“LUCIAN BLAGA” UNIVERSITY OF SIBIU
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PhD Thesis Executive Summary

CONTRIBUTIONS ON INTEGRATION OF KNOWLEDGE MANAGEMENT IN THE SUSTAINABLE DEVELOPMENT OF SMALL AND MEDIUM - SIZED ENTERPRISES

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CONTENTS

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Introduction

Innovative products are becoming dominant in all area of activity by the integration of different technologies in production and by the network integration of different abilities. The necessary knowledge is becoming more specialized with an increased necessity for aptitude, knowledge and action connections. These connections and interactions can only happen in the context of a sustainable development of small and medium size enterprises within strategic alliances.

Considering present economic and strategic conditions many SME's are vulnerable in areas concerning intellectual property (according to Michel Juneau Katsuya, chairman and CEO of the „Northgate Group"). SME's generally regard the security problem as an extravagance; this can lead in many cases to their elimination from the market as small companies do not have the capacity to absorb losses (for example the theft of prototypes and technologies).

An important role in the knowledge based economy is held by the "brand knowledge" concept which refers to a cognitive representation of a brand from the consumer's perspective. For SME's, although smaller in dimensions compared to large companies, there has to be a strong connection between these and brand management. A strong brand can improve customer loyalty and generate long term incomes combined with an increased market quota for the respective company.

A large scale recognized trend in all emerging markets, including South Africa, is that SME's play a major part in the economic growth and job creation.

The following measures were adopted in France in order to support SME's in the crisis period:

- The insurance of intragroup loans as an alternative financing solution for SME's with the inclusion of new customer management methods. In 2009 SME's which went into insolvency recorded a loss exceeding 5.5 billion EUR;
- Cash consolidation for SME's by relaxing contribution payments to social security (extensions from 12 to 18 months for companies with less than 50 employees);
- Promotion of business transfer (property);
- Zero tax for every job created. This allowed for the creation of 110,000 jobs in 2010, two thirds of which went to young people;
- Counselor training for the regional work force agencies adapted to the specific needs of SME's;
- Implementation of mandatory regulations for continuing vocational training for company employees;
- Implementation of the educational model from Denmark and Holland, where one in two student have a job while competing university studies; this method result in a low unemployment rate among young people (lower than in Germany);
- Attracting young graduates between the ages of 25 and 35.

German SME's are among the most innovative in Europe. 54 % of these brought in the market at least one product or process innovation between 2008 and 2010, considering an EU average of only 34 %. 8.7 billion EUR is the amount invested by German SME's in 2010 for research and development. More than one from every seven euros invested in research and development comes from the middle class. The increase in research and development investments between 2004 and 2010 for German SME's is 71 %.

Germany has a patent campaign for SME's and freelancers to ensure results from research and development are supported and guided through intellectual property rights.

PART I. PRESENT STAGE ANALYSIS ON THE SUSTAINABLE DEVELOPMENT OF SMALL AND MEDIUM SIZE ENTERPRISES IN A KNOWLEDGE BASED GLOBAL ECONOMY

Chapter 1 Theoretical concepts regarding the functioning of small and medium size enterprises in the context of globalization

Globalization represents a complex phenomenon started at the end of World War II, initially based on “interdependence”. Reference literature provides several definitions for globalization, but for this situation I will choose the definition according to which globalization is “the particularly dynamic process for increase of independence between national states resulting from the expansion and deepening of transnational connections in wider and more varied areas of economic, political, social and cultural life with the direct implication of problems becoming more global than national and requiring solutions which are global rather than national”.

1.1. The enterprise – concept, architecture and features. Expansion of small and medium size enterprises in the current economical context

The enterprise represent an economic ensemble, an economic production system which allows for the combing and usage of production factors for the development of goods and services sold on the market for meeting customer needs and obtaining a profit.

The enterprise architecture according to John Zachman, represents a detailed plan, an "enterprise blueprint". This makes it a container for storing business plans, data models, processes and all the elements and specifications designed at conceptual, logical and physics levels.

"The category of Micro, Small and Medium size enterprises (SME’s) consists of enterprises with less than 250 employees and a net turnover of up to 50 mil EUR and/or total actives of up to 43 mil. EUR" (fragment form Article 2 of annex from Recommendation 361/2003/CE).

The expansion of SME’s is focused, considering existing regional conditions and strategies, on different areas of development (some generated by the effects of the economic crisis). For example, in Asia (Japan, China, Vietnam, Thailand, India and others), offshore SME’s were particularly developed.

The main advantage for offshore enterprises (enterprises with now activities in the host country) located in destinations such as Cyprus, Malta and the US is represented by the low level of taxation.

An important expansion of SME’s took place in Brazil (member of the emerging group BRICSA), after the 2002 elections, mainly based on the existence of rich natural resources, an increasing population (with a low degree of indebtedness) and a stable macroeconomic situation.

1.2. The appearance and evolution of the sustainable development concept

The term development comes from the area of social sciences and especially the economics area and refers to a growth, an improvement. In order to observe this growth quantification was required by inserting indicators which allow for the measurement of economic growth and performing analysis and comparisons between different geographic-territorial units.

Sustainable development represents a concept which defines a type of economic growth than ensures a satisfying level of welfare not only for a short or medium term but also a long term one. Sustainable development is a development which follows to meet the needs of the present without compromising the possibilities of future generations to meet their own needs (Brundtland Report).

The main objectives of sustainable development according to the Brundtland Report are:

- Continuing to ensure economic growth while meeting the basic requirement for conservation of natural resources;
- Eliminating poverty and ensuring conditions for meeting essential needs for jobs, food, energy, water, housing and health;
- Orientation of economic growth processes to a new quality;
- Ensuring a controlled population growth;
- Conservation and expansion of natural resources, controlling the environmental impact of the economic growth;
- Restructuration of production technologies and controlling the risks involved;
- Ensuring an integrated approach for decisions involving economic growth, the environment and energy resources.

In this context, a new concept was developed in Canada, called "Sustainable happiness", which offers a new approach considering sustainable development, considering quality of life improvement for individuals and communities mainly by changing inter human behavior and human behavior toward the environment. Happiness contributes to the welfare of individuals and communities at a global level, without the exploitation of other individuals, the environment or future generations.

The model constituting the quality of life only refers to practically applied aspects and not declarative ones. There is sometimes a gap between theoretically stated models and practically followed ones, as some groups are interested in dissimulating their politics, showing a system of values – norms and principles practically promoted as an expression of interests for the entire society.

The practical model for the quality of life essentially represents the manner in which goods, services are allocated, their effects (on individuals and/or groups), access to the social opportunities system and a social repartition for individual rights and obligations. The access values to goods and services, social allocation of rights and obligations are different considering the social and economic systems, this outlines the criteria which constitute the quality of life for individuals, groups and society (while considering work, ownership, political power and others). Different types of values (criteria) generate the norms and principles for allocation of goods, services and effects in society.

From this perspective, it can be said that the quality of life not only refers to a simple description of neutral "facts", with no actual value but expresses an evaluation of the entire society, of its development pattern (meeting human and social requirements and self-regulation of nature), and so it can be useful in the evaluation processes for the quality of sustainable products and a "clean" production.

Considering the characteristics, tendencies and studies for sustainable development in the context of globalization we can synthesize the problem of sustainable development considering cause and effect interactions, meaning from the perspective of the problematic complexity:

- Principles (Open economic and mutual aid systems; Peace, development and environment protection; Life quality and others);
- Objectives (Eradication of poverty; Controlled population increase and others);
- Dimensions (Spiritual, human, social, cultural, political, economic and ecologic development);
- Economic, ecologic and social performance;
- Policies ("Limits of growth" Report, "The future we want" Report and others).

1.4 Sustainable business in the context of SME's sustainable development.

The „sustainable business" concept was presented as a new challenge for business of the future leaders by Willums Jan-Olaf, in 1998. The World Business council for Sustainable Development approached this subject in numerous publications, giving this challenge a special attention in the context of sustainable development for SME's.

The resilience of a sustainable enterprise represents its ability to survive, adapt and grow when faced with turbulent changes by creating more business opportunities through ecologic technologies, reducing material and energy consumption, discovering innovative methods and techniques for recovering and reusing waste instead of using new resources, all in order to increase value added and the company's market share. The strategy for a sustainable enterprise was defined as the alignment process of an enterprise to the business environment in order to maintain a dynamic balance. By adding the "sustainability" element in the strategic planning for SME's, the development of this category of enterprises is trying to create a balance between resilience and growth, necessary for the population's economic, ecologic and welfare and for the conservations of values for future generations.

The European sector for small and medium size enterprises represents the main engine for increasing the economy's competitiveness, as this category of enterprises constitutes the molecular structure of the EU economy, consisting of about 23 million SME's, which account for 99 % of business on internal markets and employ 90 million workers.

The essential elements necessary for the implementation of sustainable business practices for SME's are shown in figure 1.13.

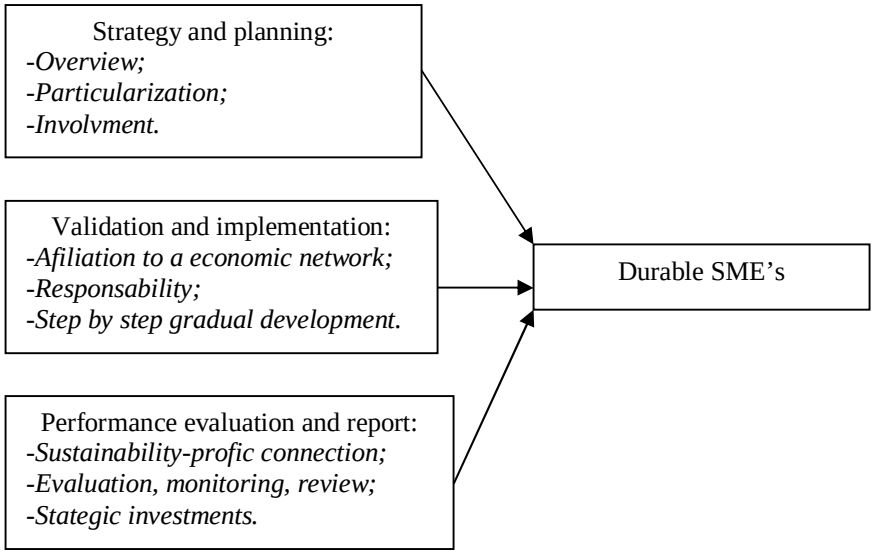

Figure 1.13 Key elements necessary for the implementation of sustainable bussiness practices in SME's (Source: A CICA, AICPA, CIMA publications

A study involving 2,100 managers from 21 countries concerning the differentiation of competitive advantages for SME's based on performances revealed the main methods used by this organizational category in the context of the global market, as can be seen in table 1.4.

Table 1.4 Methods used by SME's performing on the global market

No.	Description of the used method	Respondents percentage [%]
1	Encouraging innovation, cost reduction and increased efficiency/quality for strategic initiatives	51%
2	Development of new products and services	49%
3	Consolidating customer relations	39%
4	Implementation of an innovation culture	34%

1.4. Evolution of SME's in Romania at the peak of the financial crisis 2008-2011

In 2013 in Romania there were 3 SME's for every 100 inhabitants; Bucharest was an exception with 7 SME's for every 100 inhabitants, the majority in retail, but also in transport and construction.

Romania was included 2012 Eurostat Report for SME's as the country with the most difficult situation compared to the beginning of the economic crisis and is mentioned as the most clear case for a simultaneous drop in production and productivity, along Spain, Greece and Latvia.

A comparative analysis for 10 counties (including Bucharest) considering the total population, the percentage of hired population in SME's and the number of SME's for every 1,000 inhabitants (SME's density) is shown by the data presented in table 1.8.

Table 1.8 County statistics for employed population compared to the number of SME's

No.	County	Region of development	Total population	Percentage hired in SME's	No. of SME's for 1,000 inhabitants
1	Bucharest	Bucharest-Ilfov	1,628,426	20.44 %	44.98
2	Cluj	North-West	674,903	4.74 %	30.79
3	Timiș	West	654,773	4.44 %	26.73
4	Constanța	South-East	680,945	4.26 %	24.75
5	Prahova	South-Muntenia	754,541	3.89 %	17.78
6	Brașov	Center	529,906	3.82 %	25.92
7	Bihor	North-West	558,613	3.40 %	23.81
8	Ilfov	Bucharest-Ilfov	353,481	3.05 %	34.39
9	Argeș	South-Muntenia	609,703	3.03 %	18.24
10	Iași	North-East	774,075	3.00 %	15.63

Source: SME's contribution to economic growth – present and perspectives - 2012

The "aging" process for the population is tightly connected to the economic development tin general and to entrepreneurial area in particular and can be shown by statistical data taken from the "Work force balance at the 1st of January 2011", as shown in table 1.9.

Table 1.9 Population structure on age groups

Region/Age groups	0 – 14 years	15 – 64 years	Over 65
Bucharest - Ilfov	15 %	70 %	15 %
Center	15.4 %	70.5 %	14.1 %
South - East	14.8 %	70.3 %	14.9 %
South - Muntenia	15.8 %	62.3 %	21.9 %
South – West Oltenia	14.4 %	69.1 %	16.5 %
West	16 %	70.1 %	13.9 %

The high share of microenterprises in given by the large amount of internal capital, the maturity of the Romanian entrepreneurial area and by the fact that in the analyzed period public policies encouraged the creation of new companies rather than the consolidation of existing ones (the main example being the SME-D initiative).

Table 1.10 Regional situation of SME's reported to the population share

No.	Region	No. of SME's for 1,000 inhabitants	Population share
1	North-West	21.80	12.67 %
2	Center	20.66	11.76 %
3	South-East	17.66	13.10 %
4	North-East	12.52	17.30 %
5	West	20.58	8.94 %
6	Bucharest - Ilfov	43.50	14.90 %
7	South - Muntenia	13.16	18.19 %
8	South - West Oltenia	14.79	8.42 %

The correlation between the population share and the SME's share can be analyzed using the data given by the Romanian Statistical Yearbook 2012 and are shown in table 1.10.

