial enterprises such as people, time, and money. However, the very nature of the not-for-profit firm (particularly limited resources, informal processes, and staff turnover) results in weak knowledge sharing practices and frequent knowledge loss. How can not-for-profit firms understand how knowledge flows through their organization and, in turn, initiate strategies to capture tacit and explicit knowledge? The purpose of this study was to develop a framework that not-for-profit firms could utilize to build a knowledge map of their sources and uses of knowledge critical to business survival. This research leverages a recently developed method (Systems Based Knowledge Management- Influence Diagram (SBKM-ID)) for capturing knowledge flows in the for-profit sector and applies it to a not-for-profit firm in a qualitative, case study approach. Not-for-profit firms can use the resultant SBKM-ID to develop intervention strategies to create, retain, apply, and reuse the firm's intellectual capital.

Keywords: SBKM-ID, System Based Knowledge Management, knowledge management, not-for-profit, influence diagram, knowledge map

1. INTRODUCTION

Not-for-profit firms are knowledge-intensive organizations who rely heavily on volunteer personnel to provide critical products and services to our society. These volunteers develop knowledge about the business and its customers, but often leave the firm after a limited tenure resulting in knowledge loss to the firm. The ability to create, identify, capture, and share knowledge across an organization is a goal of Knowledge Management (KM). The need to understand the knowledge sharing challenges within not-for-profit firms is critical to identifying and developing effective KM initiatives to

mitigate knowledge loss and accelerate new employee learning curves. However, though the intellectual capital developed by not-for-profit firms is critical to their survival, there has been limited KM research to address their knowledge sharing challenges. This research aims to contribute to the research tools which can help address these not-for-profit knowledge sharing challenges.

Not-for-profit firms lack the resources of larger, for-profit enterprises, and do not have the luxury of employing a Chief Knowledge Officer or equivalent leader to drive KM strategy and initiatives (Lettieri, Emanuele, Borga, Francesca, & Savoldelli (2004); Edge, 2005; Hurley & Green, 2005). However, the knowledge-intensive nature of the not-for-profit firm and their need to constantly improve and bring new services to market is critical to their long term viability. Not-for-profit firms operate in an environment of informal procedures, high staff turnover, and limited resources. This results in weak knowledge sharing practices and frequent knowledge loss (Lettieri et al., 2004; Edge, 2005). The constant pressure of having to renew their services and products to survive and continue to attract funding further amplifies this problem.

The not-for-profit firm selected for this study was founded in 1994 with a mission to continuously improve the teaching and learning competencies of K-8 teachers, with a focus on science education and mathematics. The firm is one of eight sites working with the National Science Resource Center, which is part of the Smithsonian Institution and the National Academies of Science. The firm has grown from supporting two school districts in Southwestern Pennsylvania to supporting 48 school districts, 3,000 teachers, 125,000 students and over 200 schools. The firm's Board of Directors is comprised of individuals from Fortune 500 companies, national and state agencies, private companies, not-for-profit foundations, institutions of higher education, and teachers and administrators from participating school districts.

The firm fulfills its mission through five key strategies: 1) design, develop, and deliver on-going teacher professional development, 2) provide quality curriculum materials, 3) provide centralized materials management, 4) provide and assist in assessment that is aligned to standards (i.e., No child Left Behind and National Science Education Standards) and curriculum, and 5) community involvement.

The firm is structured into three major areas: Administration, Materials Support Center, and Professional Development. The Administration function encompasses an Executive Director and the functions of Finance and Accounting, Marketing and Communications, and Fund Raising. The Materials Support Center primarily operates an inventory and warehouse distribution function for ordering materials, storing materials, assembling kits for use by member school districts, shipping the kits to member school districts, receiving returned materials when schools have completed utilizing the kits, and refurbishing materials/kits for redistribution.

Understanding where a firm's key knowledge assets exist is a crucial requirement to sustainable competitive advantage. Understanding who holds this knowledge, how the knowledge works in the organization, and how this knowledge can be better managed are imperatives in today's knowledge economy. Understanding the knowledge landscape of the firm is a fundamental building block for developing a KM strategy, and a key dimension of this research project.

The purpose of this study was to develop a framework to help a not-for-profit firm identify and understand the sources and uses of knowledge critical to its survival. More specifically, this research leverages a technique developed by Swart & Powell (2006) in the United Kingdom for use in the for-profit sector known as the Systems Based Knowledge Management-Influence Diagram (SBKM-ID) and it applies it to a not-for-profit firm. The question this research answers is:

> Can the recently developed Systems Based Knowledge Management Influence Diagram (SBKM-ID) method be utilized to identify and capture the key knowledge flows in a not-for-profit firm, thereby, helping the not-for profit firm identify and understand the sources and uses of knowledge critical to its survival?

2. LITERATURE REVIEW

KM in the Not-For-Profit Sector

Not-for-profit firms are knowledge-intensive organizations whose aim is "creating social value for society as a whole and which do not recognize as their main goal the creation of profit for stockholders" (Lettieri et al., 2004, p. 16). Not-for-profit firms employ well educated "professionals such as psychologists, counselors, health-care professionals, and educational specialists" and are "knowledge-intensive bodies" (Hurely & Green, 2005, p. 3). Alvesson (2001) refers to knowledge-intensive firms as those organizations where "most work is said to be of an intellectual nature and where well-educated, qualified employees form the major part of the work force" (p. 863). Davenport (2005), in his book "Thinking for a Living," defined the knowledge worker as:

> Knowledge workers have high degrees of expertise, education, or experience, and the primary purpose of those jobs involve the creation, distribution, or application of knowledge. Knowledge workers think for a living. They live by their wits – any heavy lifting on the job is intellectual, not physical. They solve problems, they understand and meet the needs of customers, they make decisions, and they collaborate and communicate with other people in the course of doing their work (p. 12).

Tacit Knowledge in the Not-For-Profit Firm

A majority of this knowledge in the not-for-profit firm can be categorized as tacit knowledge. The dichotomy between tacit and explicit knowledge fundamental in understanding the challenges in the field/discipline of KM. Nonaka & Takeuchi (1995) categorized knowledge into two distinct categories: tacit and explicit knowledge. Tacit knowledge is difficult to express, represents the knowledge that people possess, and encompasses both physical skills and cognitive frameworks (Nonaka & Takeuchi, 1995; O'Dell and Grayson, 1998). Alternatively, explicit knowledge "is that component of knowledge that can be codified and transmitted in a systematic and formal language: documents, databases, e-mails, charts, etc." (Tiwana, 2002, p. 45).

