A CONCEPT-MAP MODELING APPROACH TO BUSINESS PLANNING IN A COMPUTER ENVIRONMENT

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Abstract. We have studied widely business planning in our Learning Business Planning Project. This approach emphasizes the role of creativity in business planning. Concept maps are used in this context in our theory and concept formation, in the user interfaces of our Internet applications and in decision making modeling and simulations. In the last application area we have combined the methods of concept and cognitive maps as well as computational intelligence in order to provide good systems in a computer environment. An example of this combination is provided.

1 Introduction

This paper considers such novel approach to business planning which emphasizes invention and innovation processes when new business ideas are created. Our ultimate aim is to provide new proactive and innovative resolutions for designing a computer simulation tool for learning business planning. Our economical and behavioral-scientific theories stem from the ideas suggested by [2] and according to them, instead of conducting the traditional business planning, we should be more creative and flexible as well as we should focus more on invention and development of business ideas. In our theory formation and computer simulation we apply concept and cognitive maps as well as the methods of computational intelligence.

Our approach was studied in our *Learning Business Plan Project* (LBP Project) in 2005-2007. This project models the invention of business ideas by combining theories of on creativity in order to provide a new proactive and innovative resolution for learning business planning. Our approach also combines certain philosophical ideas and the actual behavior of the human being [7].

We thus assume that human intelligence is creative and capable of interacting with reality, and these assumptions lead us to certain methodological and theoretical choices in our model construction. We use concept mapping when establish these bases. We also use concept mapping in our model construction and simulation. Hence, concept maps are used at both meta and object level of our studies. In practice we make both concept and cognitive map configurations on the business planning problems of the real world, and then we construct the corresponding computer models in order to simulate our phenomena [8] (Fig. 1).

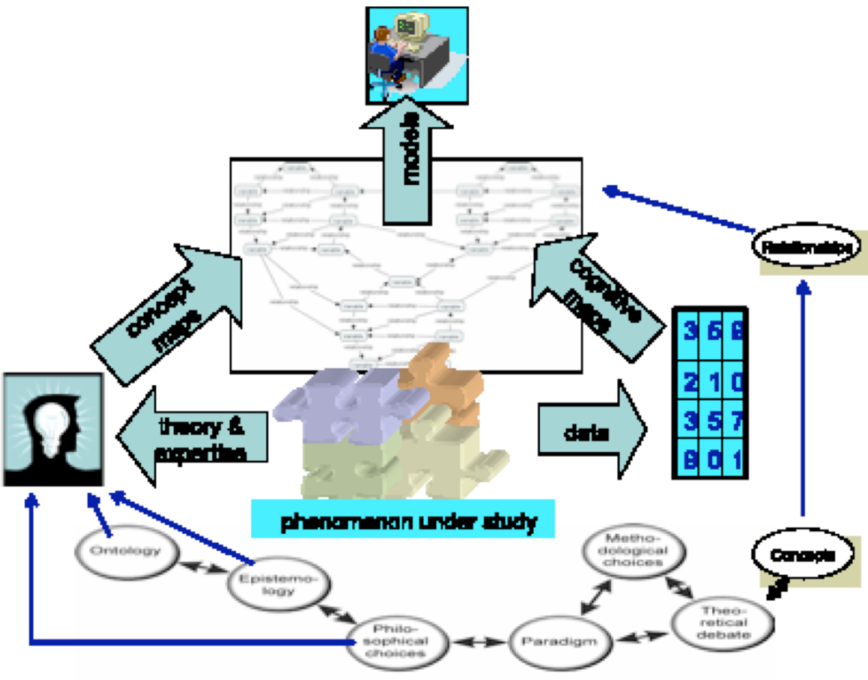

Fig. 1. The General Framework for Our LBP Modeling.