Chapter 2. Sustainable development and the management of sustainable development in the context of a knowledge based economy and organization

Knowledge based economy is a concept that emerged around 1990 and changed previous economic theories which limited the production factors to work and capital. The emergence of this type of economy is strictly connected to the evolution of an informational society, where intangible cognitive capital or knowledge is becoming the main competitive advantages for the economic system. The concept lies at the base of new public economic policies that follow the promotion of clusters as poles of competitiveness and territorial intelligence. The main characteristics for the knowledge based economy and organization are shown in figure 2.1.

2.2. Producing, utilizing and integrating knowledge in the management and policies for sustainable development

According to the studies done by "Gartner" analysts, any business with a data supply base should take into consideration the way in which that data can be used as a strategic active and income generator.

Analysis done by specialist show there are numerous categories of knowledge, with partially heterogeneous characteristics and with different roles in economic, management, educational and other processes. According to A.B. Jones, knowledge can be divided into two categories, depending on the content:

- Knowledge about something, essential for perceiving and understanding a phenomena, event or process
- Knowledge on how to do something "know-how", indispensable for producing or selling for a profit services, equipment or other.

Depending on the purpose and type of use there are five categories of knowledge shown in figure.

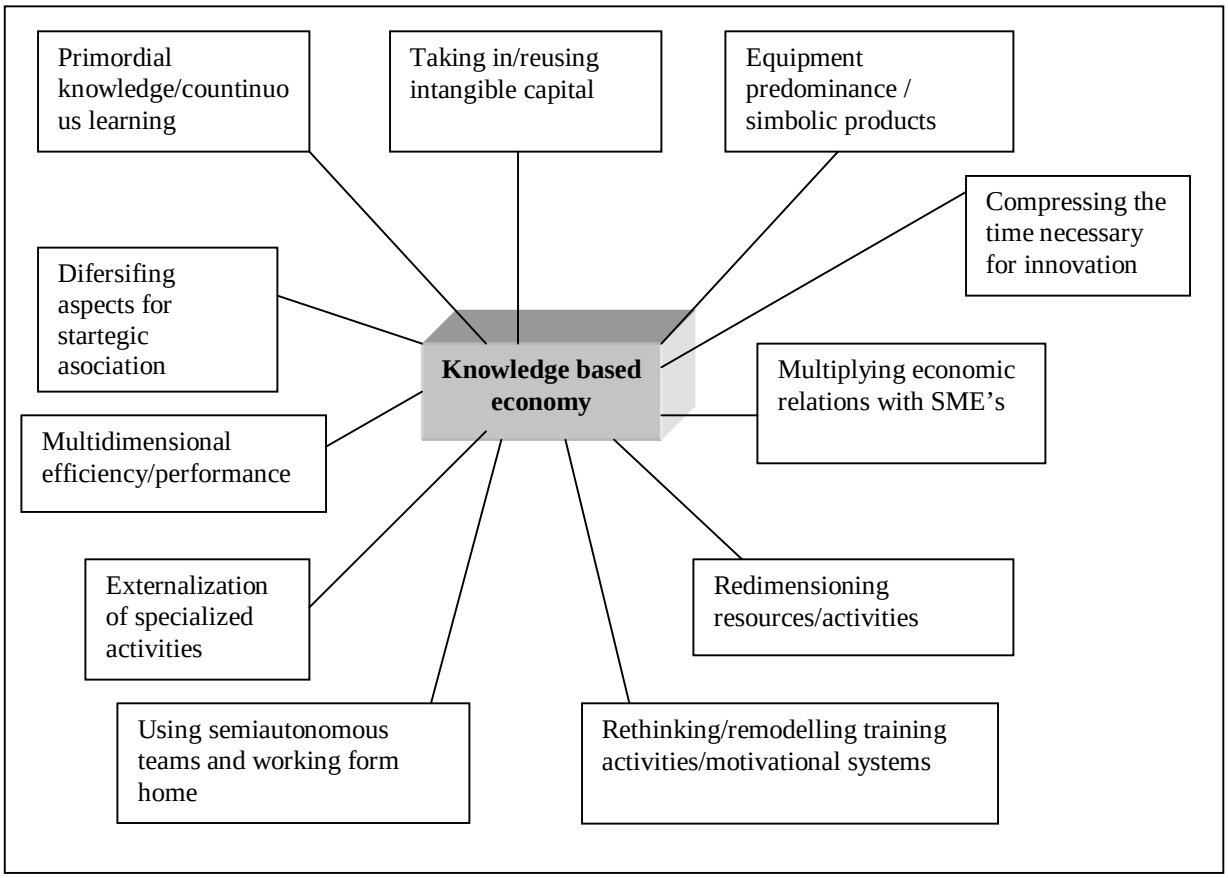

Figure 2.1 Characteristics of knowledge based economy and organization

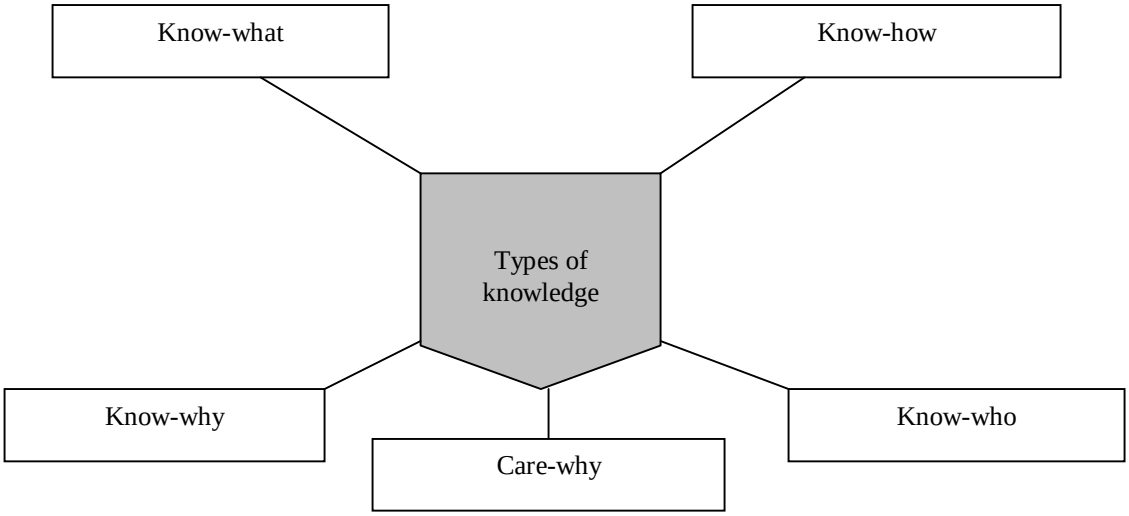

Figure 2.3 The main types of knowledge

Knowledge integration represents a complex problem and can be approached from numerous perspectives; these perspectives are shown in table 2.1.

Table 2.1 Different approaches for knowledge integration

No.	Points of view for knowledge integration
1	Knowledge integration in specialized and general multicultural systems
2	Knowledge integration in the organization
3	Integrated knowledge organization in an electronic environment
4	Knowledge integration in information systems
5	Knowledge integration through career counseling
6	Integration of scientific knowledge with practice
7	Knowledge integration form the new paradigm of complexity perspective, centered on a nonlinear approach of reality, based on claims such as: the analysis of a complex system cannot be done by its fragmentation, the difference between this and a complicated system is consists in the difficulty of prediction – caused by the systems sensitivity (different evolutions of inputs) and the interaction of the composing subsystems – the systems' study/modeling requires specific topologic conditions (faze space), its dynamic and evolution requiring a set of specific approaches themselves.
8	Knowledge integration for different areas (medical management, educational management and others)

There are three types of knowledge integration which can be used in all areas:

- **Multi-disciplinary** – involves different contents being put side by side, sometimes with no apparent relation between them; this approach is based on interpretation by equivalence, analogy and comparison of the knowledge;

- **Inter-disciplinary** – represents a form of cooperation between different subject/areas for a certain process, a phenomena the complexity of which can only be explained, proven and solved only by the convergent action of several points of view;
- **Trans-disciplinary** – assumes for the overlapping of several subjects and can generate the appearance of new areas of knowledge. This approach considers elements residing in several different subjects of study, between subjects and beyond any subjects of study; it involves the study, process exploration and complex phenomena so that by coordinating research and corroborating results new subject of study can be constituted. Its finality is the understanding of the present world and one of its imperatives is represented by the unity of knowledge.

2.4. Interaction between tangible and intangible assets

Classification of identifiable incorporeal assets is done using several criteria, such as the characteristics of the area where they occur, their nature and similar use in the enterprise's activity, also the useful lifespan of incorporeal assets. The 30 identifiable incorporeal assets (shown in lowercase below) of the 5 corresponding areas (numbered below) represent a selection of the most common incorporeal assets from a long list which includes more than 100 incorporeal assets that can be separately assessed commercially:

1. Incorporeal assets in the **marketing** area**:**
   a. Commercial denominations;
   b. Brands;
   c. Trademarks;
   d. Trademark related services;
   e. Specific elements (color, shape, package design);
   f. Banner type advertising;
   g. Internet domains;
   h. Agreement regarding competition.
2. **Customer related** incorporeal assets:
   a. Customer lists;
   b. Customers contracts and connected relations;
   c. Production orders and delays;
   d. Non contractual customer relations.
3. **Technologic** incorporeal assets:
   a. Property over patented and non-patented technologies;
   b. Software;
   c. Data bases;
   d. Commercial secrets (property, processes, networks and others).
4. C**ontractual** incorporeal assets:
   a. Licenses and copyrights;
   b. Supply contracts;
   c. Rental contracts;
   d. Construction authorizations;
   e. Franchise;
   f. Radio and TV broadcasting rights;
   g. Maintenance and mortgage contracts;
   h. Work contracts;
   i. Contracts for exploitation and commercialization rights for certain categories of resources (oil, coal, water, wood and others)

5. **Artistic** incorporeal assets**:**
   a. Theater plays, opera, ballet;
   b. Books, magazines, newspapers and other types of literary work;
   c. Musical work (compositions, lyrics, songs, commercials);
   d. Paintings, photos;
   e. Movies, music videos;
   f. TV shows.

The useful lifespan for incorporeal assets can be finite or undefined. The first category includes all incorporeal assets with the lifespan specified in contracts and/or legal property titles (for intellectual property) while the second category includes the commercial fund and the trained work force. The useful lifespan is the shortest of the:

- Economic lifespan – estimated time period for which the asset will generate benefits for his owner;
- Legal lifespan – limits control over benefits generated by the asset.

This classification has a significant importance for the accounting of incorporeal assets as those in the first category are redeemable and are subjected, at least once a year, to the depreciation test (in accordance with IAS 38 Intangible Assets), while assets with an undefined life span are not redeemable but are subjected to the depreciation test once a year.

Besides the five categories of intangible assets defined in the SFAS 141r/2007 standard, we can also add a new category called "the socio-professional area", composed from the components shown in table 2.2:

Table 2.2 Intangible assets that belong to the socio-professional area

No.	Intangible assets included in the socio-professional area
1	Continuous professional training
2	Job satisfaction
3	Coworker friendship
4	Flexible work hours
5	Position corresponding to qualification
6	Satisfaction regarding time devoted to family
7	Satisfaction or disappointment for work condition
8	Customer satisfaction or disappointment
9	Employee morale
10	Amount of support from the local community
11	Changes occurring in productivity
12	Enterprise's type of leadership management

Conclusion: The classification of intangible assets is done on a number of six distinct areas/activities: marketing, clients, technology, contracts, art and the socio-professional area.

2.4.1. The monitoring of internal and external processes and procedures

Process orientation leads to the usage of the „process based approach" principle. This approach has the following objectives:

- Considering processes depending on the added value;
- Increasing process performance and efficiency;
- Continuous improvement by the evaluation of achieved indicators.

A "process" is defined in SR EN ISO 9001:2001 as an assembly of interconnected activities that transform inputs into outputs. These activities require the allocation of human, material and financial resources. Process monitoring represents an integrant part of the life cycle for an efficient management (Performance Management Cycle -PMC), as can be seen in figure 2.10.

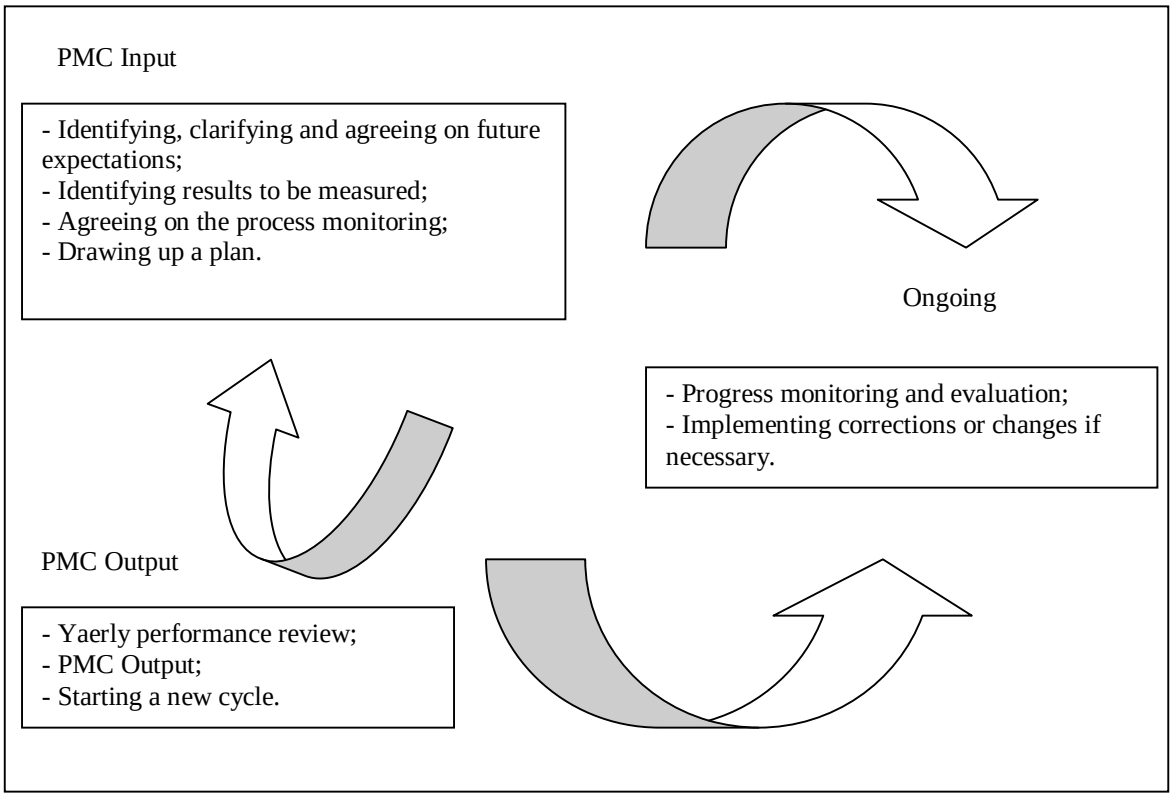

Figure 2.10 Process monitoring – part of the life cycle for efficient management

Chapter 3. Doctoral thesis objectives

It is obvious that the domino effect generated by the 1989 economic crisis has lead and will lead to significant changes in all areas, including knowledge based economy and in the adaptation process of the middle class to new specific durable conditions for intelligent learning small and middle sized enterprises.