There is constant pressure in the not-for-profit sector to renew services and improve performance; or otherwise, fade away as demand for services decrease and externally supplied funding is redirected elsewhere. To improve performance in this sector, "all available resources should be managed with increased effectiveness and efficiency, the most important of these being knowledge" (Lettieri et al., p. 16). Employees of not-for-profit firms develop, implement, and run programs which is knowledge-intensive work, yet the tacit nature of this knowledge permeates the business. Hurely & Green (2005) expound on this point further stating:

> One of the keys to an effective nonprofit organization is the transfer of this tacit knowledge into explicit knowledge. By combining and documenting the explicit knowledge learned from program development, management, and program evaluation, these "best practices" and "lessons learned" can be stored for use. This process will allow the best elements of old programs to be modified, replicated, and incorporated into new programs – the result being better programs and more efficient and effective organizations (p. 8).

However, the knowledge capital in the not-for-profit sector is "rarely formalized and unstable because of considerable turnover rates among volunteer workers" and KM adoption/application and research in this sector has been limited (Lettieri, p. 17). Sveiby and Simmons (2002) reported that the two most significant KM challenges in the public sector were a culture of resistance and hoarding knowledge. Additionally, Svieby and Simmons (2002) found that public sector organizations have a more difficult challenge than the private sector in developing a culture of collaboration.

An effective KM capability starts with understanding the business and the knowledge requirements of the organization to develop a comprehensive KM strategy. Various research highlights the need to first

understand the short and long term business strategies of the firm and then identify where the knowledge gaps exist (Earl, 2001; DeTienne and Jackson, 2001; Arora, 2002; Schwikkard and Toit, 2004; McCann & Buckner, 2004; Snyman and Kruger, 2004). Next, the company needs to understand where its knowledge capital (explicit and tacit) exists and develop intervention strategies to enhance the processes of creating, capturing, storing, and sharing knowledge. The creation of a knowledge map is a valuable component of the overall KM process and is the focus of Lettieri's et al. (2004) research into KM in not-for-profit firms. Once a company understands where the knowledge gaps exist relative to alignment with the business strategy, KM initiatives can then be developed.

To understand the knowledge landscape of firms in the not-for-profit sector, Lettieri et al. (2004) conducted a study comprised of a sample selection of four not-for-profit firms. One of the goals of the study was to develop a grid to categorize the knowledge held by those organizations. One outcome of the research was a high-level knowledge map which is presented in the Appendix in Figure 1.

Figure 1 conceptually illustrates the division of knowledge into tacit and explicit dimensions on the Y or vertical axis (knowledge ontology) and individual and group knowledge dimensions on the X or horizontal axis (knowledge epistemology). The explicit knowledge is further divided into codified and uncodified components. The major functions (i.e., accounting) of the four not-for-profit firms were then plotted on the grid. Lettieri's et al. (2004) model categorizes tacit and explicit knowledge at a department level by plotting each department name on the grid.

The SBKM-ID (Systems Based Knowledge Management-Influence Diagram) Technique

The Systems Based Knowledge Management-Influence Diagram (SBKM-ID) technique (Swart & Powell, 2006) is a knowledge mapping method rooted in the discipline of Systems Dynamics (SD). SD involves using models or schematic diagrams to understand how a process or system works (Forrester, 1958; Wolstenholme, 1982; Coyle, 2000; MacDonald, B, Potter, J. M., & Jensen, K. O, 2003; Luna-Reyes & Anderson, 2003; Swart & Powell, 2005, 2006). "A model used to represent a system can range in complexity from a mental model, to a written description of the system, right through a mathematical model describing the relationships between components of the system" (MacDonald, et al., 2003, p. 161). The models in system dynamics showing the relationships between system components are called causal loop diagrams or influence diagrams (Swart & Powell, 2006).

Systems Dynamics (SD) is divided into quantitative and qualitative approaches. Quantitative SD involves the mathematical modeling and simulation of a system that "aims at identifying the feedback processes causing a system's problems and thus looks for the dynamic structure underlying the system's behavior" (Vennix, 1996, p. 108). Quantitative SD works well when one has a "full understanding of the system's behavior" (Vennix, 1996, p. 109). Qualitative SD involves descriptive modeling of the system to better understand the relationship of components in the system and how they interact. "It is important to note that the qualitative analysis by this description phase of applying system dynamics is often sufficient in itself to generate problem understanding and ideas for change" (Wolstenholme, 1982, p. 549). The SBKM-ID method utilizes qualitative SD to understand the messy concept of knowledge flow through a system.

The SBKM-ID method is comprised of three components: 1) Knowledge based influence diagram, 2) Knowledge based Qualitative Politisized Influence Diagram, and 3) Knowledge representation within the system. The first two components are leveraged from Qualitative Systems Dynamics. The third component is a table identifying roles of people in the system being modeled and their associated tacit and explicit knowledge required to fulfill that role.

The first component is the influence diagram which provides a graphical representation of how components or variables interact within a system (Forrester, 1958; Wolstenholme,

1982; Vennix, 1996; Coyle, 2000; Luna-Reyes & Anderson, 2003; Swart & Powell, 2005, 2006;). In terms of qualitative SD, a system can be a function, a process, a department or an entire organization. The component or variable is an element whose changing value can impact other elements in the system. Swart & Powell (2006), in offering a new knowledge mapping method, advocate using knowledge domains in place of traditional operational variables in the system.

The second component of the SBKM-ID method is the addition of people (i.e., actors) to the influence diagram and is called a Qualitative Politisized Influence Diagram (QPID) (Swart & Powell, 2006). As stated before, Swart & Powell (2006) extend the meaning of the traditional QPID by using knowledge domains in place of traditional operations variables and adding actors who own or influence the flow of knowledge through the system. Additionally, each of these actors is asked what data, information, or knowledge is required to fulfill their role.

Figure 2 in the Appendix is a QPID diagram (Swart & Powell, 2006) with knowledge domains used as the variables. For example, the variable training impacts (i.e., influences) the competence level of employees in a firm. The level of competence of the employees has an impact on whether the firm wins or loses business. Finally, the success in winning new business impacts the amount of revenue the firm earns. This specific influence loop is one of potentially many different loops comprising the overall influence diagram.

The underlying technique utilized to capture the dynamic and systemic qualities of knowledge was the SBKM-ID method developed by Swart & Powell (2006). A significant amount of KM practices "focus on coding, recording, and re-use of knowledge in order to build a stock of competitive resource" (p. 11). Polanyi (1966) in his discussion of tacit knowledge expressed the importance of knowing – how knowledge flows through business. The SBKM-ID technique focuses "on how knowledge flows through practice rather than how it is recorded in written format, which often distracts from practice" (Swart & Powell, 2006, p 11).

More specifically, the SBKM-ID method uses diagrams to capture the flow of knowledge through a managed system comprised of the processes, participants, and knowledge exchange. This technique can be utilized to identify the four forms of knowing (knowing what, knowing why, knowing how, and knowing who) which constitutes the idea of system-wide knowing (Johnson, B., Lorenz, E. & Lundvall, B. (2002). Know-what is knowledge about facts such as the population of a city. Know-why is about understanding "principles and laws of motion in nature, in the mind and in society" (p. 250). Know-how refers to skills or ability to perform some task. Know-who involves knowledge about who knows what and who knows what to do (p. 251).