Below we introduce our approach which combines our theories and computer simulations. We also provide two simplified examples which hopefully illuminate how we will proceed in practice. Section 2 briefly introduces the theoretical basis of our project. In Section 3 we briefly present the concept map approach to our meta level work. Sections 4 and 5 provide examples on concept maps in our computer simulations. Section 6 concludes our considerations.

2 Theoretical Basis of the LBP Project

The problems and limitations of the traditional business planning can be subsumed under three categories:

1. Business planning is regarded as an objective, isolated phenomenon excluding individual competences and contribution as well as creativity, motivation and volition, thus also excluding individual and contextual factors and processes as well as innovativeness
2. Its normative and static form follows a linear and rational logic and focuses on an existing idea and situation also excluding innovative learning and development
3. It assumes that business planning and consequently learning is a static and functional series of operational planning activities.

These core features are contradictory to those theories of entrepreneurship that stress the innovative abilities and processes, opportunity recognition, creation and exploitation as well as the complex and complicated context of entrepreneurial processes. The findings of [2-5 on the ineffectiveness of business planning may actually derive from these core features of traditional business planning and set business planning apart from the entrepreneurship theory discussion, which also justifies the criticism in [2] regarding the lack of creativity in teaching business planning. Thus in order to advance the modeling and teaching of business planning, we should be able to these limitations. First we need to find a way to model business planning that follows the core aspects and dynamics of entrepreneurial behavior and processes. Then we should be able to find an approach to teaching it. In both of these problems we have benefit from concept mapping approach and technique. Figure 2 demonstrates how the overall model has expanded from financial calculations toward creative learning process.

At stage 1 we provided configuration paradigm that follows the human being as a unique, holistic and creative individual capable of inventing and generating business ideas and activities in complex and complicated environments. This resulted five-stage business planning model.

Stage 2 added the zones of creativity in business planning into stages 1 and 2. Stage 3 provided solution for stage 3 by using concept mapping methods. Stage 4 integrated processes by segmentation of stage 3 into three sub-stages and solving the implementation of the construction in two layers and as a transformation processes between these two. Stage 5 conceptualized distinct feasibility studies integrating linguistic and numeric information by using concept map technique.

3 Meta Level Concept Mapping

At the meta level we apply concept maps somewhat in the standard manner [9]. We use them in theory and concept formation and in flowcharting the general configurations of our system. In this manner we can obtain a good general view on our system, find its possible inconsistencies and disadvantages and enhance it if necessary. We can also perform tentative computer simulations at this level already by applying the methods in section 3 and 4.

When our concept map modules are implemented as a website to the Internet server, from the customer's standpoint they obviously facilitate the understanding of the causal structures and the contents of instructional materials when an appropriate user interface is constructed. Thus, in the context of the www applications, the concept maps are useful for us when such ubiquitous computing and e-learning techniques as hypermedia, semantic web and theory of networks are utilized.