The use of modeling-simulation techniques in a new type of strategic alliance (the eco-bio-economic cluster) represents one of the solutions that can ensure a sustainable future for present and future generations. These techniques corroborated with the improvement of the knowledge based

management can create an „innovative mix" of a „disintegrated society" following the effects of the world crisis and globalization.

Based on the analysis for the present stage management for sustainable development for small and middle sized enterprises corroborated with the performances generated by the implementation of knowledge based management the following conclusions and general aspects can outlined:

- ✓ an organization represents a social-technical system based on the simultaneous contribution of several intelligent elements: human intelligence + artificial intelligence + intelligent buildings + intelligent cyberspace;
- ✓ new aspects for redefining SME's considering the effects of the economic crisis need to be considered;
- ✓ SME's are vulnerable in aspects concerning intellectual property;
- ✓ SME's need to grant an increased importance to brand management;
- ✓ in present conditions SME's have reduced their performance potential form the perspective of opportunities offered by digital economy (lack of own web sites);
- ✓ new business models that combine social and business problems with personal development need to be implemented (Example: the Mondragón model);
- ✓ implementation of tax relief measures for supporting SME's considering crisis conditions (*Example:* companies tax exemptions, payments spread, on CAEN groups);
- ✓ the performance and life span for SME's is especially influenced by external environment conditions, such as: government regulations, international agreements, social aspects in the context of sustainable development, quality of live for individuals and others;
- ✓ the different development of SME's is also a result of interactions between political, economic, cultural and environment forces at a world level;
- ✓ the defining processes for a knowledge based economy are innovation, learning and partnership activities;
- ✓ There are only three types of knowledge integration which can be used in all areas: multi - disciplinary, inter - disciplinary and trans - disciplinary;
- ✓ classification of intangible assets is done for six distinct areas/activities: marketing, customers, technology, contracts, arts and the social-professional area (introduced as a result of the studies from the present thesis);
- ✓ there are no real ways that allow for the determination of real value for incorporeal assets;
- ✓ process monitoring (value, support or management creator) actually refers to an integration process included in the life cycle of efficient management (Performance Management Cycle);
- ✓ an organizations efficiency can be measured, depending on performed activities, through the 3 E's: Effectiveness + Efficiency + perceived Effectiveness;
- ✓ sustainable development must consist of a network development of older example and new sustainable practices in the area of SME's, implemented through local/regional initiatives;
- ✓ a cluster type strategic alliance represents a sustainable inter-disciplinary system based on knowledge and environment adaptation to society and individual needs.

The present doctoral thesis follows – among other theoretical aspects – the integration and valorification of the following concepts in the context of sustainable development:

- ➢ acquiring and capitalizing intangible assets in SME type organizations;
- ➢ using inter-disciplinary connections, creativity and innovation in the process of knowledge acquiring and sharing;

- integration of eco-bio-economy in specific strategic regional alliances;
- progress through network cooperation (*Example:* http://teachforromania.ro/ce-facem/o-retea-globala/);
- modeling and simulation techniques (*Example:* using the "Arena Simulation Software");
- integration of personal development in the complex process of sustainable regional development.

The proposed subject falls in the context of present tendencies and research directions and answers to objective requirements for minimizing the effects of the economic crisis and the necessity of sustainable regional development through the innovative mix formed by eco-economy, bio-economy, knowledge based management and sustainable development management.

The main objectives of the present doctoral thesis can be classified as follows:

A. From a theoretical and methodological perspective:

- present stage analysis of sustainable development management for small and medium sized enterprises;
- analysis of main processes involved in the acquisition, transfer and integration of knowledge in SME type organizations;
- elaboration of an evaluation methodology for SME type organizations for identifying and capitalizing intangible assets, based on interactions between general welfare and different categories of assets during the life cycle of intangible benefits;
- developing new hypothesis necessary for the determination of organizational knowledge;
- generation of new knowledge in the area of sustainable development through connections between systems and processes with the end result of establishing new indicators and coefficients for organizational performance (efficiency);
- development of a conceptual analysis model for processes that lead to the success of strategic alliances;
- analysis of the interdependence between conscience, knowledge and modeling-simulation techniques with the main objective of modeling the new knowledge circle.

B. From a practical perspective:

- development of a knowledge sharing procedure in a cluster type strategic alliance;
- defining and implementing creative bio-communities;
- development of a new type of cluster: "Five for all";
- implementation of the new concept "eco-bio-economy" in the area of cluster type strategic alliances with the following secondary objectives:
  - $\Rightarrow$ establishing new types of cluster regional coordination;
  - $\Rightarrow$ defining clusters for research in education, sustainable development and social inclusion, as part of new eco-bio-economic strategic alliances;
  - $\Rightarrow$ creation of a specialized team in the "mix" between creativity and intellectual property called "Creativity and Intellectual Property Team" (C.I.P.T.).
- improvement of sustainable development management for SME's through modeling and simulation techniques using UML and Arena software.

Part II. CONTRIBUTIONS FOR MAXIMIZING KNOWLEDGE IMPACT IN THE SUSTAINABLE DEVELOPMENT PROCESS FOR SMALL AND MEDIUM SIZE ENTERPRISES

Chapter 4 Knowledge analysis and integration in the context of sustainable regional development

The mathematical formula for defining knowledge is:

$$K=P*(P+S+P*S) \qquad \textbf{(4.1.)}$$

where: K represents knowledge; P=people; S=systems and P*S=synergy between people and systems.

4.1. Establishing calculation methodology for volume and efficiency of knowledge gathered for small and medium sized enterprises

Calculating the volume of organizational knowledge according to formula 4.1 first involves the identification of existing systems in an enterprise, such as: marketing systems, patent and brand systems, software systems for SME's management, production systems, surveillance/alarm systems, automation systems, data base systems and others.

After identifying the existing systems within the organization it is essential to identify the processes in which these systems are involved, as the interactions and connections between them are knowledge generators (as shown in table 4.2).

To successfully use formula 4.1 for calculating the volume of knowledge a minimum of two simplifying hypotheses are required.

Hypothesis 1: **Every employee of an organization belonging to the „small and middle size enterprises" category has three systems: calculation, operation and communication.**

Hypothesis 2: **The minimal number of systems for every organization is seven. These are: calculation, operation, data base, copy, communication, storage (archive) and climate control.**

Table 4.2 Identifying knowledge generating processes

No.	Identifying knowledge generating processes
1	Staff training for proper system usage
2	System exploitation
3	System maintenance
4	System adaptation to specific conditions
5	System inter conditioning for complex processes
6	"4R" implementation (recovery, reusing, reconditioning, recycling) at the end of the system's life cycle

Conclusion: The results for producing knowledge in companies of different dimensions (shown in table 4.7) can explain the present economic phenomena in the context of the global economic crisis:

- Most small companies go into insolvency or bankruptcy due to the low volume of accumulated knowledge;
- Most medium or large companies disintegrate into geographically dispersed smaller companies in order to occupy new markets, and so the large volume of knowledge is divided between dispersed entities.

The division of knowledge phenomena can be explained with the usage of a new coefficient, called the "Multiplication coefficient – C_m", which expresses the number of new knowledge (O_k – Output Knowledge) resulted from processes of evaluation and capitalization of the initial knowledge (I_k - Input Knowledge). A schematic representation of this phenomenon can be seen in figure 4.1.

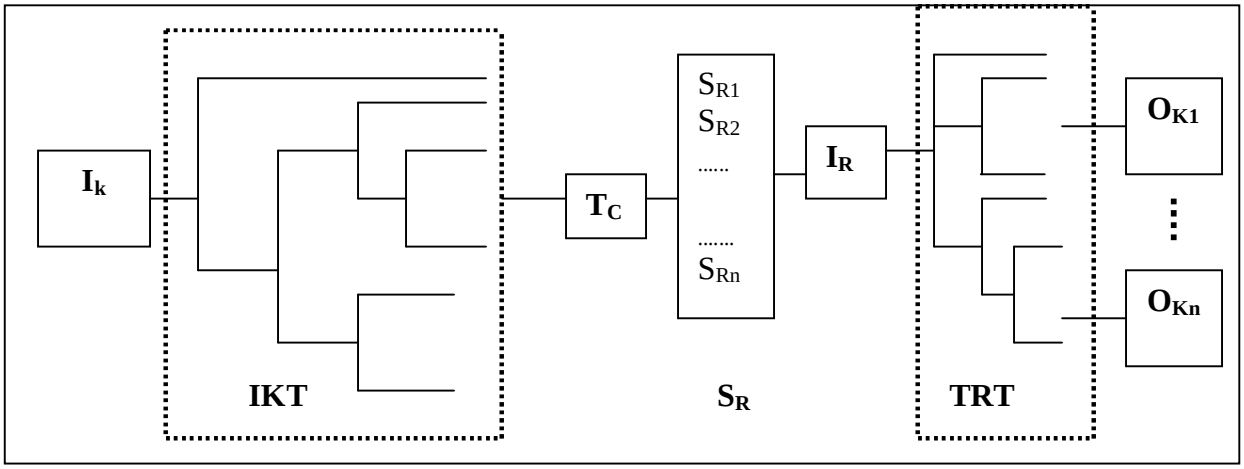

Figure 4.1 Knowledge multiplication and connected processes

Where:

- I_k - Input Knowledge – initial knowledge (inputs);
- IKT – Initial Knowledge Tree;
- T_C – Tree conversion (Tree conversion into a set of rules/procedures);
- S_R – Set of Rules. These can be ordered or unordered (some rule can overlap and lead to different conclusions). Following procedures is essential for the efficient functioning of a cluster;
- I_R – Interpreting rules (rules/procedures interpretation);
- TRT – Transforming a rule set into a tree (Transforming a set of rules into a new knowledge tree);
- O_K - Output Knowledge (Resulted new knowledge, calculated using formula 4.1. and previously noted with K).

The attributed values for the new multiplication coefficient, C_m are shown in table 4.3.

Evaluation of the knowledge impact on different entities (activities, individuals, organizations, departments, branches, towns, projects, programs and others) must be done using the "Attack coefficient – C_k".

The efficiency of gathered knowledge depends on the "Association coefficient - C_a", evaluated depending on the number of sets (combinations) of knowledge with common attributes. When the number is low (the maximum possible value being 10) the coefficient's value will be high.

Depending on the percentage of original elements included in the acquired knowledge it is necessary to introduce the "Shining coefficient – C_S"as part of the future formula that will establish "The enterprise's knowledge efficiency".

Starting from the data above, knowledge efficiency (E_K) for an organization from the small and middle size enterprises can be calculated using formula 4.4.

$$E_K = K * C_m * C_K * C_a * C_S / 100 \quad [WU] \qquad (4.4.)$$

As proper usage (according to English man Spurgeon C.H. 1834-1892) and resource sharing represent wisdom, the "The enterprise's knowledge efficiency", will be measured in "Wisdom Units-WU".

Considering that a cluster or a region has a large number of SME's, the data obtained (as shown in table 4.7) will help in the implementation of a coherent strategy for sustainable development. The evaluation of knowledge impact has to be done for every organizational, local and regional level by professional management teams (knowledge managers and sustainable development managers). Proper evaluation of this impact could lead to obtaining hard evidence on the global impact of the new knowledge based economy.

Knowledge impact evaluation will also highlight the main obstacles standing in the way of knowledge based management, some of which are mentioned below:

- Volume increase for data and information;
- Lack of experts in obtaining and/or processing strategic data/information;
- Existence of immature technologies in the area of knowledge management;
- Lack of professional knowledge managers;
- Requirement to adopt radical changes in a short amount of time;
- Low number of sustainable development managers.

Table 4.7 Knowledge efficiency based on the size of the organization

No.	SME's Name	No. of employees	No. of systems in the company	Total systems	No. of knowledge	Knowledge efficiency
a	**b**	**c**	**d**	**e=d+3*c**	**f=c*(c+d+c*d)**	**g**
1	A	5	7	22	685	0.008
2	B	35	15	120	152425	1.749
3	C	65	35	230	990925	11.371
4	D	100	60	360	3646000	41.838
5	E	125	95	470	7418125	85.123

4.2. Contributions on performance review for intangible assets in knowledge based organizations

The identification and capitalization of intangible assets in knowledge based organizations lead s to the necessity of performance reviews owed by these types of assets. The performance indicator for intangible assets, IPI, will be calculated using the following formula:

$$IPI = P * \frac{CRE}{CRI} \qquad (4.5)$$

, where P is the percentage representing incorporeal assets from the company's total market value;

CRE represents the external refinement coefficient for incorporeal assets;

CRI represents the internal refinement coefficient for incorporeal assets;

CRI, the internal refinement coefficient, is based on the implementation of measures for continuous employee professional training, on the stimulation of initiatives concerning innovation and on the reduction of polluting emissions and wastes:

$$CRI = Fp * \frac{1}{Pi} * Ed \qquad (4.6)$$

Where:

- F_p represents the percentage of employees that have benefited from professional taining programs;
- P_i represents the percentage from the yearly turnover obtained as a result of innovation (new products, technologies, processes and others);
- E_d represents the decrease in percentages of spending due to environmental issues.