The third component of the SBKM-ID is a table which identifies the tacit and explicit knowledge flowing through the system being modeled. The "Link" column identifies two knowledge domains joined by a ">" sign depicting knowledge exchange between individuals operating within the two domains. The column to the right of the "Link" column is the "Actor" column which lists the roles of individuals who own or have a material influence on the knowledge domains and knowledge exchange. The "Knowledge Type" column classifies the knowledge as either tacit or explicit. The "Knowledge" column identifies the knowledge required to fulfill the particular role in the knowledge exchange. This table and third component of the SBKM-ID is presented in the Appendix in Figure 3.

3. METHODOLOGY

Introduction

A qualitative case study methodology was selected for this research due to the need to observe, interview personnel, and identify the tacit and explicit data required to develop a SBKM-ID (i.e., knowledge map) for this not-for-profit firm. A case study approach enables the researcher to work directly with not-for-profit volunteer participants who create this mission critical knowledge and then leave the organization. Therefore, this approach will allow the researcher to observe as well as interview

the full complement of participants across the entire set of knowledge flows. Identifying and capturing tacit and explicit knowledge is a dynamic modeling challenge. A qualitative systems dynamics modeling approach is an effective tool in understanding messy problems (Vennix, 1996). In particular, capturing tacit knowledge flows in a not-for-profit firm falls into this messy classification and warrants the use of the following four step qualitative methodology:

1: Company and Researcher Introduction and Orientation
2: Executive Director Interviews
3: Individual Director/Participant Interviews
4: Develop the SBKM-ID
- 4.1: Develop the Influence Diagram
- 4.2: Convert the Influence Diagram into a SBKM-ID
- 4.3: Conduct Follow-up Director Interviews and Validation of SBKM-ID
- 4.4: Update SBKM-ID From Interview Results
- 4.5: Complete Final Validation Reviews of SBKM-ID

Step 1: Company and Researcher Introduction and Orientation

Prior to the introductory interview, external research was completed on the not-for-profit firm to orient the researcher and set a foundation for productive dialogue. An agenda was developed to achieve two objectives. The first objective was to obtain the not-for-profit firm's participation in the study. This encompassed personal introductions, a discussion of the purpose of the study, a discussion of the research questions the study aimed to answer, and a definition of KM and its unique challenges within the not-for-profit sector. The second objective was to develop an initial understanding of the firm's mission, history, and structure.

Approval was sought to conduct the research, communicate a high-level timeline of events, establish follow-up Executive Director interviews to determine where to focus the research efforts, and to secure approval to digitally record future interviews with select personnel. All interviews were digitally recorded and transcribed by a third party.

Step 2: Executive Director Interviews

All subsequent interviews with other participants from the not-for-profit firm were scheduled through the firm's schedule coordinator. Each interview session lasted no more than 60 minutes. A follow-up interview was conducted with the Executive Director to capture and understand the firm's strategic plans, goals, major challenges, organizational structure, and value chain.

Once the specific business areas (i.e., components of the value chain) of the firm's value chain were reviewed, discussed, refined, and approved by the Executive Director, the selected business areas were scheduled for review in the subsequent steps in the methodology.

Step 3: Individual Director/Participant Interviews

Based on the priorities established in the Executive Director interviews, additional interviews were conducted with the Directors and key individuals who owned or influenced the selected components of the value chain. The approach utilized in-depth, open, semi-structured interviews to identify the key business processes and more specifically the key variables that were captured in the SBKM-ID.

The SBKM-ID method (Swart & Powell, 2006) was used to capture the roles, processes, and knowledge flows within the selected areas of the firm's value chain. All documents and diagrams were inventoried and coded with the date of collection and each source was given a unique tracking number.

Step 4: **Develop the SBKM-ID**

The transcribed interviews, researcher notes, and any supplied documentation were utilized to begin building the first draft of the SBKM-ID. The initial influence diagram was developed following a four step procedure outlined by Vennix (1996 p.120) and as described in Step 4.1.

A software application called Vensim (www.vensim.com), used for constructing business models such as qualitative and quantitative systems dynamics diagrams, was utilized to develop the influence diagrams in this research.

The influence diagram, transcribed interviews, and researcher notes were analyzed for knowledge process flows, points of knowledge exchange, and process participants. Knowledge flow owners and influencers were added to the influence diagram to convert the influence diagram into a SBKM-ID (Powell & Swart, 2006) as described in step 4.2.

After analyzing the captured data questions were developed to validate and expand the understanding and flow of knowledge through a specific component of the managed system. The first DRAFT SBKM-ID and question set became input into subsequent rounds of interviews as described in Steps 4.3 through 4.5 to refine the SBKM-ID.

Step 4.1 Developing the Influence Diagram

Vennix (1996) developed a four step procedure for building causal loop diagrams through an interview process. Causal diagrams are also called influence diagrams, which is the term used by researchers in studying knowledge flows. Influence diagrams comprise the foundation for the SBKM-ID technique. Vennix's (1996) four step process for developing an influence diagram is briefly outlined below and also detailed in Figure 4 in the Appendix.

- Step 1: Identify the variable (i.e., problem variable or operational variable) which is of interest to the researcher and is labeled as the problem or operational variable.
- Step 2: Identify the influencers or causes of the problem or operational variable through the use of an arrow pointing from the cause/influencer to the problem variable.
- Step 3: Identify the outcome or consequences of the problem or operational variable through the use of an arrow from the problem variable to the outcome or consequence variable.
- Step 4: Identify the feedback loops through the use of an arrow from the outcome or consequence variable back to the cause/influence variable (Vennix, 1996).

The resulting influence diagram became the primary input into developing the SBKM-ID.

Step 4.2 Converting an Influence Diagram into a SBKM-ID

Converting an influence diagram into a SBKM-ID is a three step process. The first step is replacing traditional operational variables with knowledge domains. The second step involved adding actors, owners and influencers to the arrows from one variable to another in the influence diagram, which results in a modified QPID diagram. By modified QPID, the researcher is referring to the replacement of traditional operational variables with knowledge domains. For example, a manager (M) may own the area where the knowledge flow is occurring and a volunteer (V) may have material influence on the content or speed of the flow of the knowledge. The label MV (Manager Volunteer) may be added to an arrow to show these actors control or influence a specific knowledge flow. Understanding who has control and influence over a given knowledge flow, can be a focus of policies, procedures, organization change, and technological strategies to impact the behavior and execution of a particular process. An example of the addition of the actors M (Manager) and V (Volunteer) is shown in Figure 5 (See Appendix).

