Application of the Semantic Learning Approach in the Feasibility Studies Preparation Training Process

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Abstract: The present paper is concerned with an ontology-based knowledge network developed for the semantic representation of the feasibility studies preparation procedure. Specifically, a training scenario in feasibility studies and business plan preparing was built, using the CULTOS tools that are based on a self-contained reusable knowledge repository, which combines the ontology constructs with supportive multimedia objects. The proposed approach may have significant impact to enabling users participate actively in the feasibility studies preparing process since they are equipped with an appropriate tool for acquiring a clear and an in depth understanding of this process. Through the present application, it seems that the model could combine any existing multimedia material with ontology constructs, using knowledge-based multimedia authoring tools, in order to build user-training scenarios and satisfy specific training needs.

Keywords: feasibility studies, semantic learning, training tool, ontology-based knowledge networks, business plans

The process of putting together a feasibility study forces the person who makes it to take an objective, critical and unemotional look at this business project in its entirety. The feasibility study and the business plan is an operating tool that, if properly used, will help create and manage the business more effectively in order to achieve success. By taking an objective look at his business, one can identify areas of weakness and strength, pinpoint needs he might otherwise overlook, spots opportunities early, and begins planning how to best achieve his business goals. This type of studies also helps see problems before they grow large and helps identify their source, thus suggesting ways to solve them. A well-prepared feasibility study or business plan will even help avoid some problems altogether. It also provides information needed by others to evaluate the venture, especially if one will need to seek outside financing. A thorough study of this kind can quickly become a complete financing proposal that will meet the requirements of most lenders. Since many business plans are submitted to banks or other sources of financing, it is important to realize how a banker analyses a business plan and what questions will be asked during this analysis. A banker’s job is to assess

the degree of risk for each proposed loan and to be satisfied that the loan can be repaid by the borrower while still allowing the business to operate profitably. This analysis is based on factors such as the nature of the business, the purpose of the loan, the amount of the loan; the ability to repay the loan; and the character and management skills of the business owner. Bankers, lawyers, and certified public accountants are professionals in their fields and should be included in the planning at whatever points their knowledge and expertise can be helpful.

A well-organized, insightful business plan must convince a banker of the entrepreneurs’ ability to understand their market, demonstrate their technical knowledge required in the field, and the company’s ability to understand and respond to customer needs. The plan must ultimately show their ability to manage the business so it can be operated in a profitable way and repay the loans. There are numerous software packages on the market that will assist someone in preparing a feasibility study or a business plan. However, one should not rely on the software and simply “filling in the blanks” – he must understand the document and avoid preparing a document ignoring the meaning of its content (Bhide, 1999; Lambing & Kuehl, 2003).

On the other hand, world economy has been transformed into a knowledge economy. In that economy, the application of knowledge is the main means of production...
and has become more important than traditional resources, such as labour, capita, or base materials. Traditional economy that was primarily driven by transformational activities (turning raw product into finished product, or turning data into information) has been transformed into knowledge economy where the highest-value activities are complex interactions between people and systems. This shift from transformation activities to interactions represents a broad shift in the nature of economic activity. Economic success and most productivity gains in the future are going to be in interactions. Hence, enterprises are beginning to realize that strategic advantage becomes less focused on ownership of distinctive stocks of knowledge (Georgopoulos, 2005). Instead, strategic advantage resides in the institutional capacity to get better and faster the most promising flows of knowledge and in the rapid integration of the knowledge acquired from these flows into the enterprise activities (Tome, 2008). One of the key issues for the successful integration of knowledge flows into the enterprise activities is active user participation. This is achieved through continuous interactions between experts (knowledge workers) and trainees (candidate knowledge workers). In essence, active user participation that is enabled through user training is considered a knowledge-creation spiral that emerges when the interaction between tacit and explicit knowledge is elevated dynamically from lower to higher ontological levels (Nonaka & Takeuchi, 1995). Figure 1 shows graphically how existing individual’s tacit knowledge is converted by experts into explicit knowledge. In turn, this knowledge is enriched in order to be converted into group’s knowledge through group training, thus enabling user groups (trainees) participate in the development of new systems in co-operation with experts. New processes designed represent organizational knowledge in intra-organizational process activities and inter-organizational knowledge in inter-organizational process activities.