CRE, external refinement coefficient for incorporeal assets is based on results obtained from business practices done in partnership, association, clusters or other different types of networking.

$$CRE = \frac{Ni}{Ai} \qquad \textbf{(4.7)}$$

Where:

Ni represents the mathematic average of contractual activities done in a partnership throughout a year; Ai represents the mathematic average of the organization's identified and capitalized intangible assets as a result of contracts/partnerships/activities of clusters and/or networks throughout a year;

In order to efficiently capitalize on existing knowledge at a regional level, through a strong dynamic of development for regional clusters, an evaluation of knowledge based processes and organizations is the first necessary step.

4.4. Comparative analysis of processes that lead to the success or failure of strategic alliances

A strategic alliance represents a cooperation agreement between two or more independent companies and involves working together to fulfill a common objective. Unlike a joint-venture, the companies in the strategic alliance do not form a new entity for continuing to achieve objectives; they collaborate while remaining distinct organizations.

The "alliance" concept represents a recent innovation of the European industrial policy that is proving to be very useful for integrated or currently developing activities as a result of creative

industry. It is specifically a matter of operation in a more open and horizontal manner for the construction of a tighter relation between **innovation, financing and cooperation**.

While analyzing the stages where the main factors that affect an alliance's stability come into play (and that can lead to its failure), I have tried to avoid their appearance by implementing efficient methods (projects/strategic partnerships) which lead to organizations adapting to the environment changes and by introducing efficient activities (communication, creativity, innovation, sustainable production and consumption and others) that implicitly lead to the accumulation and transfer of knowledge and also to the proper use of knowledge in the regional sustainable development process where the members of the alliance are involved. The effect of the regional sustainable development combined with an equitable distribution of alliance benefits naturally leads to the creation of the sustainable happiness concept for alliance members and increases their work efficiency. Corroborating an integrating these elements as a whole has led to the development of a conceptual model for process analysis that leads to the success of strategic alliances; this model is shown in 4.7.

4.5. Analysis of the interdependence between conscience, knowledge and modeling-simulation techniques

In the present scientific research, the "personal world model" (generic name attributed by the French scientist Henri Ey) is represented by the modeling of sustainable development for small and middle size enterprises in the context of the knowledge based economy and the efforts to slow down/attenuate the domino effect generated by the economic crisis.

Taking into consideration the elements specified in the title of subchapter 4.5 we can elaborate a diagram showing the interdependence between conscience, knowledge and modeling-simulation techniques as shown in figure 4.8.

Starting from the identification process of the linking elements between knowledge, conscience and modeling-simulation techniques ("experiences", "information" and "thinking" – synonymous to "reasoning") and corroborating with the definition of knowledge as a combination of experiences, values, contextual information and intuition, while also considering that all logical thinking generates true logical knowledge, we can define a new element of the knowledge based economy which is the "knowledge circle" shown in figure 4.9.

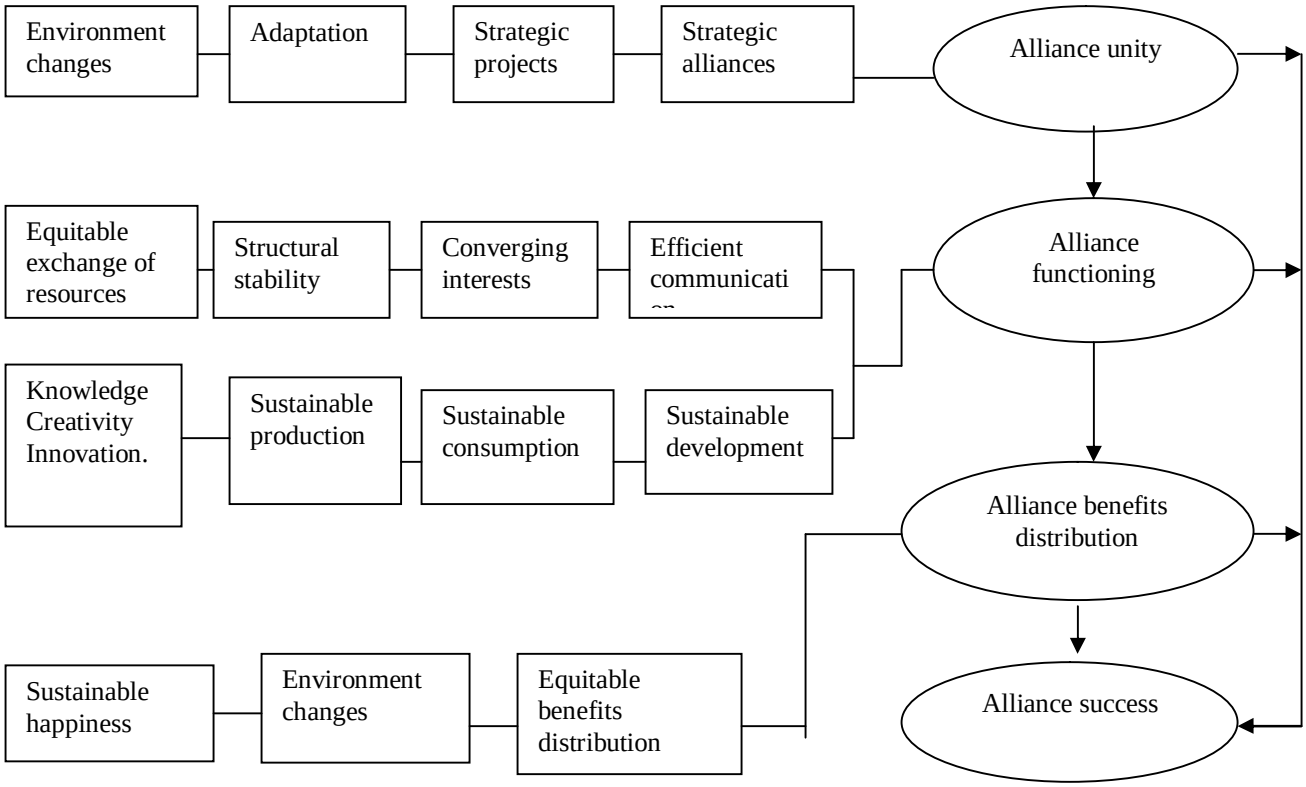

Figure 4.7 Conceptual model for process analysis that leads to the success of strategic alliances

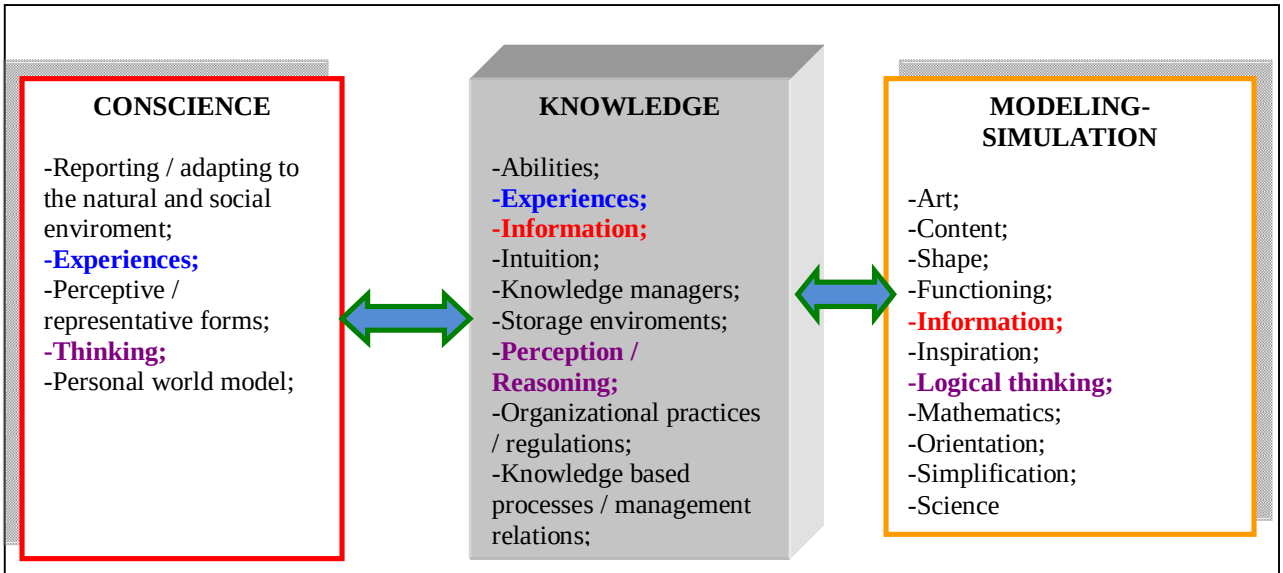

Figure 4.8 Interdependence between conscience, knowledge and modeling-simulation techniques

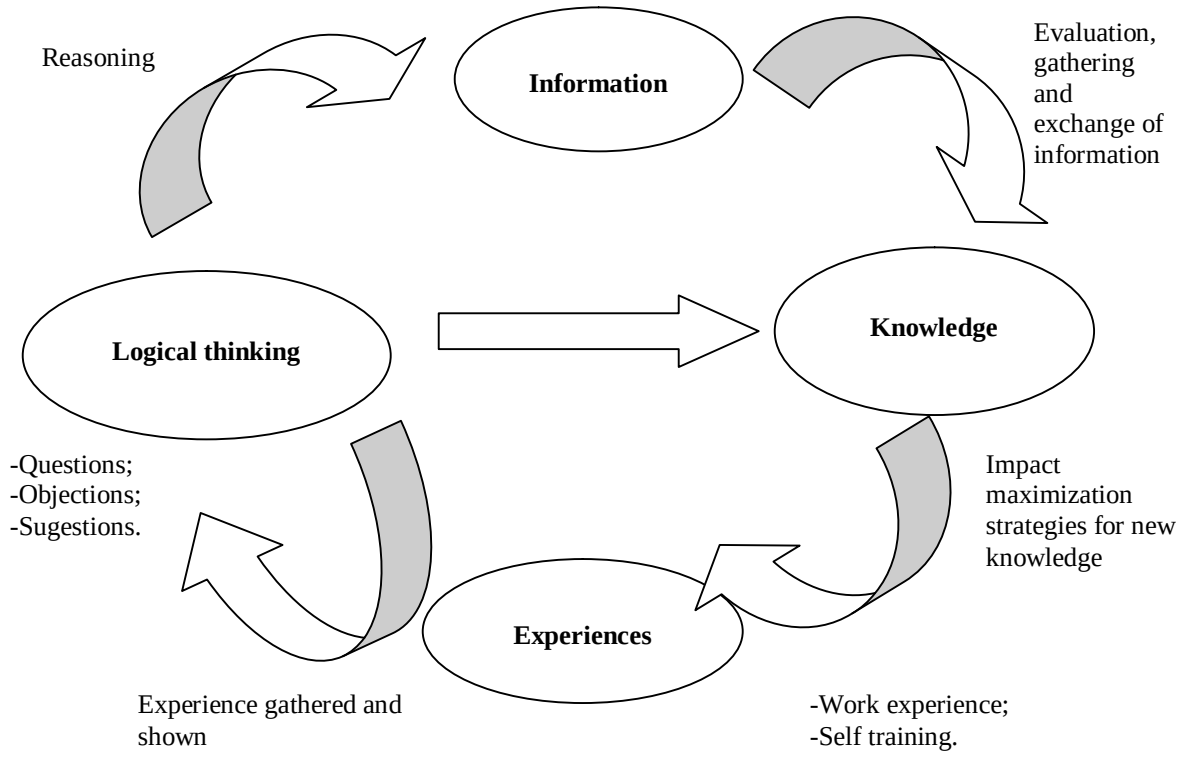

Figure 4.9 Knowledge Circle

4.6. Contributions for the development and implementation of a system procedure for knowledge sharing in an eco-bio-economic cluster

The present system procedure, developed and implemented in a hypothetic cluster, contains the following chapters: Purpose, Application Area, Definitions (defining the main 22 utilized notions), Abbreviations, Reference documents, Procedure (including subchapters such as: General aspects, Development of specific strategies for encouraging knowledge transfer, Evaluation of time required for finding information, knowledge and others), Responsibilities and Records (this contains two forms TKF1 and TKF2), used in the knowledge transfer process.

Calculation form for the amount of knowledge created and shared on an organizational level – code (Transfer Knowledge Form 1)

Considering the necessity of performing mathematical calculations an Excel spread sheet will be used.

Similar to Gantt diagrams, each activity will be divided into sub activities, as shown in table 4.12:

Table 4.12 Analysis of activity A1

Sub activities	No. of participants	No. of necessary hours	Design date	Implementation date	Observations	Estimated efficiency
SA1.1	5	6	2/17/2013	6/15/2013		50%
SA1.2	9	8	3/15/2013	8/20/2013		60%
SA1.3	6	12	4/19/2013	10/28/2013		70%
SA1.4	10	10	5/22/2013	11/20/2013		80%

No. of participants	30	people			
Activity duration	36	hours			
Time necessary for implementation:		**From:**	2/17/2013	**To:**	11/20/2013
Activity efficiency	65%				

Analysis of knowledge generating activities can lead to the obtaining and sharing of new knowledge by following these two steps:

- The first step consists in the establishment of a minimal number of five actions (A_1...A_5) which led to the obtaining of new knowledge in a certain area (industrial, tourism, education and others);
- Step two consists in creation of five tables, one for each action, for which the After Action Review (AAR) method, developed by the US Armed Forces, will be implemented as can be seen in table 4.13.