After identifying and labeling the knowledge flow with the actors, the third step in converting the influence diagram into a SBKM-ID required identifying the key knowledge domains associated with the problem or operational variable. For example, the variable "D" in Figure 4 is replaced with the key knowledge utilized by the manager (M) and the volunteer (V) in the knowledge flow from "D" to "X."

Step 4.3: Conduct Follow-up Director Interviews and Validation of SBKM-ID

Utilizing the SBKM-ID and question set derived from step 4.3, follow-up interviews were conducted with the study participants. The goal of each interview was to fill in any perceived gaps and to ensure the researcher understood the processes and knowledge identified. Additionally, the researcher probed deeper into the SBKM-ID to identify and note the presence of the four types of knowing: knowing what, knowing why, knowing how, and knowing who. The SBKM-ID was reviewed with each participant and updates were applied to the diagrams. At the completion of each interview, the SBKM-ID was reviewed with various participants to confirm the researcher's understanding of the knowledge flows.

Step 4.4: Update SBKM-ID From Follow-Up Interview Results

The researcher reviewed the process flows, points of knowledge exchange, and process participants. The SBKM-ID was updated with the additional information and clarifications. The outcome of this analysis was used to develop a list of questions to ask the participant in follow-up interviews.

Step 4.5: Complete Final Validation Reviews of SBKM-ID

A final review of the SBKM-ID was conducted with each of the study participants who participated in the individual interviews. Each causal relationship captured in the SBKM-ID was discussed, modified/corrected if required, and confirmed with each individual. Any disagreements among participants that were not resolved were noted and reported within the findings section of the study. The final SBKM-ID represented a graphical and tabular representation of knowledge sharing within the not-for-profit firm.

4. RESULTS

SBKM-ID Development

The final version of the SBKM-ID is comprised of three levels of granularity. The first level, a summary level SBKM-ID of the entire firm, is presented in Figure 6 (See Appendix). There are multiple knowledge flows in the diagram that have been highlighted using different symbols and arrows representing specific knowledge flows through the firm under study. Five primary knowledge flows are detailed:

1. Strategic knowledge flows represented by black arrows,
2. Materials Management knowledge flows represented by brown arrows,
3. Registration and Enrollment Management knowledge flows represented by blue arrows,
4. Assessment knowledge flows represented by red arrows, and
5. Professional Development knowledge flows represented by green, dotted arrows.

Summary Strategic Knowledge Flow

The Strategic knowledge flow (black arrows) captures the high-level strategic knowledge function which involves the Board of Directors, the Executive Leadership Council (ELC), fund raising efforts, relationships with the State, and strategic planning. The tacit and explicit knowledge applied and exchanged throughout this knowledge flow helps provide high level direction, set high level priorities, provide financial/budgetary guidance, and set boundaries of activities for the not-for-profit firm for the coming year. The individuals involved in the strategic knowledge flow come from public corporations, private firms, institutions of higher education, school districts, and other community organizations.

Summary Materials Management Knowledge Flows

The Materials Management knowledge flow (brown arrows) captures the high-level flow of the tacit and explicit knowledge exchanges of this function which involves the identification and procurement of supplies from outside entities such as inquiry based education kits (i.e., Full Option Science System) from the University of California at Berkley. There are also key knowledge exchanges between the scheduling function within the Professional Development group to secure materials for workshops as well as the participating school districts which order and return education kits upon completion of a learning module. Additionally, there is a knowledge exchange between the materials management function and the research and development (R&D) function to determine what materials are

needed to develop new Professional Development offerings.

Summary Registration and Enrollment Management Knowledge Flows

The Registration and Enrollment Management knowledge flows (blue arrows) capture the high-level flow of the knowledge exchanges encompassing scheduling (i.e., workshops, conferences, institutes, showcases), enrollment management and administration, member communications, roster management, coupon management and redemption/payment, ACT48 teacher credit reporting, and attendance reporting (measures of success). There is a high degree of interaction between the Registration knowledge flow and the Professional Development knowledge flow. Though the individuals within these knowledge flows actually work in the same department, the flows have been highlighted in different colors for two reasons. First, the Professional Development knowledge flow (green arrows) focuses specifically on the key knowledge domains necessary to design, develop, and deliver Professional Development training to K-8 teachers, which is the primary mission of the firm. The Registration knowledge flow (blue arrows) provides primarily an administrative function to support that mission. Secondly, the Professional Development knowledge flow is comprised of volunteer employees (teachers on loan from participating school districts) and the Registration knowledge flow is comprised of permanent employees of the not-for-profit firm.

Summary Assessment Knowledge Flows

The Assessment knowledge flows (red arrows) capture the high-level flow of the tacit and explicit knowledge exchanges encompassing student achievement results, measures of success for the firm, providing educational evidence of success to the state, funding sources, the Board of Directors, and feedback to the Professional Development function. Tacit and explicit knowledge exchange within the assessment process and outcomes is critical to the on-going support and sustainability of the not-for-profit firm. Standardized tests taken by the participating school districts provide explicit evidence of performance. Understanding the not-for-profit's impact on the test scores among many other variables is a complex, tacit process, and an area the firm wants to more concretely address in the near future.

Detailed Professional Development Knowledge Flows

The Professional Development flow (green, dotted arrows) was selected by the Executive Director to explore more deeply because it represents the function that creates and delivers the firm's core services to its constituents. The Professional Development knowledge flow has been extracted and expanded into more detail from the firm-wide SBKM-ID and is presented in Figure 7 (See Appendix).

The Professional Development knowledge flow begins with the strategic planning knowledge domain which links to the research and development knowledge domain. The actors who hold or influence the knowledge interaction are the Executive Director (ED), Director (D), Professional Development Manager (PD-M), and the Materials Support Center Manager (MSC-M). Each of these actors possesses both tacit and explicit knowledge required to fulfill the responsibilities within the strategic domain and across the interaction with the research and development domain. For this particular link, the Executive Director and Director (ED/D) possess tacit operational knowledge combined with the vision of the firm. The ED/D also possesses the explicit knowledge of the high level businesses goals and objectives which have been communicated to the employees of the firm. The Professional Development Manager (PD-M) has the tacit leadership knowledge necessary to form the research and development focus group, allocate the resources to support the team, and mentor the group.

The Professional Development Manager (PD-M) has the explicit knowledge of techniques for planning and scheduling the work of the research and development focus group. Finally, the Professional Development Resource Teacher (PD-RT) possesses the tacit experience of applying learning cycle methodology (such as FERA) to the process of designing new Professional Development training. The PD-RT also possesses explicit

knowledge of the FERA learning cycle methodology. Each knowledge link, the associated actors, the knowledge type, and knowledge description is presented for each link in the Professional Development knowledge flow which is presented in Table 1 (See Appendix).