From these considerations, the research problem addressed in this paper is concerned with the development of a training tool that enables users understand business process modelling concepts in general, with the objective to enhance and empower their ability in developing business projects by preparing good feasibility studies and business plans. To this end, an ontology-based knowledge network is developed that can be used as a tool for the semantic representation of how a business project is being created and functions and, hence, as a means for the development of an appropriate training aid in feasibility studies preparing.

**Design of an Ontology-Based Training Tool**

The proposed model is developed on the bases of the principles set by various initiatives concerning the semantic web, all having in common the focus on extending current web technology with machine-understandable metadata (Berners-Lee, Hendler, & Lassila, 2001). Those metadata are stored in ontologies (Gruber, 1993) and play an essential role in semantic web, since they provide the shared conceptualizations expressed in a logical form. Web services are layered services, able to exploit the semantics provided by these metadata.

![Figure 1. Developing organizational knowledge through users' participation.](image-url)
descriptions in order to expand the current capabilities of web technology (Sycara, 2004). The semantic web vision has been combined with the principles of knowledge transformation in order to provide a theoretical model of e-learning processes (Collazos & García, 2007; Naeve, Yli-Luoma, Kravcik, Lytras, Lindgren, Nilsson, Korfianti, Wild, Wessblad, Kamtsiou, Pappa, & Kieslinger, 2005; Nonaka & Takeuchi, 1995; Vargas-Vera & Lytras, 2008; Yli-Luoma & Naeve, 2006), thus enhancing the Knowledge-creating company towards the vision of the Semantic Learning Organization (SLO) (Sicilia & Lytras, 2005).

Ontologies are collections of concepts (universals), instances of concepts (particulars) and relations among them (Fielding, Simon, Ceusters, & Smith, 2004). Attributes are assigned to concepts, instances and relations in order to specify the content of the knowledge network. In addition, ontology constructs (e.g., concepts, relations, and instances) could be enriched with terms, definitions, axioms and constraints that are expressed at the desired level of formality and that are deemed to be important in characterizing the knowledge domain under consideration at the desired level of detail (Grenon, 2003; Sowa, 2000; Gruber, 1993). These are used in asking and answering questions, making assertions, offering insights, describing practices and discussing investigations. The development of an ontology is usually a top-down process which starts at the highest level of abstraction considered and finishes at the lowest level of abstraction which is considered appropriate for the purpose of the ontology building process (Colomb & Dampney, 2005; Masuwa-Morgan & Burrell, 2004). As an example, in an ontology development process there could be considered three levels of resolution: the upper-ontology (which includes the basic concepts and relations), the mid-ontology (which includes more detailed concepts and relations) and the lower-ontology (which includes all the concepts, instances, and relations necessary for the specific purpose of the ontology).

Most of the existing automated training aids are essentially collections of multimedia objects (content). These multimedia objects are usually grouped hierarchically (e.g., in units and sub-units), indexed and combined, through hyperlinks, in order to support various training needs. However, these training aids only provide for manipulating and restructuring multimedia objects in order to create training material, serving specific needs, for the knowledge domain under consideration. Hence, this knowledge must be externalized and made explicit by the user in order to become diffused and reusable. The approach proposed in this paper enables experts in the domain of business plan preparing to externalize the domain knowledge in the form of ontology-based knowledge networks (training scenarios serving specific training needs) and, hence, better communicate it and make it reusable. The basic structure of the proposed approach is a domain specific ontology, which captures the relevant knowledge. Thus, training scenarios combine ontology constructs with supportive multimedia objects helping trainees acquire an in depth understanding of the knowledge domain. The approach is based on Sowa’s definition of user perception as the process of building a working model that represents and interprets sensory input (mosaic of percepts) into a more abstract part (conceptual graph) (Novak & Gowin, 1984; Sowa, 1984). Hence, understanding of a training material by a trainee can be modelled as a two stage process: (i) the analysis sub-process, where the material is broken down into concepts; and (ii) the synthesis sub-process where concepts are linked to other concepts which are found either in the training material at hand or in other related material that the trainee has already analyzed before in order to form more complex structures (conceptual graphs). Thus, meaning is not discovered but constructed and training material has meaning only in relation to other material, being interconnected to each other as codes and systems in the minds of the trainees according to their cultural and social traits.