Table 4.13 Implementation of the AAR method for activity A1

Question / Answer	**What should have happened? Why?**	**Suggestions / Conclusions**
1…4		SC1.1 … SC1.4
Question / Answer	What actually happened? Why?	Suggestions / Conclusions
1 … 4		SC2.1… SC2.4
Question / Answer	What is the difference? Why?	Suggestions / Conclusions
Between A1 and A2 … between A1 and A5		SC3.1… SC3.4
Question / Answer	What went wrong? Why?	Suggestions / Conclusions
1…4		SC4.1… SC4.4
Question / Answer	What could have gone better? Why?	Suggestions / Conclusions
1…4		SC5.1… SC5.4
Question / Answer	What lessons can we learn?	Suggestions / Conclusions
1…4		SC6.1… SC6.4

The number of knowledge created and shared (K_{CT}) at a certain time by an organization can be calculated using the following formula:

$$K_{CT} = 6 * N_A * N_S * N_I = 6 * 4 * 24 * 30 = 17280 \text{ [knowledge]} \quad (4.8)$$

Where:
6 = number of questions used with the AAR method;
N_A = number of analyzed sub activities (in this case - 4);
N_S = number of suggestions / conclusions / results (in this case - 24);
N_I = number of participants (in this case - 30).

Processing and efficiency form for idea results using the SMART method – code TKF2 (Transfer Knowledge Form 2)

Considering the quality evaluation of proposed ideas by the employees of an organization the six questions proposed by the SMART method can be used, as shown in table 4.14

Table 4.14 Idea processing using the SMART method

Question / Answer	**Where does this idea come from?**	**Suggestions / Conclusions**
1…4		SC1.1 … SC1.4
Question / Answer	When did it appear?	Suggestions / Conclusions
1…4		SC2.1 … SC2.4
Question / Answer	What were the conditions which lead to its appearance?	Suggestions / Conclusions
Between A1 and A2 … Between A1 and A5		SC3.1 … SC3.4
Question / Answer	Which are the factors that lead to its development?	Suggestions / Conclusions
1 … 4		SC4.1 … SC4.4
Question / Answer	How should it be properly capitalized?	Suggestions / Conclusions
1 … 4		SC5.1… SC5.4
Question / Answer	Why is it relevant at this stage?	Suggestions / Conclusions
1…4		SC6.1 … SC6.4

In order to register the knowledge resulted from the processing of an idea we also need to answer the following questions:

- How many areas are there (N_D) with theoretical/practical implementation opportunities for the respective idea?
- How many new ideas (N_I) were generated from the evaluation of the initial idea?
- How many new questions (N_Q – which will require answers and generate new knowledge) resulted from the processing of the initial idea?
- What is the applicability rating (R_A – explained in table 4.15) for the idea's results depending on the geographic dispersion of the users/beneficiaries?

Table 4.15 Applicability rating for an idea's results

Level of geographic dispersion	Rating	Applicability
Local	1	Low
Regional	2	Extended
National	3	Large scale
International	4	Very large scale

In this situation the number of knowledge gathered and shared from the processing of an idea (K_I) can be calculated using relation 4.9.

$$K_I = R_A/6 * (N_S + N_D + N_I + N_Q) \qquad (4.9)$$

Where:
R_A = Applicability rating;
6 = Number of questions used by the SMART method;
N_S = Number of suggestions generated by answers given to questions from the SMART method;
N_D = Number of areas benefiting from the idea's implementation;
N_I = Number of new ideas generated;
N_Q = Number of new generated questions.

The main contributions presented in chapter 4 are:

a) Implementation of a method for knowledge calculation based on an existing formula, as follows:

- The introduction of relation 4.1, established by Russ, M. Jones, J. and Fineman, R.;
- Identification of existing systems for the analyzed enterprise;
- Identification of knowledge generating processes;
- Establishing two simplifying hypothesis for the minimal number of systems for a natural person (three systems) and for a legal person (seven systems);

Observation: The main effects of the economic crisis can be explained by the results obtained using the presented methodology.

b) Knowledge impact evaluation at an organizational level based on a new formula which allows for the determination of knowledge efficiency; the formula includes four coefficients: multiplication, attack, association and shining;

c) Introduction of the performance indicator for intangible assets (IPI) based on two refinement coefficients (internal and external CRI / CRE) for incorporeal assets;

d) Correlation of the knowledge sharing process with the necessary steps for the implementation of a system procedure for a cluster strategic alliance (establishing area of applicability, defining the terms used, usual abbreviations, official documents referred and others);

e) Establishing the context for the knowledge sharing process (general aspects);

f) Establishing responsibilities for entities involved in the knowledge sharing process (transfer center for success knowledge, entrepreneurial excellence center, pilot center for cooperation and development in the eco-bio-economy area and others);

g) Development of a cooperation based on dialog and respect, based on the Peer Assist model (Service-Learning, Crisis orientated dialogue and others);

h) Organization of knowledge fares and the creation of a specialized publication;

i) Development of a calculation form for the number of created and shared knowledge (KCT) la for an organization (Transfer Knowledge Form 1), based on an innovative combination between Gantt diagrams and the After Action Review (AAR) method;

j) Development of a processing and efficiency form for results of an idea (Transfer Knowledge Form 2), using the SMART method. This lead to the establishing of the applicability rating for an idea's results based on the level of geographic dispersion (local, regional, national and international) and to the implementation of a calculation formula for the number of knowledge acquired and shared resulted from the processing of an idea (K_I).

The main theoretical and methodological conclusions resulted from chapter 4 are:

- Identifying aptitudes for organization members as well as existing technologies in their respective companies (network members) which allows for the exact establishing of areas of applicability and for organization of stages of development considering priorities and time scales;
- Coworker friendships ensure an efficient use of the management service for service principle for meeting the organization's goals;
- Existence of a functioning network (formal or informal) which allows for the use of the business-to-business agreement between the network's entities. This agreement has proven to be efficient in several countries and has been presented by famous economist Adam Smith in his work "an inquiry into the nature and causes of the wealth of nations";
- Identification of intangible assets has led to the identification of areas of current interest such as neuromarketing and sustainable development management, areas that will benefit from considerable attention form employees of SME's;
- An important role in the support process of strategic alliances is held by government and local authorities;
- Alliances, in fact represent a closer relation between innovation, financing and cooperation;
- The existence of an alliance can lead to the development of a new system of relations;
- An alliance's stability and adjustment ability is mainly influenced by the local market characteristics and changes in the external environment;
- The main flaws for an alliance are strategy, structure and the culture of each alliance member;
- Elements that affect the stability of an alliance do not occur simultaneously, but are involved in different stages/a different moments;
- An alliance's life cycle contains the following stages: establishment, development, obtaining of results and dissolution;
- The success of an alliance can be ensured by the implementation of efficient methods (communication, creativity, innovation, sustainable production and consumption and others) accompanied by an equitable distribution of benefits and a sustainable regional development;

- Conscience represents a reflection of reality experienced by an individual or a group;
- Knowledge results from the process of using information in an organized environment;
- Knowledge based organizations use skills, knowledge and the creativity of knowledge managers;
- Knowledge based management and organizations efficiently capitalize on the value of knowledge;
- The development of a model involves a combination of the following elements: inspiration + orientation + exemplification + information and research;
- The linking elements between knowledge, conscience and modeling and simulation techniques are experience, information and thinking;
- The Knowledge Circle presents the following categories of processes:
  - Evaluation, gathering and exchange of information;
  - Transforming information into knowledge;
  - Implementation of strategies for maximizing the impact of new knowledge;
  - Using knowledge in the work process to complete the organization's tasks leads to the buildup of experience, one of the criteria based on which managers evaluate employyes as experience gathered and used;
  - When new, highly complex problems arise even if an individual has significant experience in the area (job) he starts asking questions, has objections to suggestions and offers suggestions, based on his own experience, expertise.;
  - New knowledge corroborated with gained experience leads to a presentation by the individual of solid and serious arguments which can bring plus value to the organization's products or could lead to significant saving in materials, energy, time and others.

Chapter 5 Theoretical and practical model for the sustainable development of small and middle sized enterprises through "five for all" type eco-bio-economic regional clusters

5.1. Contributions on defining and implementing creative bio-communities

A first step in creating a network or an efficient and durable strategic association is represented by the existence of a regional community interested in the past, present and future of society.

A "Creative bio-community" should be defined as an inter-disciplinary micro-community with a high ecologic conscience, belonging to a small geographic region (group of towns, counties) with certain common interests in areas such as bio-economy and the use of alternative energy, whose members, organizations and institutions work as a team for achieving maximum efficiency for bio-technologies, eco-management and acquired knowledge sharing for significantly transforming quality of live for themselves and future generations. For achieving these goals the most important aspect is represented by the development of an efficient network of creative bio-communities.

From the eleven characteristics necessary for the implementation of a creative bio-community we mention:

- The creative bio-community should combine the ability to understand new bio-economic mechanisms with medium level abilities on the use of TIC in order to ensure efficient knowledge sharing;
- The new community should develop partnerships and strategic alliances with all interested entities;

- The community should create new decision making mechanisms through regional strategic alliances (SME's, NGO's, universities, clusters and others);
- Determining the communities dimensions and geographic limits/defining and evaluations the needs of the regional bio-community;

The prototype of a creative bio-community is based on a combination of 14 eco-bio-logistic components, some of which are presented below:

- Minimal road and railway infrastructure;
- Regional, national or international cooperation opportunities;
- Medium TIC development and average skills for community members in this area;
- Favorable conditions in aspects concerning the environment: bio agriculture and permacultures;
- Level of schooling/culture for community members;

The main benefits for implementing a regional bio-community are:

- The acquiring and sharing of knowledge and experience in eco-bio-economy will result in financial savings and decision making that will ensure sustainable development and the reduction of global warming;
- Creation of sustainable professional relations between the educational systems and labor market organizations;
- Fast implementation of research results in areas such as industry and agro tourism;
- Increased number of jobs, especially in rural and small urban areas.

5.2. Contributions on defining and implementing a new cluster model "Five for all"

Considering sustainable development and the necessity to adapt to change (figure 5.4), cluster evolution has led to the requirement of implementing a new cluster model "Five for all", replacing the „Four clover" cluster as a 5^{th} element was required; this is a regional network of creative sustainable development based on the American concept of "Smart community", built from five categories of managers belonging to the cluster's organizations and stakeholders – this network has a determining part in regional decision processes and will be referred to as "Smart network":

- Knowledge Manager;
- Senior Sustainable Development Manager (Standard for the occupation „Sustainable development manager", which I have developed and published throughout doctoral school);
- Migration Manager;
- Facilities Manager;
- Transverse Manager.

A selection of the main responsibilities for the new management team is shown in table 5.2.

Table 5.2 Main responsibilities of the "Smart Network" management team

No.	Management function	Responsibilities
1	Knowledge Manager	Implementation of knowledge based management by sustainable development teams
		Ensuring the progress of foreseen processes by the knowledge based management at the right time and place
		Ensuring knowledge acquirement, capitalization and sharing in the sustainable development teams
2	Senior Sustainable	Collection of market information and presenting strategic

No.	Management function	Responsibilities
	Development Manager	initiatives for meeting the needs of cluster members
		Promoting regional, national and international sustainable development through alliances and strategic networks
		Facilitating access to new markets by activity globalization for SME's belonging to the cluster
3	Migration Manager	Ensuring efficient migration/transition of activities in a controlled environment (for example a cluster), through continuous, proactive customer relation up to the activity migration moment and through the stabilizing period
		Is indirectly responsible for creating and sustaining relations with knowledge managers that ensure the sharing of knowledge and information
4	Facilities Manager	Implementation of facility management for ensuring a compatible, safe, comfortable and efficient environment for existing business entities
		Providing the link between builders and owners/tenants for efficient use of building from both a functional and maintenance perspective
5	Transverse Manager	Identification of problems, coordination mechanisms and present challenges regarding transversality
		Corroborating specific elements of transversal management (projects, processes, networks and others)
		Training teams and individuals with an intellectual respect for the source of legitimacy. Legitimacy represents the conviction that the given order is correct and authority resulted is a power given by prestige and respect

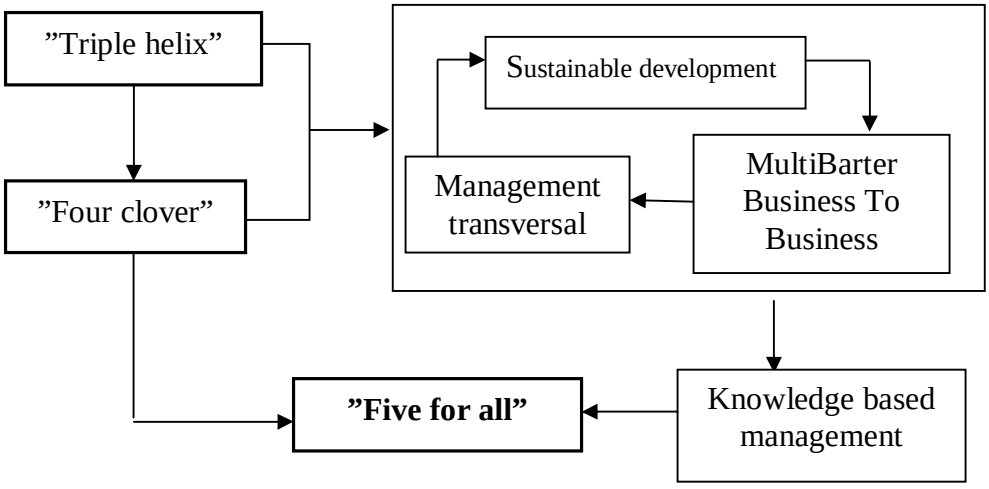

Figure 5.4 Cluster evolution in the context of sustainable development to a „Five for all" model

Starting from the attempts to unify the concepts of eco-economy and bio-economy into a new integrated concept of "Eco-Bio-Economy", concept belonging to Professor Alexandru T. Bogdan Ph.D., Dr.h.c., corresponding member of the Romania Academy, I have tried to create a new sustainable development model for Romanian SME's through a regional eco-bio-economic cluster build based on the "Five for all" model (shown schematically in figure 5.5); this model combines the characteristics of three types of clusters: bio clusters, innovative regional clusters and research in education, sustainable development and social inclusion.