The "Link" column identifies two knowledge domains joined by a ">" sign depicting knowledge exchange between individuals operating within the two domains. The "Links" contained within the Professional Development knowledge flow are listed. The column to the right of the "Link" column is the "Actor" column which lists the roles of individuals who own or have a material influence on the knowledge domains and knowledge exchange. The actors listed in the diagram and table are defined as follows:

- ED/D = Executive Director/Director: The Executive Director is the overall leader of the not-for-profit firm. The Director is the second in command and is responsible for the overall operations of the firm.
- PD-M = Professional Development Manager: The Professional Development Manager is responsible for managing the day-to-day operation of the Professional Development design, development, and delivery process which is performed by the Resource Teachers (RT).
- PD-RT = Professional Development Resource Teacher: The Professional Development Resource Teacher is responsible for the actual design, development, and delivery of professional development training.
- T = Teacher: The Teacher is an individual who teaches in a participating school district who has undergone professional development training through the not-for-profit firm and will apply these skills and techniques in his/her classroom with the objective of improving learning outcomes and standardized test scores.
- MSC-M = Materials Support Center Manger: The Materials Support Center Manager is responsible for understanding, securing, inventorying, distributing, and receiving the type, quality, and quantity of materials required to achieve the Professional Development training objectives.
- SOS = Support On-Site: The Support On-Site person is a teacher at the participating school that has undergone professional training through the not-for-profit firm and is a liaison between the not-for-profit firm and the faculty and administration at the school.
- R = Register: The Register is the individual responsible for performing the scheduling, registration, logistical coordination, enrollment management, coupon management, and reporting process for all Professional Development training.

The "Knowledge Type" column divides each actor's knowledge into tacit and explicit knowledge. The "Knowledge" column lists the key areas of knowledge associated with the tacit and the explicit categories for each actor. Table 1 only provides a partial breakdown of the Professional Development knowledge flow diagram.

Table 1, together with Figures 6 and 7, represents the completed SBKM-ID and framework for the professional development knowledge flow of the not-for-profit firm. The completed framework, beginning with the Lettieri et al. (2004) model and exploding it out into the detailed knowledge flows within the professional development area of the not-for-profit, is presented in Figure 8 (See Appendix).

The summary level SBKM-ID (Figure 9 in the Appendix) of the not-for-profit firm studied provides a picture of the complexity and inter-connective flow of knowledge through the firm. Utilizing color coding, the SBKM-ID identifies five separate knowledge flows (Strategic, Professional Development, Materials Management, Registration and Enrollment Management, and Assessment) comprised of 21 knowledge domains, and 44 knowledge connections (i.e. arrows flowing into another knowledge domain) across this firm.

Observations

Examining Tier 1 of the SBKM-ID, three key observations can be made. The first is that the knowledge flows revolve around this firm's customers (i.e., the participating school districts). Secondly, the Professional Development knowledge flow is prominent and integrated with every other knowledge flow in this firm. The third key observation is that the highly integrated, high-touch Professional Development team that dominates the map is a volunteer organization that experiences significant turnover over a three year period. The application of the SBKM-ID method to this not-for-profit firm amplifies the magnitude and significance of knowledge flows within the volunteer organization, between the volunteers (i.e., Professional Development) and this firm's customers, and between the volunteers and the balance of this firm.

Examining Tier 2 of the SBKM-ID, two key observations can be made. The first is that there are a number of different actors participating in the knowledge flows and the Resource Teacher (RT) is a constant throughout the Professional Development flows. Given the understanding that this firm's primary service is providing training, one would expect the Resource Teacher to be a prominent player. However, given the Resource Teacher is a volunteer position which turns over every two to three years, the visual power of the knowledge map amplifies how intertwined the role is with other knowledge flows in this firm as well as externally with the customers of this firm. The development of KM initiatives to manage the knowledge of the resource teacher should be a KM priority.

Examining Tier 3 of the SBKM-ID, the tacit and explicit knowledge flowing through each link is presented by role/participant. One can begin to prioritize areas and consider initiatives to improve the management of knowledge that passes through each link and participant. After examining Tiers 1-3 of the SBKM-ID, this method was found to be an effective knowledge mapping technique for this not-for-profit firm.

5. CONCLUSIONS

Relative to the research question presented, the SBKM-ID method can be utilized to capture knowledge flows in a not-for-profit firm. Not only can the SBKM-ID method be applied to a not-for-profit firm, it may be of even greater value given the lack of formal process, limited resources, and staff turnover relative to a larger for-profit firm. Every two to three years, the entire value delivery component (i.e., Professional Development) of the not-for-profit firm studied in this research turns over. In other words, the individual volunteers comprising the professional development group, which is the sole provider of this firm's services to its constituents, return to their school districts.

The return of volunteer employees to their respective school districts results in significant "knowledge turnover." The processes and tacit knowledge developed and used to construct the products and services also leaves with them. The SBKM-ID clearly provides the overall knowledge flows and the specific breakdown of the professional development knowledge into tacit and explicit knowledge categories. The resultant SBKM-ID was utilized to identify links in the Professional Development flow to initiate KM initiatives which could potentially reduce the impact of volunteer turnover and expedite the learning curves of replacement volunteers.

The not-for-profit SBKM-ID framework integrates the Lettieri et al. (2004) model with the Swart & Powell (2006) knowledge mapping technique to identify the knowledge flows through the firm and is presented in Figure 10 (See Appendix).

The framework begins with the Lettieri et al. (2004) not-for-profit KM model which helps show where a given department may be plotted in terms of tacit and explicit knowledge and individualized versus shared knowledge. Though this model is helpful and provides insight, it lacks the depth and breadth in visualizing how knowledge flows through the firm which results from using the SBKM-ID method. The application of the SBKM-ID technique (Swart & Powell, 2006) provided three additional tiers of detail which further enhanced the understanding of knowledge flow within the firm studied and

provided a foundation from which to identify and build KM initiatives.

The first tier of the SBKM-ID in the framework begins in the top, right corner of Figure 10 with an arrow pointing from the Lettieri et al. (2004) model to the high-level firm-wide view of knowledge flow through the firm. The linkage of the SBKM-ID technique developed by Swart & Powell (2006) with the Lettieri et al. (2004) model provides a logical step to a more holistic picture. A firm can begin with the Lettieri et al. (2004) model and drill into a greater level of detail and understanding in the highest priority area of the firm. The addition of color coding to highlight different knowledge flows in the high-level SBKM-ID aids the reader in understanding the different knowledge flows and where knowledge exchanges (i.e., knowledge sharing) occur. The dotted lines further enable the reader to quickly pinpoint the knowledge flows impacted by volunteers. Color coding the knowledge flows and using dotted lines to highlight volunteer driven knowledge flows is an enhancement to SBKM-ID method suggested by this researcher.