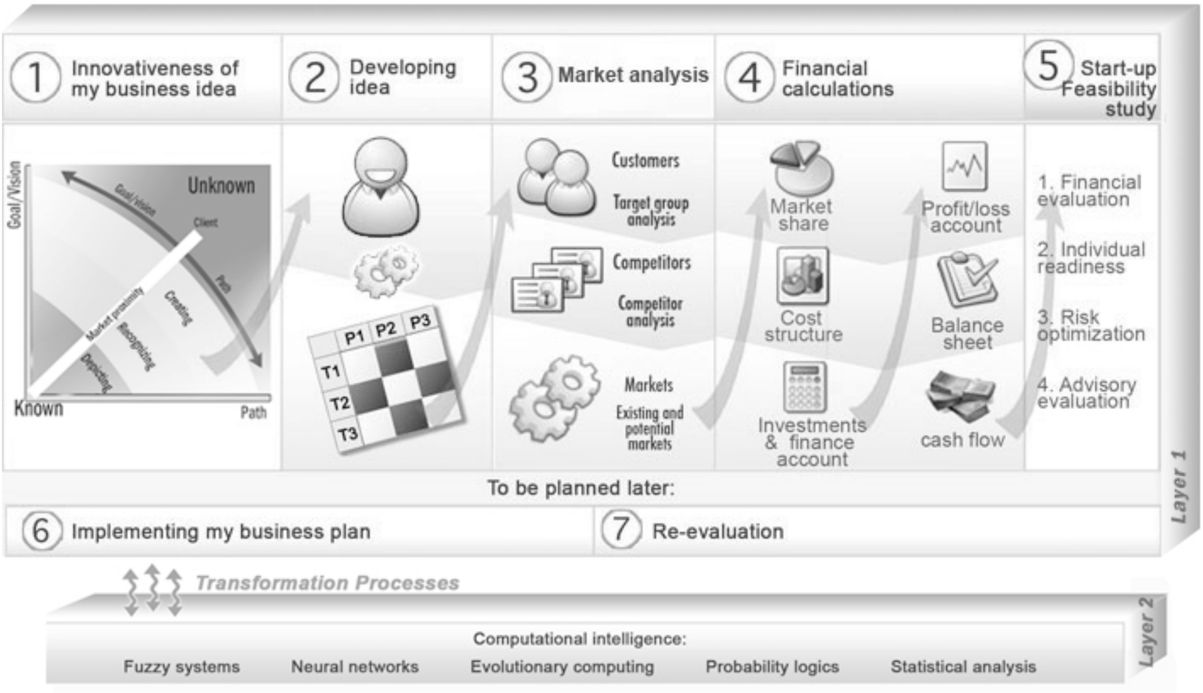

Fig. 2. General View on the LBP Project.

4 Concept and Cognitive Maps in Computer Simulation

To date it has been problematic to operate with such theoretical frameworks and model simulations in a computer environment as was mentioned above because they include a great number of concepts and various interrelationships between these them. In brief, the quantitative methods are unable to cope with the linguistic and approximate values and relationships, whereas the qualitative methods are principally based on manual work and human reasoning. By virtue of such methods of computational intelligence as fuzzy systems, neural networks and evolutionary computing, we can resolve several of the foregoing problems because, in addition to numerical methods, these methods enable us to construct such simple models which use human-like reasoning and operate with both linguistic and approximate concepts and relationships [11]. We can thus apply both quantitative and qualitative methods in combination in our studies and our results correspond well with human reasoning.

In practice our configurations can base on both human expertise and empirical data. In the former case we thus operate with a priori concept maps, whereas in the latter case a posteriori maps can be used. In the a priori maps we specify the concepts and establish their interrelationships according to our intuition and expertise and their evaluations are also based on our reasoning. Consider the simple configuration in Figure 3 [10]. It includes seven concepts or nodes which in our case are often numerical or linguistic variables, i.e., their values numerical or linguistic (e.g., *5*, *about 5*, *very high*). The interrelationships, in turn, are mathematical functions of several variables or linguistic rule bases. The former case is analogous to regression equation specification, and the rule bases usually apply fuzzy reasoning.

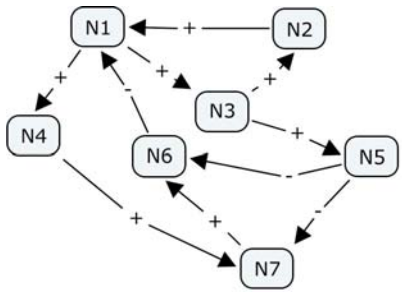

Fig. 3. An Example of a Simple Configuration.