In designing an ontology-based training aid, the main objective is to capture and represent the knowledge, which is implicit in the application domain so that it can be made reusable. Thus, domain experts record their knowledge on the particular field under consideration in terms of an ontology, which is recorded in the ontology repository. Hence, each ontology construct is recorded only once and can be made available to every training scenario using it (Heiwy, 2006). In addition, relevant supportive material (either existing or created) in the form of multimedia objects (e.g., text, image, video and animation) is used in order to develop a collection of reusable multimedia objects that are related to the knowledge domain under consideration (Chebotko, Deng, Lu, Fotouhi, & Aristar, 2005; Steinmetz & Seeberg, 2003). This collection of multimedia objects comprises the content repository. The ontology and content repositories are then used to create knowledge networks, each corresponding to a training scenario, which are recorded in the knowledge repository. Figure 2 shows a schematic representation of the three repositories used in the proposed approach.

Contrary to traditionally designed training scenarios which are based on mere user navigation to multimedia objects, training scenarios that are based on the proposed approach are enhanced and empowered in that they allow users to navigate into the domain knowledge which has been represented in the form of a knowledge network. Thus, the user of the training scenarios is guided either through a semantic search followed by a navigation to the knowledge network, or directly through navigation to the knowledge network. To enhance his/her
understanding of each ontology construct included in a knowledge network, the user can access relevant supportive material in the form of multimedia objects and identify the relation of the particular construct with other relevant constructs.

A Training Tool for the Preparation of the Feasibility Studies

In order to enable trainees understand the feasibility studies preparing process and make them capable in participating actively and successfully in such a process, a training scenario (knowledge network) incorporating the underlying logic was created using the tools developed by the CULTOS (Cultural Units of Learning—Tools and Services; http://www.cultos.org) project. These tools are: (i) K-infinity (http://www.i-views.de) tool (for creating and populating the ontology repository); (ii) CULTOS media import tool (for creating and populating the content repository); and (iii) CULTOS authoring tool (for creating and populating the knowledge repository). For the purpose of this research, which is mainly to show the advantages of the knowledge network approach, the ontology model proposed by Sowa was used mainly due to its simplicity (Sowa, 2000).

The Feasibility Study Outline

The first step for the development of a feasibility study-training tool is to understand what is this document and which are its contents. A feasibility study is a formal document, which explains in detail the strategy for creating and developing a financially successful business. Writing a good feasibility study is necessary if one expects to receive financing. Virtually all sources of financing will want to see the study and a substantial part of the lender/investor’s decision on whether or not to finance the business is based on it. There are several other very good reasons to prepare a feasibility study. Writing such a study forces someone to consider important issues and to answer fundamental questions about its business before he actually starts the business. As such, it helps him to organize his thoughts, as well as his resources. It helps him to communicate the specifics of his business idea to others, including business advisors, potential suppliers and major customers, and family and friends. This study will provide a “yardstick” against which one can measure his progress during the initial years of his business. Research has shown that businesses that start with a formal feasibility study are considerably more likely to succeed than those that go without a written plan (Tidd, Bessant, & Pavitt, 1999; Gate2Growth, 2002a).

The goals of a feasibility study are to develop and implement the entrepreneur’s ideas into actual business practices, products or services; to identify the strengths and weaknesses of a company and its competitors; to provide a strategy to further a company’s growth; to develop guidelines for the operation of a company; to assist the entrepreneur to obtain money from lenders or investors. It includes a written description of the business and corresponding financial data. Specifically, the body of the feasibility study can be divided into four distinct sections: a) the marketing plan, b) the operations plan, c) the project implementation plan, and d) the financial plan. Additional sections of this study should include the executive summary, supporting documents and financial projections (Behrens & Hawrauk, 2000; Hisrich, Peters, & Shepherd, 2005). In a good feasibility study, the following issues should be included (Sahlman, 1999; Eglash, 2001; Gate2Growth, 2002b; Stutely, 2002):

Business Description: When describing a business, one should explain issues such as:

- The legal structure;
- The business type (e.g., retail, wholesale, construction, manufacturing or service);
- The products or services offered;
- The business history;
- Why a business will be profitable both in the near-term and long-term;
- The strategy to be successful in the market it is designed to operate; and
- The business goals and objectives, and so on.