The second tier of the SBKM-ID in the framework is shown in the bottom right of Figure 10 (See Appendix). This diagram is an isolated and enlarged view of the Professional Development (green) knowledge flows. At this level, the actors (i.e., knowledge owners or influencers) are added to each of the arrows to specifically identify the roles within the organization which own or influence the flow of knowledge between points. Peter Drucker (1993) stated that knowing is more important than knowledge and a key source of competitive advantage. In other words, understanding how knowledge flows and works in an organization is critical. Once one understands how the know-how, know-where, know-who, and know-why dimensions of a given knowledge flow, KM initiatives can be developed to harness and reuse this critical asset. Therefore, by understanding who the key owners and influencers are, KM policies can be put into place to impact behavior and better mange this critical asset (Swart & Powell, 2006).

The third tier of the SBKM-ID in the framework is shown in the bottom left corner of Figure 10 (See Appendix). This table takes each of the professional development linkages and identifies the tacit and explicit knowledge used by each actor (Swart & Powell, 2006). By understanding the specific type of knowledge used by each actor, KM initiatives can be developed to enhance training and knowledge sharing practices as well as potentially converting some tacit knowledge into explicit knowledge as advocated by Nonaka & Takeuchi (1995).

This framework can be used to establish a basis for developing knowledge management initiatives to improve the identification, creation, storage, and dissemination of knowledge critical to the on-going survival of a not-for-profit firm. Further research could extend this framework by analyzing the external constituents with an emphasis on the teachers who have received training. For example, this specific research could be expanded by including the teachers in a quantitative approach to assess the knowledge transfer and application process to their teaching plans and outcomes.

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Appendix

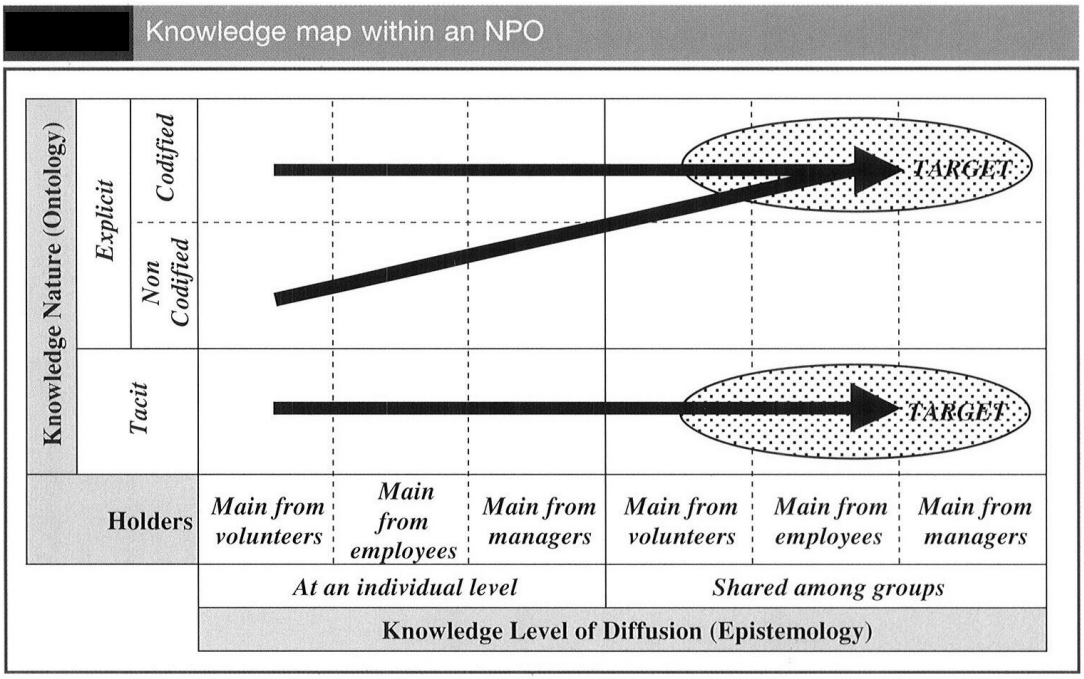

Figure 1: Lettieri et al. (2004) Not-For-Profit Knowledge Map

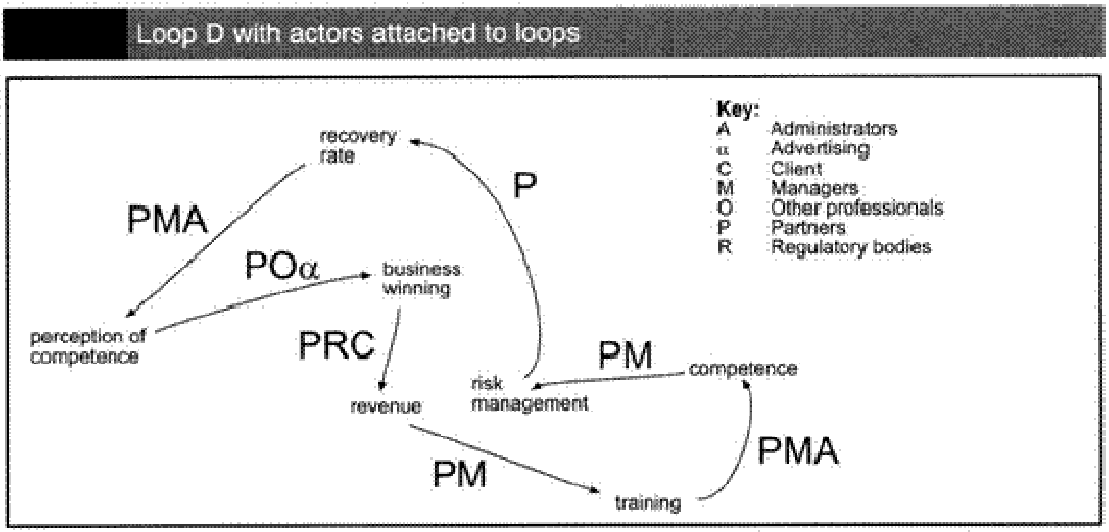

Figure 2 – Knowledge Based QPID

Link	Actor	Knowledge Type	Knowledge
Risk management > recovery rate	P	Tacit	Recruiting skills (knowledge of people and requirements), understanding of nature of reputation, vision of future reputation and mechanisms, judgment of cases based on experience.
		Explicit	Security or document control procedures, knowledge of ethical values to minimize ethical risk
	M	Tacit	Commercial, legal, regulatory, terrain, self-knowledge
		Explicit	Knowledge of what can be done in any particular circumstance, rule based commerciality