In Figure 3 we first use two types of simple relationships, *x increases y* (+) and *x decreases y* (-), and we thus have a rough configuration of our system. Then we proceed by establishing more concrete relationships. For example, given the concepts 2, 6 and 1, we can generate such rules as

1. *If N2 is low and N6 is low, then N1 is medium.*
2. *If N2 is low and N6 is high, then N1 is fairly low.*
3. *If N2 is medium and N6 is low, then N1 is fairly high.*
4. *If N2 is medium and N6 is high, then N1 is medium.*
5. *If N2 is high and N6 is low, then N1 is high.*
6. *If N2 is high and N6 is high, then N1 is fairly high.*

By using fuzzy reasoning methods with this rule base, we can obtain such model for this relationship as depicted in Figure 4. Since the similar method can be applied to all concepts, we obtain a configuration which can be simulated in a computer environment (Fig. 5). For example, we can then consider the behavior of our map in various conditions by assigning initial values to the concepts or we can provide such *what-if* questions as *What happens in the network if N3 is initially fairly low?* Hence, concept mapping enables us to consider complicated networks of events or phenomena with computer models.

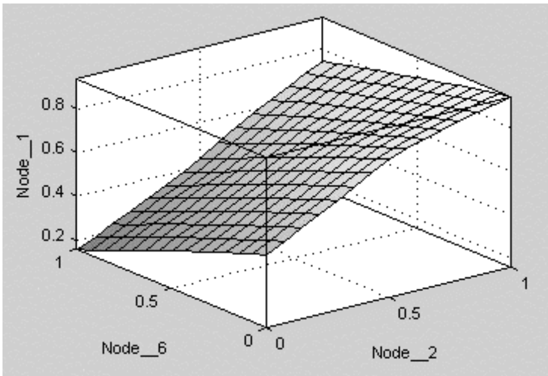

Fig. 4. Fuzzy Reasoning Model Based on the Foregoing Rule Set.

In a posteriori configurations, in turn, we operate with data sets. If numerical data is available, we perform the foregoing constructions "automatically" by using evolutionary computing, in particular the genetic algorithms. These methods provide as with the appropriate rule bases and they can even select relevant concepts to our configurations. In the case of non-numerical data it is possible that first we have to perform some modifications or transformations to them.

By virtue of computational intelligence, we in fact combine two methods, concept and cognitive mapping [1,6,10]. The latter has already been used in fuzzy modeling to some extent but in most cases in a pure numerical form in dynamical systems. In this respect it is only an application of a directed numerical graph from the mathematical standpoint. However, there are also some linguistic versions available and these are applied to our approach. Hence, concept mapping provides us with a tool for representing our ideas and theories fluently, whereas by transforming these configurations into cognitive maps, we can apply better computational intelligence in concept and theory formation and in particular in model construction. These maps also allow us to use feedback (loops) in our models, and these operations are not possible with the Bayesian networks. In this manner we are unable to utilize fully the capabilities of the concept maps but in our decision making and decision supporting systems the foregoing approach seems to be justified.