Product/Service: It describes the products and services the business sells and the benefits they provide to the customers. Successful business owners know what their customers want or expect from them. A feasibility study should describe the strategies to build customer satisfaction and loyalty, and it should include what features the business offers that set its products or services apart from the competition.
**Location:** It describes the location or the requirements for a future location. One has to consider these questions when addressing this section of a feasibility study:

- What kind of customer access does the location need to have?
- What kind of space is need for the near future (about five years)?
- What other features such as loading dock, display windows, traffic count, access to transportation (roads, railroads, etc.), parking, etc are necessary for the operation of the business?

**Marketing plan:** The key element of a successful marketing plan is to know its customers e.g., their likes, dislikes, expectations etc. By identifying these factors, one can develop a marketing strategy that will create interest and meet their needs. Customers should be identified by their age, sex, income/educational level and residence. At first, one ought to target only those customers who are more likely to purchase his product or service. As his customer base expands, he may need to consider modifying the marketing plan to include other customers. A marketing plan should be included in every feasibility study and contain answers to many different aspects of the business including:

- Who are the customers?
- What are the target market(s)?
- Are the markets growing, steady, or declining?
- How large is the market share?
- How will the business capture more of it?
- How are markets segmented?
- Are markets large enough to support business expansion?
- How will business attract, hold, increase its market share.

**The Market**

**The Competition**

- Who are the nearest direct competitors and who are the indirect competitors?
- What strategies do the competitors use to pursue their markets?
- How will the strategies of the business compete with theirs?
- What are their strengths and weaknesses?
- How does their product or service differ from this of the business?

**Pricing and Sales**

- What is the pricing strategy?
- How does the strategy compare to the competitors in the market?

**How will the business price its products or services to be profitable while keeping the prices attractive to customers.**

**Advertising and Public Relations**

- Devise a plan that uses advertising and networking as a means to promote the business
- Develop short, descriptive text material that clearly identifies goods or services, its location and price.

The feasibility study should clearly delineate the advertising budget and how it will be spent to promote the business.

**Management plan:** A management plan should be included in the feasibility study answering questions such as:

- How does the background/business experience of the entrepreneurs help them in this business?
- What are their weaknesses and how can they compensate for them?
- Who will be on the management team?
- What are their strengths/weaknesses?
- What are their duties?
- Are these duties clearly defined?
- What are the current personnel needs?
- What are the plans for hiring and training personnel?
- What salaries, benefits, vacations, and holidays will be offered?

**Financial plan:** To effectively manage the finances, one ought to plan a sound, realistic budget by determining the actual amount of money needed to open his business (start-up costs) and the amount needed to keep it open (operating costs). The first step to building a sound financial plan is to devise a start-up budget. The start-up budget will usually include such one-time-only costs as major equipment, utility deposits, down payments, etc. It should allow for these expenses: personnel (costs prior to opening), legal/professional fees, occupancy, licenses/permits, equipment, insurance, supplies, advertising/promotions, salaries/wages, accounting, income, utilities, and payroll expenses.

An operating budget is prepared when one is actually ready to open for business. The operating budget will reflect his priorities in terms of how he will spend his money, the expenses he will incur and how he will meet those expenses (income). The operating budget also should include money to cover the first three to six months of operation. It should allow for these expenses: personnel, insurance, rent, depreciation, loan payments, advertising/promotions, legal/accounting, miscellaneous expenses, supplies, payroll expenses, salaries/wages, utilities, dues/subscriptions/fees, repairs/maintenance, taxes.

Furthermore, the financial section of a feasibility study should include any loan applications one has filed,
capital equipment and supply list, balance sheet, breakeven analysis, pro-forma income projections (profit and loss statement) and pro-forma cash flow (Gate2Growth, 2002c). The following questions should help determine the amount of start-up capital he will need to open and run a business: How much money will be needed for start-up? How much money will be needed to stay in business? What type of accounting system will be used? What will be the sales goals and profit goals for the coming year? If a franchise, will the franchisor set the sales and profit goals? What financial projections will be needed to include in the feasibility study? What kind of inventory control system will be used? It must be noted that this study should include an explanation of all projections.