Swart & Powell, 2006

Figure 3 Knowledge Representation Within the System

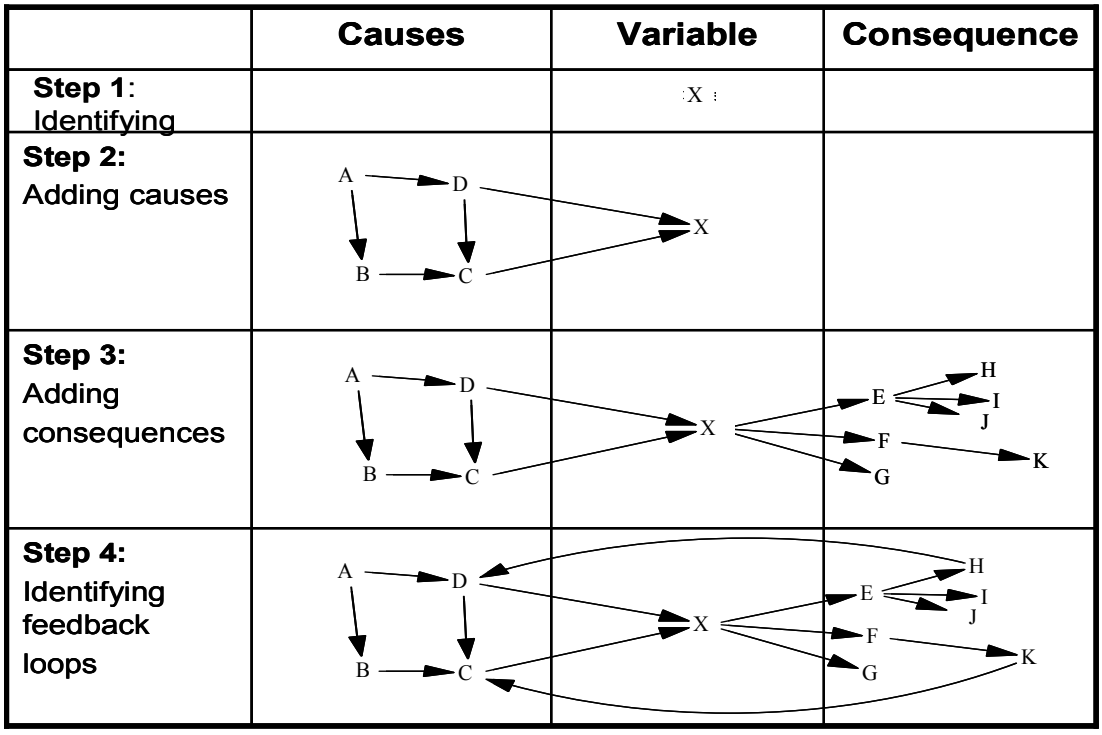

Figure 4: Vennix Four Step Procedure for Developing an Influence Diagram

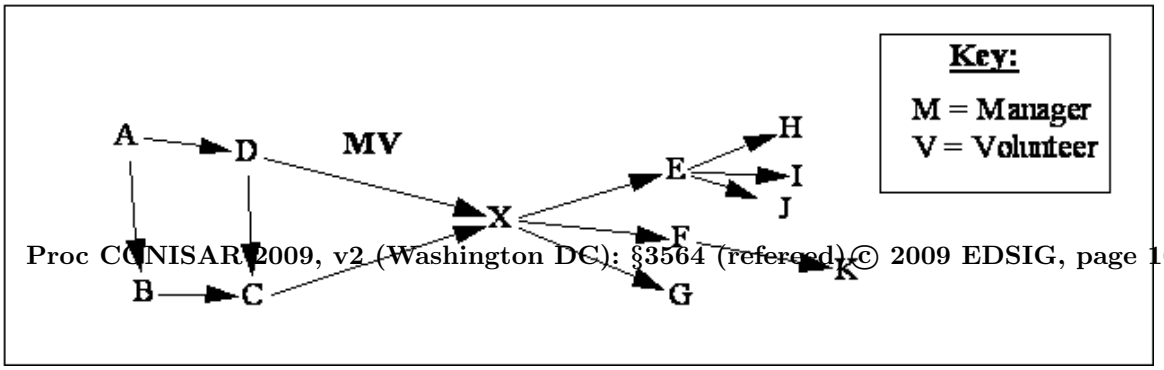

Figure 5: Addition of Actors to an Influence Diagram (Vennix, 1996)

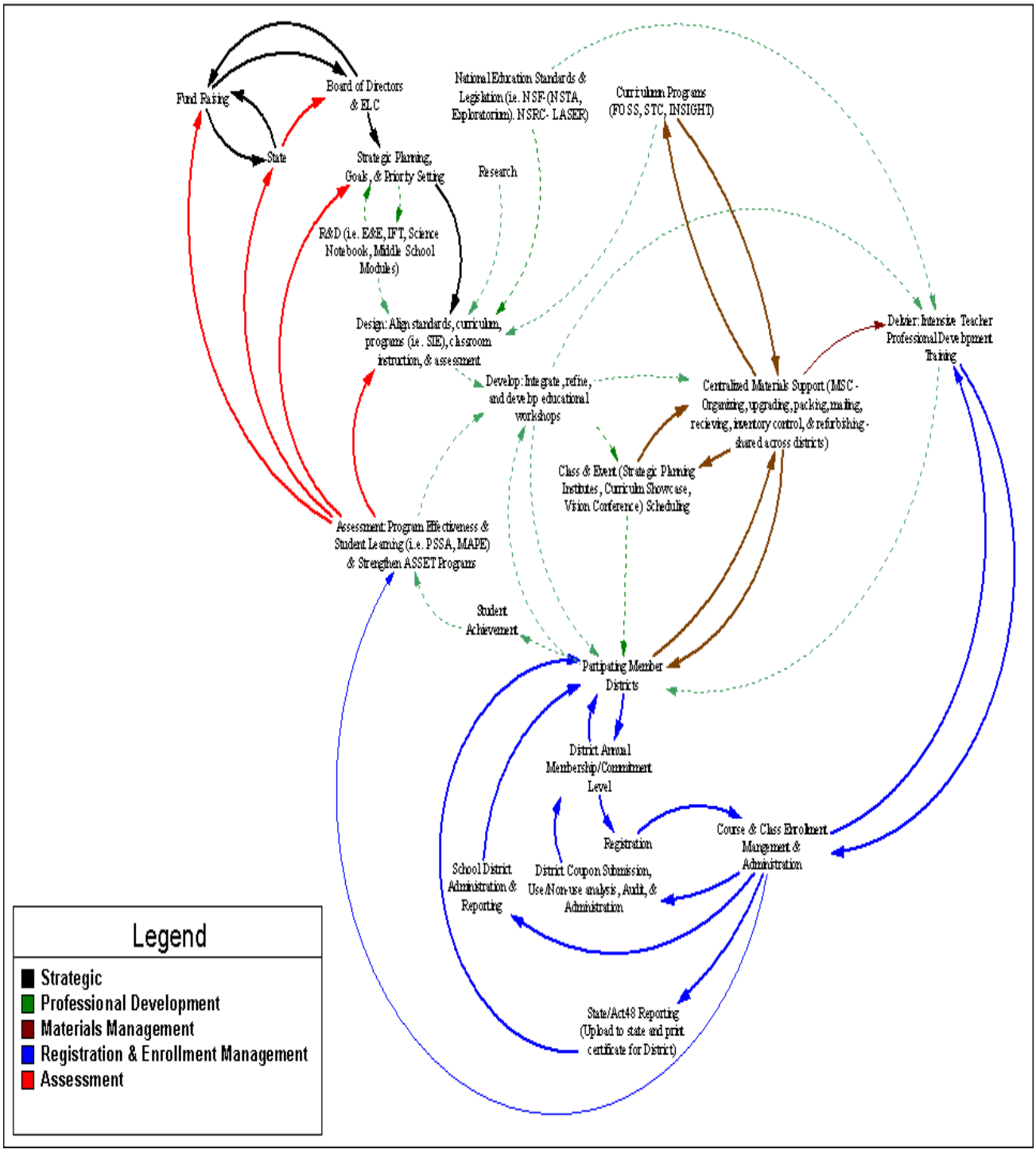

Figure 6: Summary SBKM-ID (Tier 1)