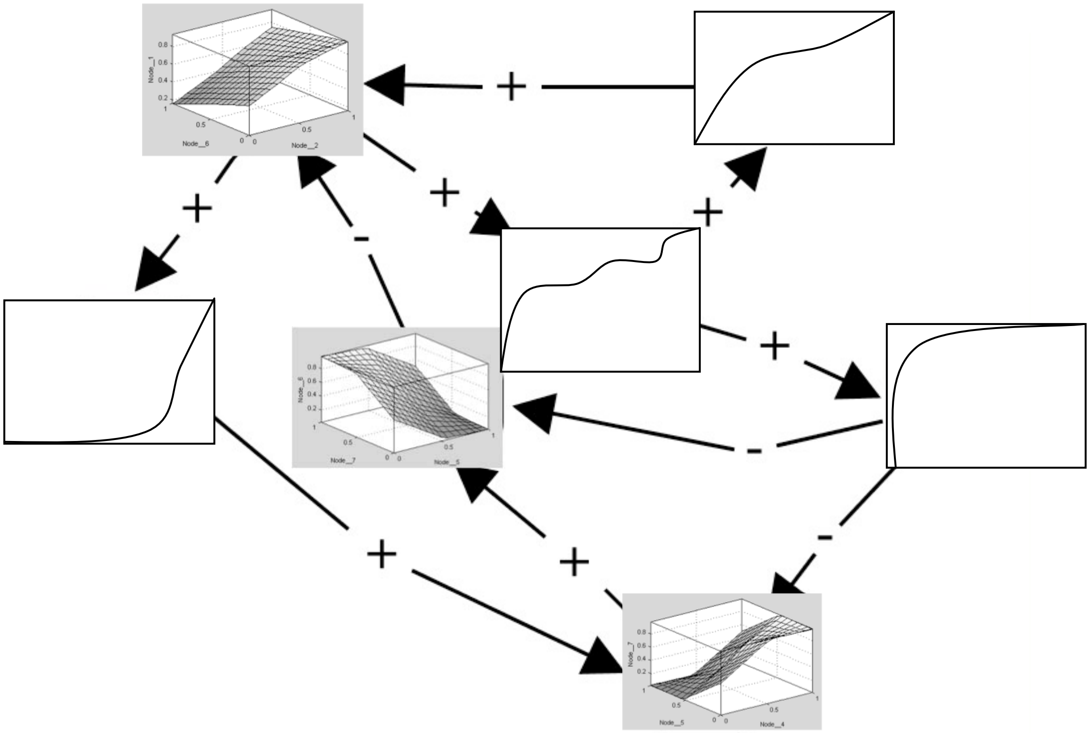

Fig. 5. A Tentative Modeling According to Fig. 3.

5 Example of LBP Modeling

Below we sketch a model which deals with market segmentation in the LBP system and in this context we apply the configuration depicted in Fig. 6.

When an entrepreneur considers his/her business idea by using our planning matrix at stage two (Fig. 2), he/she is expected to make certain assessments on the customers, products and services. Given the target group of customers and the product or service, the system uses such variables as their benefit matching, buying profiles and psychological profiles are constructed (Fig. 7).

The psychological profile constitutes variables which measure such customer's traits as interests, values, attitudes and lifestyle. Buying profile includes gender, age, education, socio-economical status, brand loyalty, product usage rate, etc. Benefit matching, in turn, is obtained according to the target group's benefit sought, readiness for buying and income. We provide a tentative model for the third case.

We thus have four variables as follows:

1. Benefit sought: by using the scales with the extremes low - high, we measure the degree of similarity between the entrepreneur's and target group's opinions on the economic / non-economic benefit assigned to the product or service. The more similarity, the better for the benefit matching (and for the business plan).
2. Readiness for buying: we use the extremes not ready - ready when we assess target group's readiness to buy the given product or service. The more readiness, the better for the benefit matching.
3. Income: the degree of similarity (low - high) is measured when the target group's income and the entrepreneur's estimate on an appropriate target group income for the product are compared. The more similarity, the better for the benefit matching.
4. Benefit matching: reveals the goodness of the entrepreneur's assessments. The more matching, the better.