Summarizing, the feasibility study is a written document prepared by the entrepreneur that describes all the relevant external and internal elements involved in starting a new venture. It is often an integration of functional plans such as marketing, finance, manufacturing, and human resources. It also addresses both short-term and long-term decision making for the first three to five years of operation. Potential investors, suppliers, and even customers will request or require feasibility study (Siegel, Ford, & Bernstein, 1993; USDA, 2000).

The Feasibility Study Training Ontology-based Knowledge Network

Figure 3 shows the ontology concepts of the feasibility study preparing process considered, in the form of a generalization-specialization hierarchy, linked with relations. The upper ontology consists of the six categorizations of concepts proposed by Sowa (2000): Physical (concerning matter or energy) and Abstract (concerning pure information structures). These are further broken down into Physical and Abstract Continuants (having stable attributes that enable their various appearances at different times to be recognized as the same object) and Physical and Abstract Occurrents (processes or events that are in a state of flux and that can only be identified by their locations in some region of time-space). These concepts are then further specialized into lower level sub-concepts.

Figure 3. A training ontology for the feasibility study preparation process.
For example, in Figure 3, the Physical Continuant concept is specialized into the concepts personnel and raw materials and factory supplies while the personnel concept is specialized into the concepts marketing personnel and production personnel. Also, the Physical Occurrent concept is specialized into the concepts technology selection and land site selection etc. Moreover, relations are defined between ontology concepts of upper and lower level of resolution. Any relation defined between two concepts holds also for lower level concepts. The training scenario (knowledge network) was designed on the feasibility study preparing process considered, where concepts are represented as rounded rectangle nodes and relations are represented as oval edges. In what follows, a description of the above business process is provided using ontology concepts (shown in italics) and ontology relations (shown in single quote enclosures).

Figure 4 shows the training scenario on the above feasibility study preparing process. For example, project strategy and marketing concept (one of the three opening steps of the process, together with operational and organizational structure and project implementation plan) ‘determines’ sales programme and revenues, marketing personnel and marketing cost. The latter ‘contributes’ (among other) to the total cost of products sold, which ‘affects’ net working capital and ‘decreases’ net income. The latter ‘affects’ ROI (return over investment) and ‘determines’ pay back period, which both ‘contribute’ to the project appraisal, while it ‘contributes’ also to the financial statements. Subsequently, project appraisal and financial statements ‘contribute’ to the financial analysis, which is the target of a feasibility study, or (in other words) the core outcome of all feasibility studies. In practice, using the above approach for designing training material would involve both a high level view of a feasibility study model, such as the one described above, and a low level view of the model that takes into account the characteristics of a particular product or service. In addition, multimedia objects will be associated with concepts and relations in order to demonstrate the specific features of each product or service under investigation through the feasibility study. Moreover, the training scenario designed can be easily used to show to the trainees, not only the meaning and the importance of functional plans such as marketing, finance, manufacturing, human resources etc, but also and mainly how they affect to each other within a business development project. Likewise, in some extent, it could be easily adapted to represent other versions of the business process.
project considered so that to enable trainees assess the pros and cons of a business redesign exercise. Redesign of a business project can be performed by simply manipulating already defined objects, hence providing flexibility, agility and reusability of the training material designed.

Discussion

The approach proposed in this paper is mainly concerned with capturing and representing the knowledge found in the logic, the structure, and the application of business plan preparing processes as an ontology-based knowledge network, i.e., a training scenario serving a specific training need. The ontology contains all the relative concepts and the relations between them. The knowledge network relates the basic entities defined in the ontology with the various multimedia (text, image, video, animation etc.), which are supportive for better understanding the ontology constructs. Thus, the user of the resulting training material is enabled to search for an ontology construct (for example a business function) and understand its meaning and usage with the help of the supportive multimedia. Furthermore, the user can navigate to associated ontology constructs (for example, other functions, business units and resources) in order to acquire an in depth knowledge about the business project, the data and control flows between business processes, organizational structures and business functions and, finally, the needs for preparing a high-quality and reliable business plan. More precisely, the objective of the approach presented in this paper is to enable users get familiar with and, hence, be able to participate actively in business plan preparing activities. In this context, a training scenario in this domain was built, using the CULTOS tools, that is based on a self-contained reusable knowledge repository which combines the ontology constructs (stored in the ontology repository) with supportive multimedia objects (stored in the content repository).