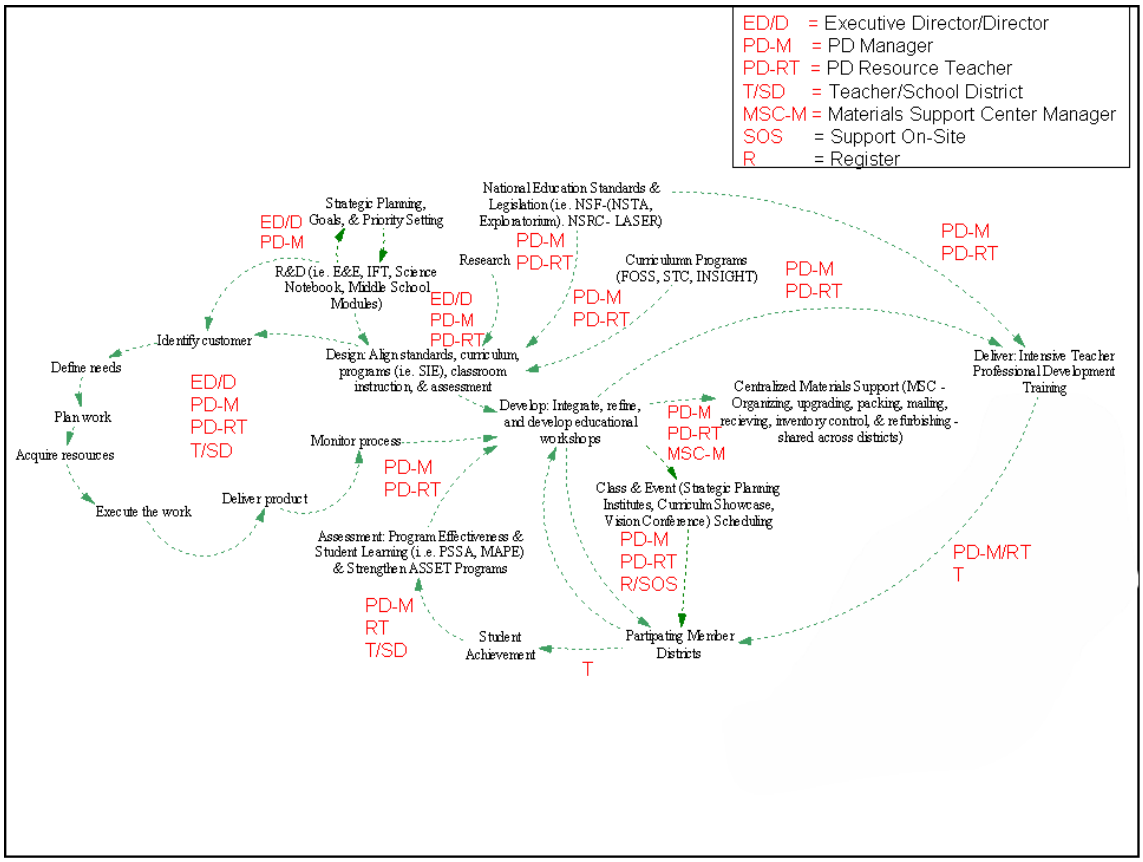

Figure 7 – Detailed Professional Development Knowledge Flow (Tier 2)

Table 1 Detailed Professional Development SBKM-ID Data (Tier 3)

Link	Actor	Knowledge Type	Knowledge
Strategic Planning > R&D	ED/D	Tacit	Operational experience, vision, and inspiration. Interaction, collaboration, and relationship development with partners, the Board, the State, and community.
		Explicit	NSF guidelines, policies, procedures. PA standardized test score thresholds.
	PD-M/RT	Tacit	Leadership team development/mentoring/coaching.
		Explicit	National science education standards, LASER, and other curricula programs such as FOSS/STC/INSIGHTS
R&D Cycle: Identify Customer THRU Monitor Process	ED/D	Tacit	Develop leadership team. Identify customers from teachers in member schools districts, administrators in member school districts, scientist in LASER program, University Professors/other experts other educator resources in region. Working with accounting, perform cost analysis and determine fee structure. Establish launch date & coordinate communications.
		Explicit	Member and partnership directory. State test results, National Science Education Standards guidelines.
	PD-M/RT	Tacit	Professional Development training know-how. Develop leadership team. Identify customers from teachers in member schools districts, administrators in member school districts, scientist in LASER program, University Professors/other experts other educator resources in region. Evaluation of needs. Interviewing skills. Convene and lead focus groups; perform research; collect/analyze results & compare projects to other projects around the country. Understanding and application of learning cycles such as FERA and 5Es. Develop materials. Designing and

Link	Actor	Knowledge Type	Knowledge
			executing pilot.
		Explicit	"New Product Planning Document"; National Science Education Standards; Learning cycles such as FERA. State accreditation process and submission form. Update Asset training schedule and offerings
	T/SC	Tacit	Focus group participation; Provide formal and informal evidence to support needs for new offering. Pilot participation and soft feedback.
		Explicit	Provide test scores and other assessment results. Provide hard results/feedback from pilot.
R&D > Design: Align	ED/D	Tacit	Operational experience, vision, collaboration, and inspiration to the firm. Leadership team development.
		Explicit	How firm goals and objectives tie to professional development priorities.
	PD-M	Tacit	Leadership, team development, mentoring, and resource allocation of focus group, resource teachers, and others to accomplish professional development priorities.
		Explicit	Scheduling the work.
	PD-RT	Tacit	Application of learning cycles to specific PD initiative and managing group dynamics. Ability to assess audience needs, practical education and classroom experience. Teaching adult learners, lesson planning and design, and determining lesson plan content to complete supplied template
		Explicit	Major module program understanding (FOSS, STC, INSIGHTS). Education lesson planning and developing lesson plan templates. Learning cycles such as FERA