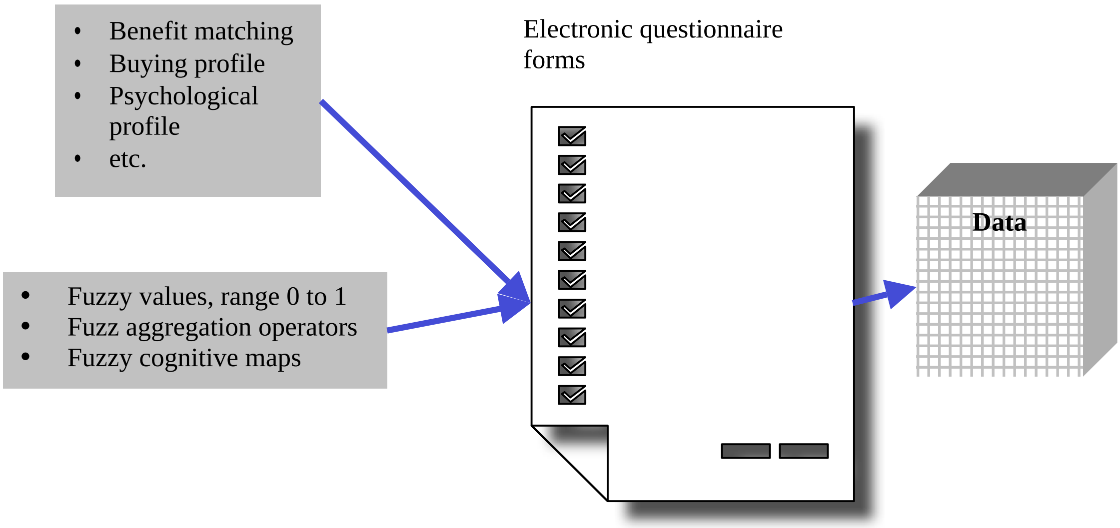

Fig. 6. Excerption from Business Plan Analysis at Stage 2.

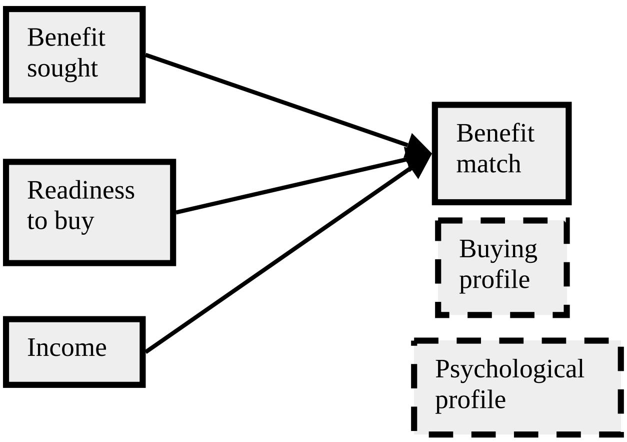

Fig. 7. An Example of Fuzzy Modeling.

Our linguistic scales constitute the extreme values, the linguistic modifiers of these values (very, fairly, etc.), and a midpoint value (e.g. medium). In our model we use the linguistic scales

extreme1 - fairly extreme1 - medium - fairly extreme2 - extreme2

For example,

low - fairly low - medium - fairly high - high

In our reasoning model we presuppose that, first, the outputs should be average aggregations of the possibly weighted inputs; second, compensation should be taken into account; third, high input values should yield high output values and vice versa; and finally, if at least one input variable has the minimum value, the minimum output value should be obtained.

If we obey these metarules, we can generate for our reasoning system such fuzzy rules as

1. If the similarity in benefit sought is low and readiness to buy is not ready and similarity in income is low, then benefit match is low.

2. If the similarity in benefit sought is low and readiness to buy is ready and similarity in income is high, then benefit match is low.
3. If the similarity in benefit sought is medium and readiness to buy is between ready and not ready and similarity in income is medium, then benefit match is medium.
4. If the similarity in benefit sought is high and readiness to buy is ready and similarity in income is high, then benefit match is high.

Fig. 8. Depicts the variation of the outputs in the case of two input variables, benefit sought and income, when a constant value is assigned to readiness for buying. Similar output surface is obtained if alternative input pairs are used in the figure because of the symmetric nature of our model.