A bio-cluster represents a geographically concentrated group of companies, continuous professional training organizations and NGO's, which focus on sharing applications and experiences in the area of bio-technologies and also information on the existing specific local resources by using technologies associated with developing connections, alliances and specific cooperation methods through complementary projects.

An innovative regional cluster follows the stimulation of innovational activities by promoting interactions between its members (supporting involvement of companies in collaboration activities for research, development and innovation, facilities and know-how exchange) and by effectively contributing to research, development, innovation, technological transfer, networking and dissemination of information between cluster members.

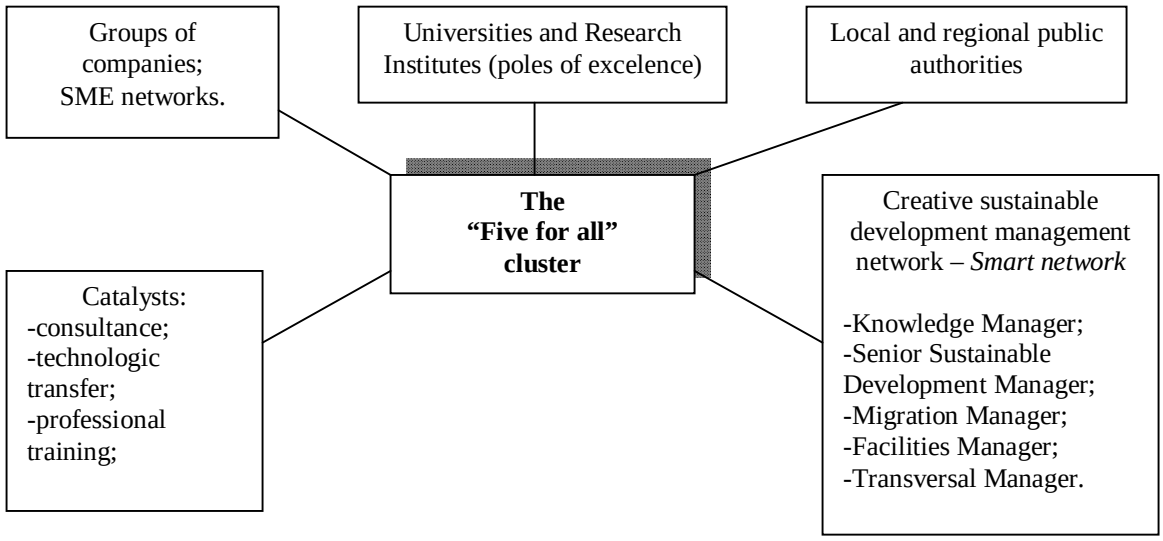

Figure 5.5 The eco-bio-economic cluster based on the "Five for all" model

A cluster for research in education, sustainable development and social inclusion is based on the sustainable interaction, within a strategic alliance, between organizations form the area of education for sustainable development, local and regional authorities and social inclusion policies. Some of the objectives of a cluster for research in education, sustainable development and social inclusion are presented below:

- Social inclusion, demographics and work force employment;
- Scientific research, education for sustainable development and technologic development;
- Development of human resources for promoting sustainable occupation;

- Development of the knowledge based society;
- Sustainable development through economic, social and environmental objectives;
- Development and promotion of social commerce ("Markets represent conversation"- concept promoted by "Amazon" and "EBay"), derived from electronic commerce and involving the use of "Social Media" and online commerce for supporting social interaction and user involvement. This endeavor must support the buying and selling of products/services in the social environment. The strongpoint of this new marketing game is the art of conversation and the power to persuade the customer through the sent message. The main player on the social commerce market is the social media website "Facebook.com" with more than 600 de million users globally, that is 10% of the total world population, with a constant ascending trend.

The six pillars for social media allow for the identification of new trends in the knowledge based economy (figure 5.6), including within the new cluster strategic alliances.

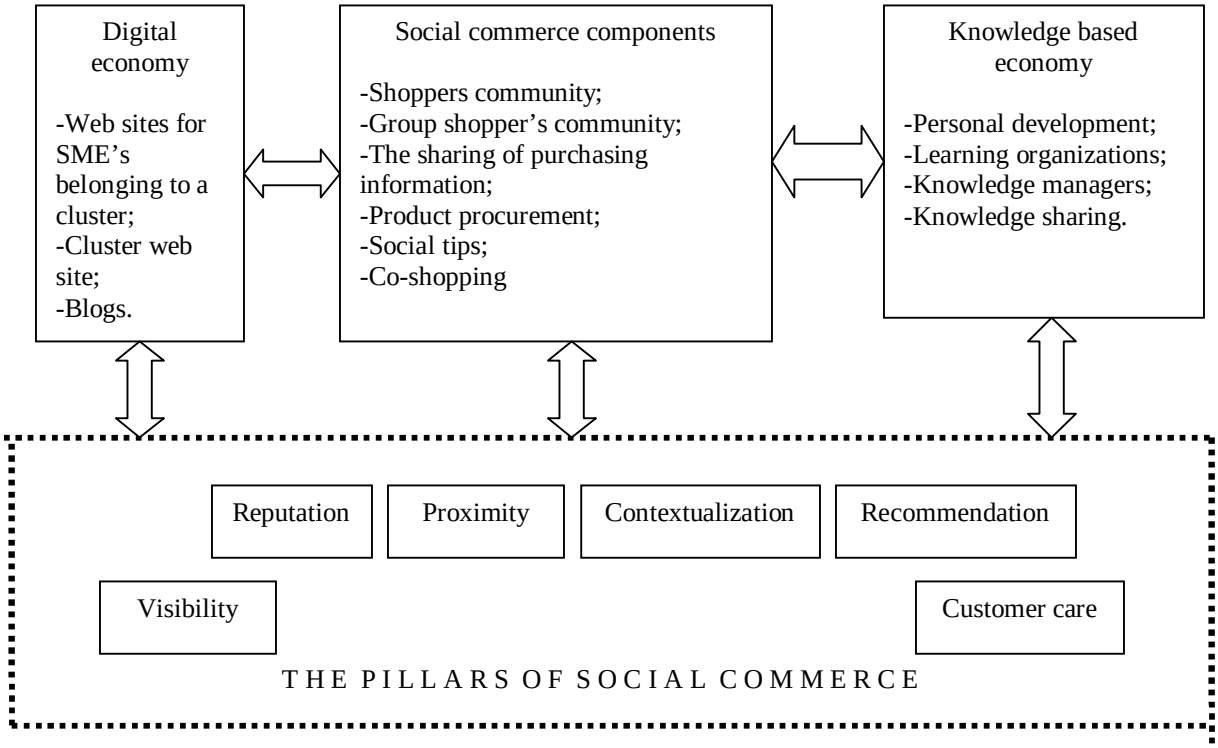

Figure 5.6 The importance of social commerce in clusters belonging to the knowledge based economy

5.3. Contributions of the implementation of creative industries in the "Five for all" cluster

Creative industries are those types of industries that originate in the creativity, talents and craftsmanship of individuals and have the potential for creating jobs and generating prosperity by producing and exploiting creativity, intellectual work and ideas – intellectual property. They include eleven significant economic areas, such as: advertising, architecture, design, crafts, publishing and others. *Application:* The creative sustainable development management network, Smart Network (S.N.) implements for a cluster a team specialized in the "mix" between creativity and intellectual property, called C.I.P.T. (Creativity and Intellectual Property Team). The work procedure involves the following eight steps

- **Step 1:** The C.I.P.T. identifies new subjects and continuous professional training programs that need to be implemented in high schools, universities or organizations with the main object of activity "Other forms of learning" - CAEN code 8559;
- **Step 2:** The C.I.P.T. implements an information and documentation system (I.D.S.) based on high school and university volunteer students;
- **Step 3:** The I.D.S. collects data and information by using key words and expressions defined by the C.I.P.T. The main elements followed are scientific journals, conference proceedings, government and consultancy/long life learning web sites;
- **Step 4:** The I.D.S. shares its news archives with other individuals and/or networks (I.D.S. outside connections) and obtains other data, information or knowledge;
- **Step 5:** The C.I.P.T. with the S.N. analyze and sort I.D.S. archives;
- **Step 6:** The C.I.P.T. with the S.N. and the management of the educational university and pre university units from the cluster's area of interest establish priority an directions of action that will benefit from the newly acquired knowledge;
- **Step 7:** The C.I.P.T. with the S.N. identify sponsors that will support the development and implementation of new subjects and/or professional training programs, as well as the agreements needed for satisfying the requirements of those involved for ensuring "sustainable happiness";
- **Step:** The C.I.P.T. with the S.N. and other interested entities form virtual teams that will develop instruction manuals and auxiliary materials necessary for the implementation of the new subjects in the educational curricula in accordance with the increasingly "sophisticated" labor market.

5.5. Contributions on using the UML language in the identification and capitalization of a cluster's assets

Unified Modeling Language (UML) is a unified modeling language, resulted from the process of introducing standardization and object oriented design. This programming language represented the starting point in the development of graphic programming.

The present doctoral thesis uses a number of 12 UML diagrams for the analysis of SME's belonging to a cluster, some of the most important being:

- Case diagram for attitude toward the environment;
- Case diagram for customer relation management;
- Case diagram for employee satisfaction;
- Case diagram for the style of management;
- Case diagram for interest towards employees, results and efficiency;
- Case diagram for human capital;
- Activity diagram for the implementation of an innovative regional cluster;
- Class diagram for intangible management aspects.

The class diagram for intangible management aspects for a regional innovative cluster is shown in figure 5.22.

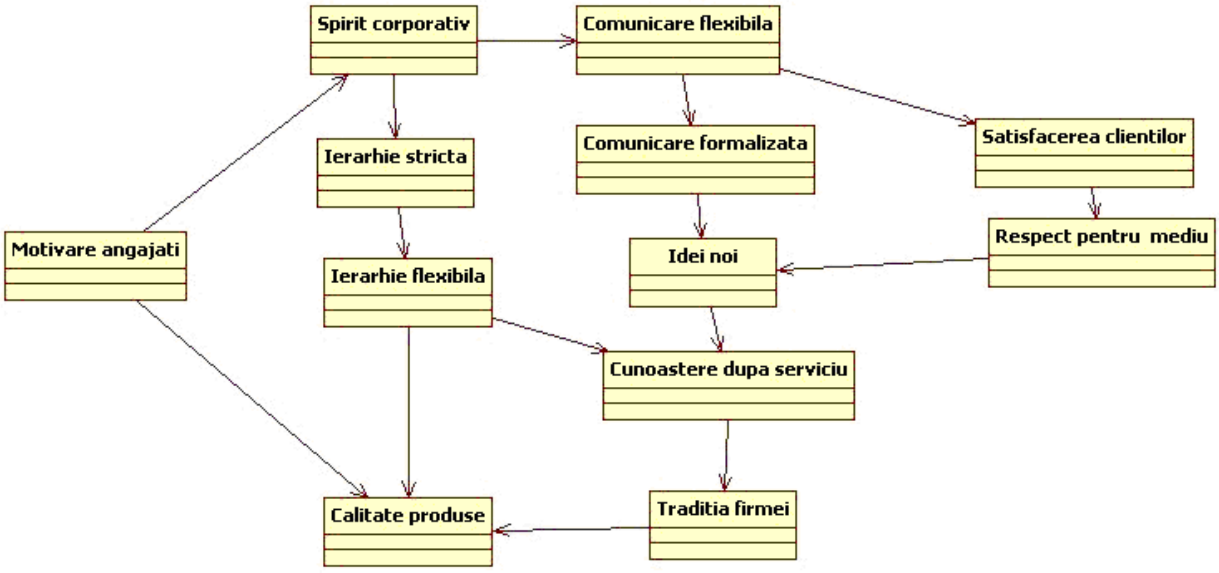

Figure 5.22 The class diagram for intangible management aspects

The main contributions brought in chapter 5 are:

- Implementing creative bio-communities as the first step in creating sustainable regional strategic alliances;
- Connecting the eco-bio-logistic components necessary for the implementation of creative bio-communities;
- Analysis of benefits resulting from the implementation of creative bio-communities;
- Defining and implementing a new cluster model "Five for All" (superior to previous „Triple helix" and „Four clover" models);
- Defining and implementing an eco-bio-economic cluster (starting from the eco-bio-economy concept), using the "Five for All" model;
- Implementing a specialized management team, that will handle the coordination of the future cluster, consisting of five managers: Knowledge Manager, Sustainable Development Manager, Migration Manager, Facilities Manager and Transverse Manager;
- Establishing the main characteristics of the new eco-bio-economic cluster, based on the combination of characteristics from three types of clusters: bio-cluster, research in education cluster, sustainable development and social inclusion and innovative regional cluster;
- Implementation of creative industries for the "Five for All" type cluster through procedures developed by two specialized teams: the sustainable development management network Smart Network - SN and the CIPT (Creativity and Intellectual Property Team). One of the main objectives followed will be the efficient capitalization of scientific publications in different areas of interest;
- Development of a hypothetic model for the new eco-bio economic cluster "Five for All", for county Dâmbovița, from the South – Muntenia development region.

Chapter 6 Theoretical and applied research on improving the sustainable development management for SME's through modeling and simulation techniques

The methodology for creating a new type of eco-bio-economic cluster (using the „Five for All" model), is based on a ten step algorithm:

1. Identifying the main regional work systems;
2. Identifying the main work systems based on industrial/agricultural production;
3. Identifying SME's with industrial/agricultural production activities;
4. Identifying SME's that represent the relevant industry/industries for the analyzed region;
5. Identifying the main sector concentrations (industrial parks, integrated business complexes, and others);
6. Identifying SME's operating in the service area;
7. Identifying rural households with SME status;
8. Identifying rural households with FA status (Family Association);
9. Identifying popular craftsmen and the main crafting activities specific to the region;
10. Identifying and classifying work systems (Work force + Work task + Production means + Work environment) that can be integrated into e regional eco-bio-economic cluster on the short/medium/long term.