The proposed approach to user training may have significant impact to enabling users participate actively in the feasibility study preparing process since they are equipped with an appropriate tool for acquiring a clear and an in depth understanding of this process. Specifically, regarding the trainee, the main advantages of the proposed model are the following: a) Semantic search - This allows to search ontology or knowledge constructs semantically instead of textually (i.e., the search is based on language-agnostic semantic matching instead of keyword matching, that involves: (i) the knowledge domain under consideration; (ii) the business context; and (iii) the structure of the educational scenario) putting emphasis on matching the content and the real meaning of each relevant concept searched (Stojanovic et al, 2001); b) Knowledge or conceptual navigation - This allows the use of browsing and navigation capabilities in order to identify the ontology or knowledge constructs as they are recorded into the knowledge repository and used in the training scenario and involves: (i) navigation into the knowledge domain under consideration; (ii) navigation into the business context and (iii) navigation into the structure of the educational scenario (Stojanovic, Saab, & Studer, 2001); and c) Knowledge dissemination - This is an important function of any kind of training activity that can only be achieved if the trainee is provided with the ability to extract the knowledge implicit in the problem domain, as opposed to the mere presentation of facts and disconnected information which, in most cases, is not adequate. With the proposed model, knowledge is made explicit in order to assist the trainees' combination (from implicit to explicit) and internalisation (from explicit to tacit) knowledge transformation processes (Nonaka & Takeuchi, 1995).

In addition, significant advantages of the proposed model could be identified for the creator of the training material as well. The most important of them can be grouped around its three main components (repositories):

a. Ontology repository—There are many benefits when using ontologies, in order to make explicit the underlying business process logic in an application domain so that it can be made reusable, that have already been recognized in the learning technology community (Nonaka, Saab, & Studer, 2001).b. Content repository—Content reusability of the educational material created, that is achieved with the proposed model and is related to the knowledge domain under consideration, is a key issue in the literature (Chebotko et al., 2005; Steinmetz & Seeberg, 2003); and

c. Knowledge repository—A knowledge network is a self contained entity that serves a specific training need in a specific knowledge domain, in a specific business context and has a specific structure (Stojanovic et al., 2001).

Reusability of knowledge recorded into training scenarios is also achieved as knowledge constructs instilled into older scenarios can be used into new scenarios in order to meet new training needs. Additionally, the expected deployment of the semantic web will allow the combination and multiple exploitation of dispersed training ontologies (through the internet): (i) from writers of training material, since training ontologies and scenarios will be available at various sites around the world; and (ii) from web services that will be able to process the knowledge built into ontologies and knowledge networks for various purposes.
Summary and Concluding Remarks

This paper presents the development of a training tool that enhances and empowers trainees’ ability in developing business projects by preparing high-quality feasibility studies and business plans. An ontology-based knowledge network was developed for the semantic representation of the feasibility study preparation procedure. The model can combine existing multimedia material with ontology constructs in order to build user-training scenarios and satisfy specific training needs. Hence, users are enabled to actively participate in the feasibility study preparing process, since, they are now equipped with an appropriate tool for acquiring a clear and in-depth understanding of this process, because the training scenarios designed show not only the meaning and the importance of the various business functional plans, but also how they affect each other within a business development project. Knowledge reusability is also achieved, since knowledge constructs instilled into a knowledge network can be used into new scenarios in order to meet new training needs.

It must be noted, however, that the proposed model enhances and empowers existing methodologies by allowing the semantic representation of knowledge so that to enable trainees navigate into the underlying knowledge of the application domain under consideration. Thus, the model can combine the existing multimedia material with ontology constructs, using knowledge-based multimedia authoring tools, in order to build user-training scenarios and satisfy specific training needs. Hence, in addition to the existing multimedia objects, the knowledge built into both the ontology and the training scenarios is fully reusable. Finally, due to the encouraging features of the approach described, it is intended to evaluate it extensively using more elaborate implementation tools and more complex business processes.

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