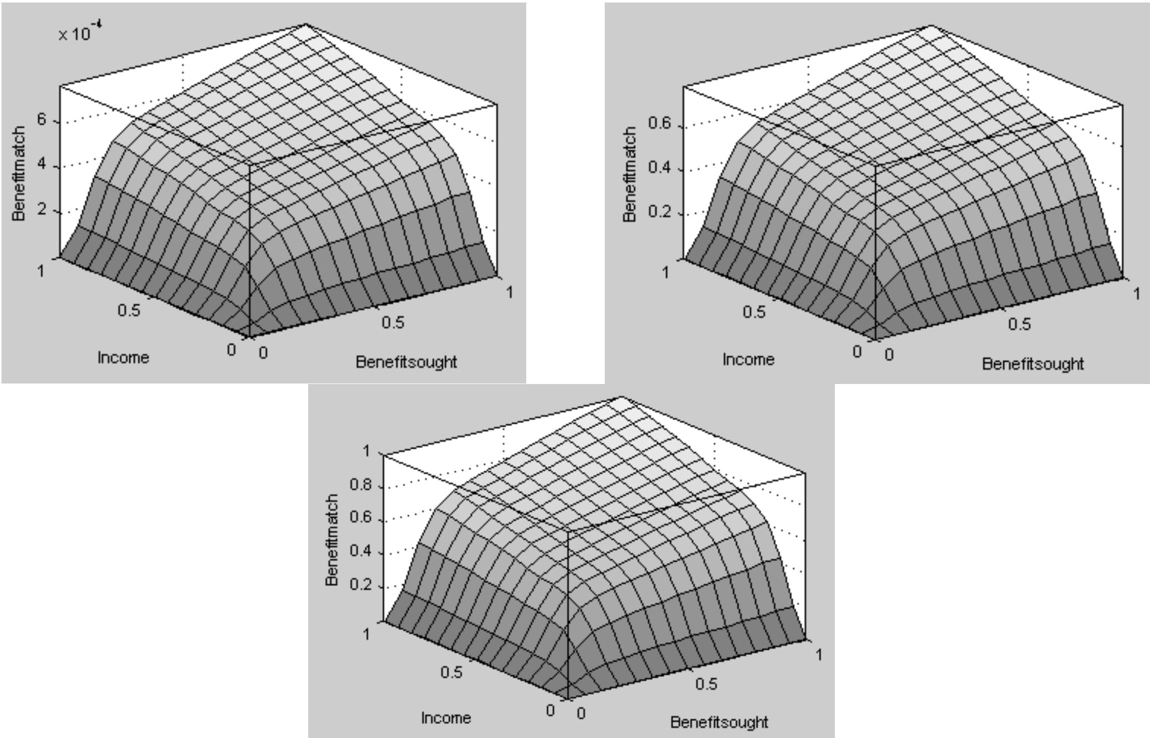

Fig. 8. Benefit Match Model with Two Varying Inputs and when Readiness for Buying Is Not Ready (top left), between Ready and Not Ready (top right) and Ready (bottom).

This example shows us that we can construct reasoning models effortlessly in our LBP Project when we apply computational intelligence and concept and cognitive maps. First, we can model even complicated causal networks in business planning with these maps, and, second, only indicative and approximate linguistic metarules are required that we can construct the causal connections between the system variables with fuzzy reasoning. By virtue of our linguistic approach we can use more versatile interrelationships between the variables than those used within the purely numerical methods. We can also apply qualitative techniques in a computer environment, and this task has been problematic before. Naturally, the foregoing example will only be one constituent in a large concept map representing our LBP system.

6 Summary

We have examined business planning in our LBP project in 2005-2007. This project models the invention of business ideas by combining theories of on creativity in order to provide a new proactive and innovative resolution for learning business planning. Our approach also combines certain philosophical ideas and the actual behavior of the human being.

We have used concept maps to our meta level considerations, user interfaces in the Internet and reasoning and simulations in our decision models. In the first area concept maps are used for theory and concept formation. In the second area these maps are applied to ubiquitous computing. In the third area we have used the idea of concept mapping when we have constructed decision making and decision support models in a computer environment. In this context we have also applied the methods of computational intelligence as well as we have transformed our concept maps into the corresponding cognitive maps if necessary.

We have recognized that concept mapping and computational intelligence are usable for our examinations because we operate with complicated systems which constitute a great number of concepts and both numerical and linguistic variables and interrelationships.

7 Acknowledgements

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