The connection between the competitive advantages of eco-bio-economic clusters and the sustainable development process is shown in figure 6.1. The competitive advantages are strictly connected to organizational performance and are generated through competitiveness factors and can be balanced by noncompetitive advantages (due to policies/erroneous regulations); the schematics are shown in figure 6.2. Competitive advantages for strategic alliances in eco-bio-economic type clusters can be better capitalized benefiting from the results obtained from the simulation of different activities from organizations belonging to the cluster.

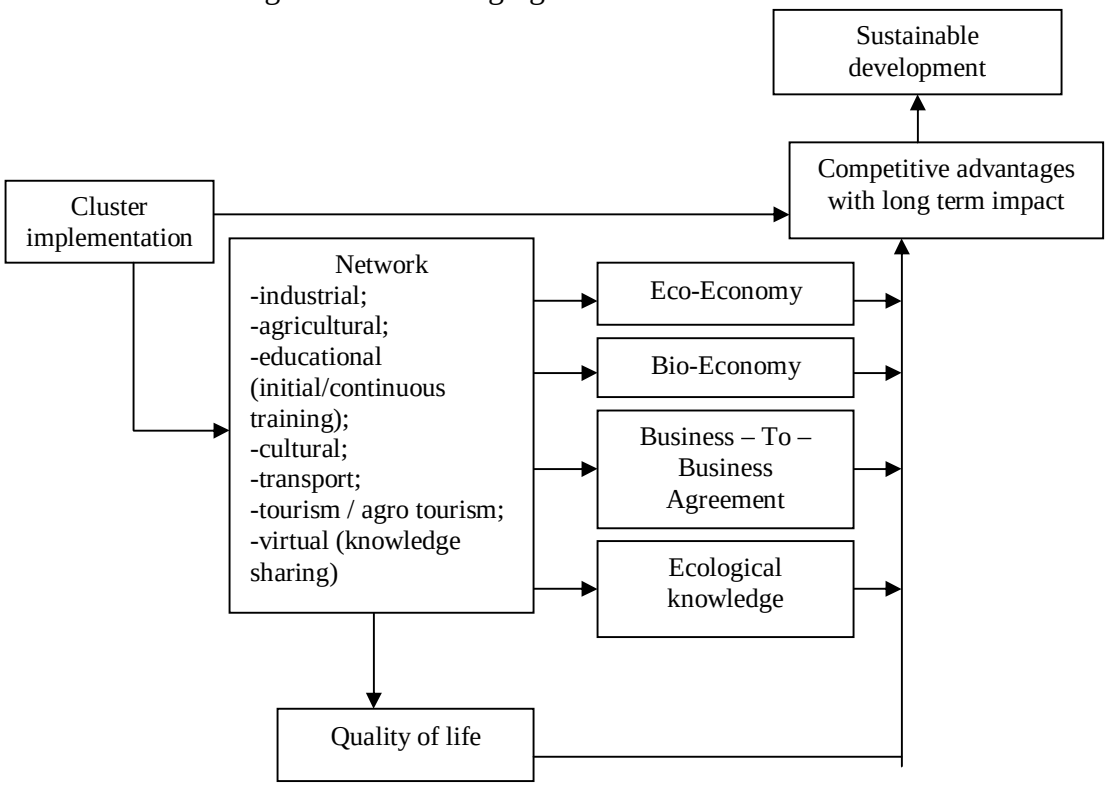

Figure 6.1 Connection between competitive advantages of eco-bio-economic clusters and the sustainable development process

The main objective for process simulation is represented by the passing from the current status („as is") to the desired one („to be") and is done by:

- Checking new studies, project, programs and systems prior to resource allocation and consumption;
- Determining new cause and effect type relations;
- Time compression or expansion;
- Determining the most important variables for achieving goals and their inter correlations;
- Identifying blockages in material, information and production flows.

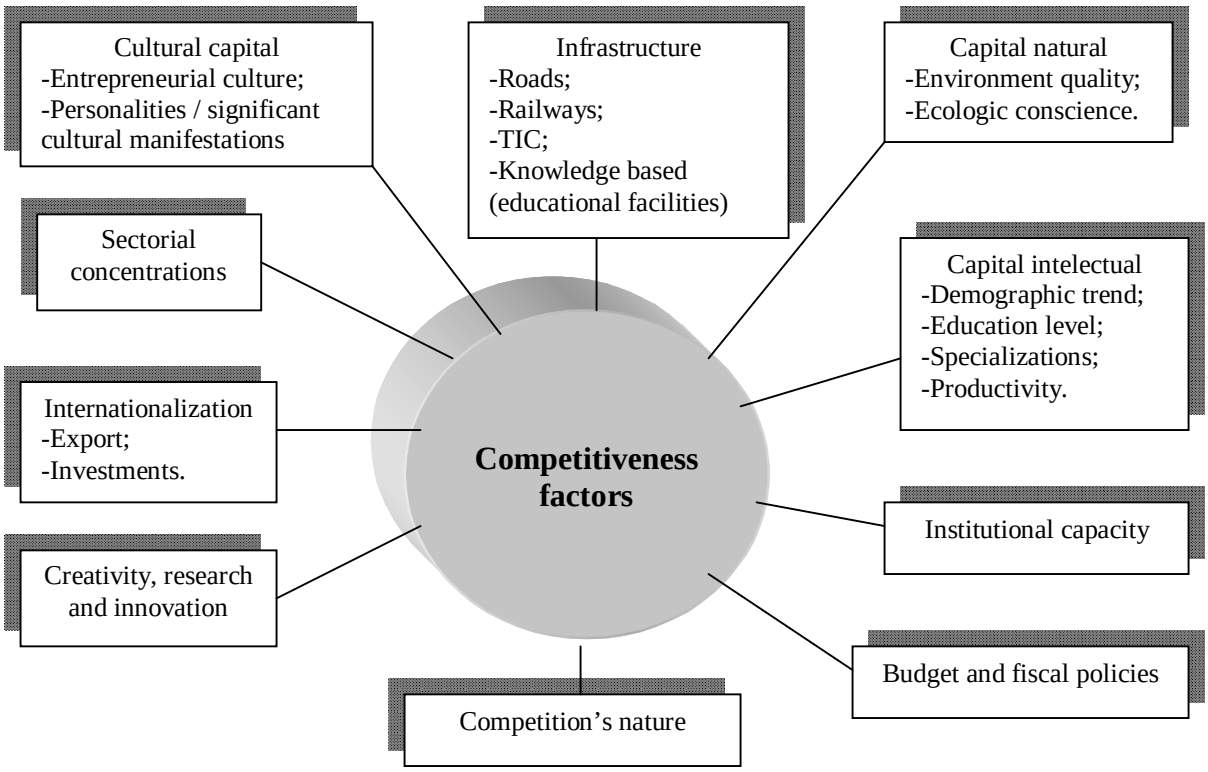

Figure 6.2 Competitiveness factors

Using the informatics software "Arena", processes involved were simulated for five problems. In order to obtain a conclusive number of results (outputs) a number of 29 simulations were performed referring to:

- Combining eco-bio-logistics components belonging to the cluster;
- Biogas production and consumption in rural areas;
- Technological manufacturing process for Porotherm ceramic blocks;
- Production and restoring of handcrafted and household items;
- Continuous professional development for employees of organizations belonging to the cluster.

The schematics for the combination of eco-bio-economic components belonging to the cluster (problem 1) are shown in figure 6.3.

Following the 8 simulations done for the first problem (table 6.5), the following categories of results were obtained:

- The medium/maximal waiting times for baling and sorting;

- Occupancy rate for every work station;
- Number of entities that transited every work station;
- Average number of entities going out of the system;
- Identifying the number of optimal situations for every operation in the technologic process.

Table 6.5 Average values for the simulation's results (selection)

Result	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	Medium values	Minimal values	Maximal values
Bailing average waiting time [hours]	0.65	0.06	0	0.44	0.44	0.44	0.13	0.14	0.2875	0	0.65
Bailing maximal waiting time [hours]	6	0.2	0	0.91	0.91	0.91	1.06	1.01	1.375	0	6
Degree of occupancy for bailing [%]	31	18	4	37	37	37	39	42	30.625	4	42
Average number of entities out of the system [type 2 bales]	95	386	130	386	260	386	576	638	357.125	95	638
Number of optimal situations	**3**	**4**	**0**	**5**	**4**	**4**	**2**	**1**			

The main contributions and advantages resulting from the simulation of eco-bio-logistic component combining belonging to the cluster are:

- Possibility to implement and improve the vegetal biomass collection process at a regional level;
- Increased efficiency or products and people transport at a regional level;
- Possibility to implement and improve collection and distribution activities for different categories of products/wastes (including the development of work at home), at a regional level.

6.4.1 Identifying traditional regional components (T_R). Calculation methods

The relation for calculating regional traditions (T_R) is:

T_R = Educational values (V_E) + Cultural values (V_C) + Technical values (V_T) + Community experience (E_C) **(6.1)**

The measurement unit for regional tradition will be called „Traditional values", abbrev. [VT], where:

V_E = Number of teaching staff (excluding engineers and foreman) + Number of learning institutions (excluding those with a technical/technologic profile) + Number of suppliers for continuous professional training;

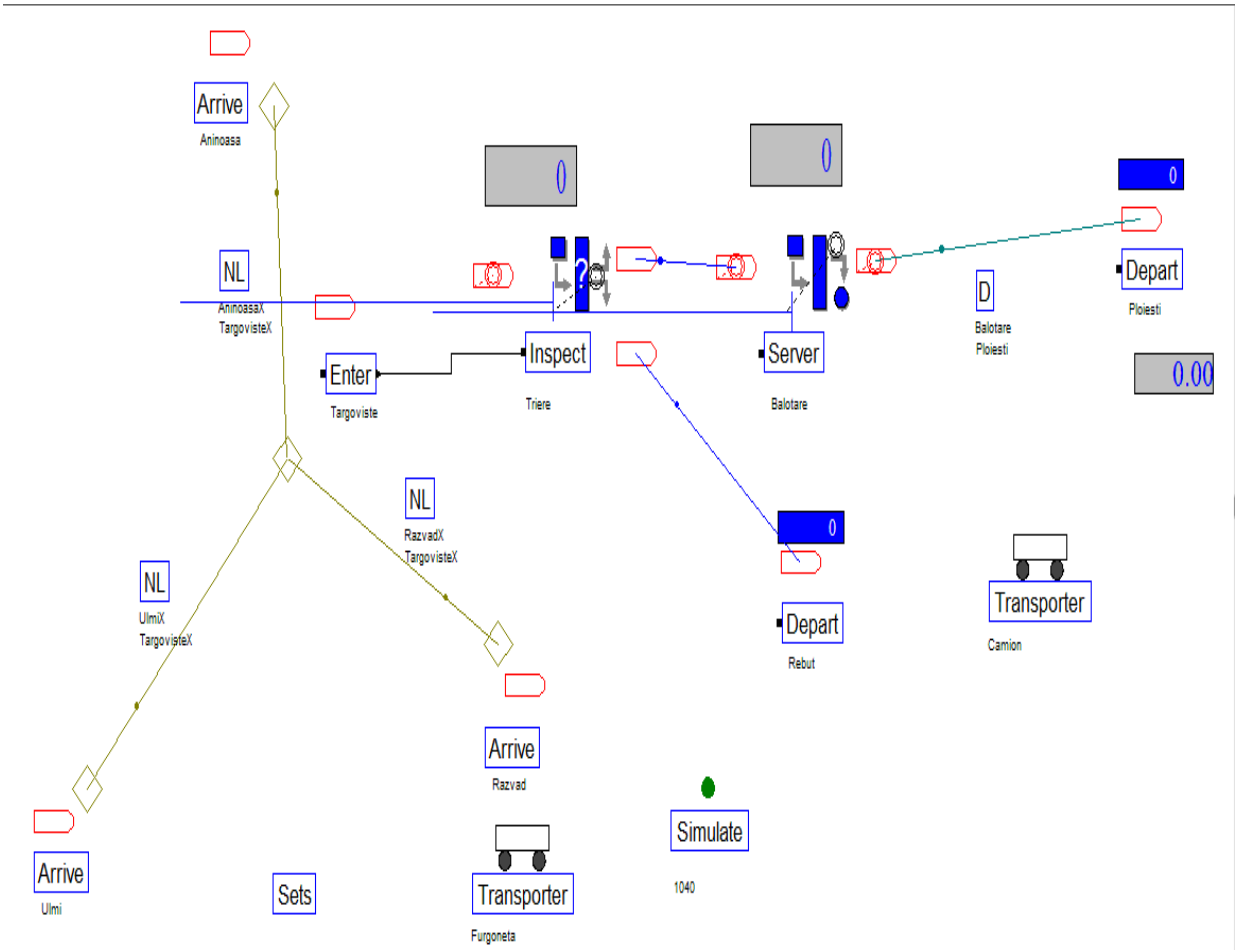

Figure 6.3 Modeling of collecting, sorting, baling and transporting vegetal biomass

V_C = Number of cultural institutions (theaters, museums – excluding technical museums, opera, movie theaters, libraries, philharmonics, castles, monasteries, mosques and others) + Number of traditional products specific to the region (homologated or not) + Number of holidays / customs specific to the area/region + Number of heritage buildings (included or up for inclusion) + Number of monuments celebrating certain personalities / historic events + Number of popular craftsmen + Number of plastic artists (members of the Plastic Artist Union) + Number of components in the specific traditional costume for the area / region (shows hard work, inclination to the beautiful and desire to be different) + Number of specific traditional / fiddler music bands registered locally / regionally;

V_T = Locality's zoning coefficient (P_Z) * [VTU (technical urban values) + VTR (Technical rural values)]. To conclude,

$$V_T = P_Z * (VTU + VTR) \qquad \textbf{(6.2)}$$

Where:

VTU = Number of organizations with the main activity "Production" + Number of technical museums + Number of technical teaching staff in the educational system (engineer and foreman) +

Number of education institutions with a technical / technologic profile (technologic High school, technical college, Polytechnic / technical University and others);
VTR = Number of natural / legal persons with the main activity "Production" (mill, popular craftsmen and others) + Number of agro tourism guesthouses (as they preserve / continue local / regional traditional recipes and customs);
$\mathbf{P_Z}$ = Locality's zoning coefficient (established by the "Romanian Evaluators Association").
$\mathbf{E_C}$ = Number of programs that contributes to the involvement / assistance of members of the community and leads to sustainable regional development NPD + Number of community art programs (territorial training art that forms community conscience and sensitizes civic perception NPA.
So:

$$E_C = NPD + NPA \qquad \textbf{(6.3)}$$

Chapter 7. Final conclusions and original contributions

7.1 General conclusions

Sustainable development for small and middle sized enterprises happens in the context of globalization, which started through the most important management phenomena of the 80's, that is "fusion" and continued after the 90's by replacing capitalist economy with a new "knowledge based economy".

1. Following the analysis for the present situation of SME's sustainable development the following elements/phenomena were defined:

- globalization's dimensions and causes;
- architecture and features for an enterprise;
- SME's expansion (and methods used) considering the appearance and developments of the sustainable development concept, with emphasis on quality of life and the interdependence between economic and social sustainability.

The main observed negative phenomena were:

- The GDP macroeconomic indicator created a false image on the existing capacity/development level for a country;
- An important cause for the lower number of SME's (especially in Romania) was the population's increased indebtedness;
- the self-employment percentage does not reflect reality (desire to be independent) but is a result of the global economic crisis.
-

The main solution for the expansion of SME's (and the middle class) is represented by their inclusion in regional strategic alliances based on knowledge sharing, development of volunteering / student work placements and business-to-business agreements.

2. Considering researches on processes involved in the acquiring, transfer and integration of knowledge in SME type organizations, the following elements were analyzed:

- the necessary steps for creating organizational knowledge;
- the main processes involved in the acquiring and transfer of knowledge;
- points of view on knowledge integration in sustainable development management and policies and forms of integration for this purpose.

Some of the measures to be implemented are:

- **development of efficient procedures for knowledge sharing;**
- **approaching the knowledge sharing process through specialized virtual teams.**

3. In order to identify and capitalize intangible assets (as a method of evaluation for SME type organizations) the interactions between welfare and different types of assets were analyzed – through the life cycle of intangible benefits – following stages/phenomena such as:

- defining assets and immobilizations;
- analyzing steps that lead to the identification, capitalization and exploitation of intangible assets;
- identification of a new category of intangible assets (the social-professional area);
- analyzing welfare as a result of interaction between tangible and intangible assets;
- analyzing the intelligent behavior of knowledge based organizations.

For an efficient knowledge capitalization the following legislative measures need to be taken:

- **the evaluation of incorporeal assets need to become an exact science, based and clear methodologies and formulas;**
- **establishing exact depreciation periods for incorporeal assets, considering the interactions between enterprises and market;**
- **a better explained/detailed classification of intangible assets.**

4. Using the formula for calculating the number of knowledge – developed by Russ, M. Jones, J. and Fineman, R. – required for the identification of new elements and the development of new hypothesis necessary for determining organizational knowledge:

- identifying existing systems for the analyzed enterprise;
- identifying knowledge generating processes;
- establishing two simplifying hypothesis for the minimal number of systems for a natural person (3 systems) and a legal person (7 systems).

Results obtained referring to the production of knowledge in different size companies clearly explain the present economic phenomena in the context of the global crisis:

- **most small companies become insolvent or bankrupt due to the low volume of accumulated knowledge;**
- **most small and medium sized companies disintegrate into smaller, geographically dispersed companies in order to occupy new markets and so the great volume of knowledge is shared between dispersed entities.**

5. Analysis of connections between systems and processes has led to the generation of new knowledge in the area of sustainable development and has resulted in the establishment of new indicators and coefficients for organizational performance:

- the multiplication coefficient expresses the number of new knowledge resulted from processes of evaluation and capitalization of initial knowledge;
- the attack coefficient allows for the evaluation of knowledge impact on different entities (individuals, organizations and others);
- the association coefficient is determined based on the number of knowledge sets (combinations) that contain common attributes;
- the shining coefficient is determined based on the percentage of original elements found in the acquired knowledge;
- the efficiency of knowledge gained by the learning organization calculate based on the previously established coefficients;
- the performance indicator for intangible assets calculated using relation 4.5., is based on two coefficients for incorporeal assets: internal and external refinement;

Using the new sets of indicators and coefficients for "learning" organization's performance will lead to a reclassification of companies at the top and of learning institutions and continuous training units as suppliers of intellectual capital for organizations of the future.

6. Considering that one of the applicative practical contributions consisted in the development of a new type of cluster, a conceptual analysis model was developed for the processes that lead to the success of strategic alliances. This model developed from the studies performed is based on elements such as:

- analysis of processes that lead to the failure of strategic alliances;
- implementation of efficient methods (project/strategic partnerships) for adapting organizations to environment changes;
- introduction of efficient activities (communication, creativity, innovation, production, sustainable consumption and others) which lead to the accumulation and transfer of knowledge and their efficient use in the process of regional sustainable development;
- equitable benefits distribution for alliance members.

By using this type of analysis at a regional level (based on specific elements), activities and implemented measures will be identified; efficient ones will be shared and less efficient ones will be improved or eliminated.

7. Following the performed researches an analysis of the interdependence between conscience, knowledge and modeling-simulation techniques was performed with the main objective of modeling a new circle of knowledge (Knowledge Circle). This was possible due to another practical contribution of improving sustainable development management for SME's through modeling and simulation techniques. This analysis is based on the existence of three common elements: logical thinking, information and experience. The Knowledge Circle developed form performed researches has the following process categories:

- evaluation, accumulation and exchange of information;
- transforming information into knowledge;
- implementing strategies for maximizing the impact of new knowledge;
- using knowledge in the work process for completing the organization's tasks which leads to the buildup of experience, one of the main criteria by which managers evaluate employees being experience gathered and shown;
- when new highly complex problems appear even if an individual has a significant expertise in that area he starts asking questions, has objections to other people's suggestions and he himself offers suggestions based on his own experience and expertise;
- new knowledge corroborated with gained experience leads to the presentation of solid, serious arguments by the individual that can bring plus value to the organization' products or can lead to significant savings in materials, energy, time and others.

The efficient use of connection between thinking, information and experience will lead to an increased role and importance for industrial psychology that develops man-machine systems considering human capacities and limitations.

7.2. Theoretical and practical original contributions

1. As the present scientific research refers to the integration of knowledge based management, a first requirement was the development of a knowledge sharing procedure. This procedure describes the acquiring and efficiently sharing/transfer of knowledge between

cluster members and partners using methods/techniques/strategies coordinated by a successful knowledge transfer center.

The developed procedure is applied in the knowledge sharing/transfer process for all entities with responsibilities in the area ok knowledge management and consists of the following elements:

- correlation of the knowledge sharing process with the necessary steps for implementing a system procedure for a cluster type strategic alliance (establishing area of applicability, defining the used terms, usual abbreviations, official documents referred to and others);
- establishing responsibilities for entities involved in the knowledge sharing process (successful knowledge transfer center, entrepreneurial excellence center, pilot center for cooperation and development in the bio-eco-economy area and others);
- Development of a calculation form for the number of knowledge created and shared (K_{CT}) in an organization (Transfer Knowledge Form 1), based on an innovative combination between Gantt diagrams and the After Action Review (AAR) method;
- Development of a form for processing and efficiency of an idea's results (Transfer Knowledge Form 2), using the SMART method. This lead to establishing the applicability rating for an idea's result depending on the level of geographic dispersion (local, regional, national or international) and to the implementation of a formula for calculating the number of knowledge acquired and shared from the processing of an idea (K_I);

2. Establishing creative bio-communities as a first step in the creation of sustainable regional strategic alliance represents the foundation for the new knowledge based sustainable regional development. A specific procedure that shows the main stages/functions for the implementation of a creative bio-community was developed:

- combining the ability to understand new bio-economic mechanisms with average skills for using TIC, for an efficient knowledge sharing ;
- developing partnerships and strategic alliances with all interested entities;
- creating new decision making mechanisms through regional strategic alliances (SME's, NGO's, universities, clusters and others);
- determining the community's size and geographic limits/ defining and evaluating the needs of the regional bio-community;
- establishing the community's purpose (mission) and its main strategies;
- establishing specific objectives and priorities in the bio-economic area as well as the main functional areas (health services, agriculture, education, transportation, sustainable development and others);
- defining the new innovative and creative concept for bio-communities as well as the new laws, rules, regulations and necessary attitudes for gathering and supporting a proper creative and innovative work force volume;
- establishing responsibilities and terms for meeting the community's plans;
- determining and analyzing functioning methods for the community's plans: public-private partnerships, strategic alliances (for example an eco-bio-economic regional cluster), strategic networks and others;
- corroborating sustainable development regional strategies with elements specific to the community: demographic, social and cultural characteristics, main characteristic of existing soils;
- supporting a creative and innovative community through energy conservation mechanisms, focus and commitment from the community's members.

3. Following performed researches and studies a new type a cluster was developed and implemented, "Five for all", superior to previous models "Triple helix" and "Four clover" type. Unlike the "Four clover" model, the new "Five for all" cluster (built on the "Smart community" concept) contains a sustainable development management network, called "Smart Network".

4. Starting from the attempt to unite the concepts of eco-economy and bio-economy in a new integrated concept of "Eco-Bio-Economy", a new sustainable development model for Romanian SME's was developed through a regional eco-bio-economic cluster; this model combines the characteristics of three types of: bio-cluster, research in education cluster, sustainable development, social inclusion and innovative regional cluster. The steps taken in the development process of the new cluster are:

- implementation of a methodology for creating an eco-bio-economic cluster (starting from the „eco-bio-economy" concept), using the "Five for All" model;
- creating a specialized management team ("Smart Network"), to handle the coordination of the created cluster, composed of five managers: Knowledge Manager, Sustainable Development Manager, Migration Manager, Facilities Manager and Transverse Manager;
- establishing the main characteristics of the new eco-bio-economic cluster, based on the fusion of characteristics from three types of clusters: bio-cluster, research in education cluster, sustainable development, social inclusion and regional innovative cluster;
- implementation of creative industries for "Five for All" type clusters through a procedure developed with two specialized teams: sustainable development management network Smart Network - SN and CIPT (Creativity and Intellectual Property Team). One of the main objectives will be efficient the capitalization of scientific publications in the area of interest;
- development of an hypothetical model for the new eco-bio-economic cluster "Five for All", at a county level for the South-Muntenia development area.

5. In the context of the development of a new type of cluster "Five for all", severeal practical applicative contributions were included, such as:

- establishing new ways for cluster regional coordination ("Smart Network" team);
- defining research in education, sustainable development and social inclusion clusters as an integrating part of the new eco-bio-economic strategic alliances (clusters);
- creating a highly specialized team in the "mix" between creativity and intellectual property, called "Creativity and Intellectual Property Team" (C.I.P.T.), with a significant part in the implementation process of creative industries.

6. The main practical results following the researches performed were obtained using modeling and simulation techniques (using UML - Unified Modeling Language and Arena software) for sustainable development processes in SME's belonging to eco-bio-economic cluster. Here are some of the main results obtained using the ULM and Arena software:

- creation of new possibilities for the development of knowledge based production processes, production/use of biogas, collection/use of biomass, manufacturing ecologic products, development of educational products/processes and crafting industry from the experiences and results obtained in the modeling-simulation process;
- ensuring perpetuation and a quantification of the perpetuation process for specific values of the Romanian people;
- ensuring the necessary logistics for implementing studies and traditional products production in education institutions;

- development and implementation of a calculation formula for regional traditions (T_R), mainly based on technical rural and urban values;
- development of a practical application for an evaluation process of a company's employees (Focal Point Review), consisting of four sections accompanied by specific examples and comments;
- creation of a questionnaire for comparing experiences gained by the employees in the process of Continuing Professional Development (CPD);

*
* *

Where communities are very poor / vulnerable the support for cluster type strategic alliances is essential. Starting from the creation of portfolios for local/regional traditions (mainly done through student volunteering) social enterprises can be implemented (by cluster NGO's) for the production and selling of products, such as: agricultural products, handcrafted products, textiles, toys, decorations, food products and others.[1] Also, this category of enterprises will be able to develop business-to-business agreements and generate satisfaction of needs for vulnerable groups.

7.3 Future research directions

Following performed researches we can conclude that some of the most important future research directions are:

- for the management support of SME's, an analysis on the implementation of a sustainable development management network for each county is necessary (of a Smart Network type) after a proper and complete evaluation of the existing sustainable development capacity focused on rural and small urban communities;
- evaluating the possibilities for the implementation of creative industries depending on the potential/characteristics of each county through the CIPT (Creativity and Intellectual Property Team) type teams;
- an evaluation (in the first stage) of entities intending to form a regional cluster (and by extension of their partners) form a knowledge management perspective;
- a "virtual" involvement of high school and college students in the process of knowledge production and sharing through volunteering. Activities will be mainly focused on the following directions: local/regional development, adapting educational programs to the new social and economic conditions and increasing the quality of future students;
- Modeling and simulation for processes considered to be „desirable" by Smart Network & CIPT teams;

*
* *

Following the researches performed for the doctoral thesis a number of 16 papers were published, 2 as only author, 5 as the first author and 9 in a collective. Six of the published papers are indexed in different international databases (ISI Web of Science, Google Scholar, ProQuest, Index Copernicus, EBSCO Publishing, WorldCat, Engineering &Technology, URLICH'S and others), while 10 are published in international conferences proceedings (also indexed), in countries such as: USA, Switzerland, Singapore, United Kingdom, Bosnia - Herzegovina, Moldavia etc.

1 *** Guide for constituting a social enterprise in rural areas for agricultural and handcrafted products. From Project POSDRU/84/6.1/S/53513

As a result of the quality of the published scientific papers (for excellence in sustainable development) I was coopted as a member of the „International Society for Development and Sustainability" in Japan.

Following the study on correlations between change management and sustainable development management (in crisis conditions) I was invited to be a part of the „Editorial Board" team for famous publishers „Sciedu Press" Canada, organization with main objectives for excellence in science, education and culture.

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