INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED'09
24 - 27 AUGUST 2009, STANFORD UNIVERSITY, STANFORD, CA, USA

DESIGNING AN ENTREPRENEURIAL MINDSET IN ENGINEERING AND MANAGEMENT

Sten Ekman[1], Annalill Ekman[2]
(1) Mälardalen University, School of Innovation, Design and Engineering, Sweden
(2) Munktell Science Park, Eskilstuna, Sweden

ABSTRACT
The purpose of this paper is to discuss how to design entrepreneurial mindsets in different academic cultures and its motives with focus on engineering and management education. Empirical data are collected from, Sweden, Ukraine and India in a ten-year period from 1998-2009. The theoretical framework is based on an integrated view of innovation, design and entrepreneurship sciences. Our findings are that it is quite possible to open up more traditional or narrow mindsets of engineering and management to more broad and multi-scientific approaches, relevant in our complex world. An entrepreneurial mindset has close links to innovation and is characterized by relentless pursuit of opportunities, thinking different, intuitive and executive, is risk-taking and eliminates pre-existing routines. It focuses more on technology and business creation than on state-of-the art technology and business administration. In this approach the culture and climate in an organization and the eco-system around the universities also can be changed to high-light creativity, design and innovation. We have learnt that a strong, open and visionary leadership is necessary in such a challenging work.

Keywords: Design Inspired Innovation, Entrepreneurship, Mindsets, Multi-scientific approach.

1 INTRODUCTION
In the first part of this paper an introduction of motives of new mindsets will be discussed followed by some methodological aspects. A theoretical framework is presented, which is relevant to the following part of the empirical studies from Sweden, Ukraine and India. A conclusion will end the paper.
In a world of higher complexity and rapid changes with new opportunities in engineering, in product and process development intersectional collaboration is growing in importance. In a research study and a book – *Design Inspired Innovation* – where one of the authors of this article was a member of the team – it was obvious that the communities of innovation, technology and design today are merging. The boundaries seem to be more blurring to meet these new challenges and also to broaden human possibilities with more user friendly and meaningful products. It requires *creativity and different thinking*, whether the products are of professional tools, machinery for production, new types of active wheelchairs, daily consumer goods, or services. [1]
Most innovative products and services spring not from particular industries or disciplines, but rather across them – the so called *Medici Effect* [2]. Medici referring to the Medici-family in Italy in the Renaissance period, who sponsored people from different disciplines and made Florence to an epicentre, an intersection and one of the most creative eras in Europe´s history. This intersection can also today be a place – a milieu – where ideas from different fields, disciplines and cultures can meet, leading to new ideas, new products and to innovations. Thus a multi-dimensional approach is necessary, where engineers, designers, entrepreneurs, psychologists, economists and others collaborate.
The importance of *creative milieus* in science and research has also been observed in the work of Nobel Laureates. Examples are the environments in which many of them have lived and worked. "The creative process is extremely dependent upon the individual´s surroundings. Often, new ideas spring forth in ´border areas´ between different disciplines. Unexpected cross-disciplinary encounters may result in new combinations of knowledge of ideas." [3, p. 175] The *climate metaphor* applied in social settings has sometimes been used for organizational creativity and to build an innovative organization. The dimensions are challenge, freedom, idea time, dynamism, idea support, trust and openness, playfulness and humor, conflicts, debates and risk-taking. All of these 10 dimensions correlate positive

with performance of creativity and innovation in organizations. The exception is conflicts with correlates opposite – many conflicts counteract performance. [4]
In an *era of open innovation* [5] and *democratizing innovation* [6], where people from inside as well as outside companies are inspired to develop and implement their ideas, these dimensions are important and relevant. Companies as Lego, Procter & Gamble and Google are some of the companies, who are increasingly rethinking the fundamental ways in which they generate ideas from both outside and in-house R&D. Special web sites for open on-line marketplaces in problem solving, idea exchange and innovation are growing as www.innocentive.com and www.ninesigma.com.
In this ´open and global society´ young people broaden their perspectives on where, how to and when to work. They want to realize their ideas, be their own coaches and get an education that encourages initiatives in their professional work, in creating jobs, products and entrepreneurship. The young generation does not believe that the society will take care of them in the future. More and more young people look for alternatives to traditional employment. Individualization, freedom and flexibility are some explanations. They also expect that the educational system will support creativity, idea generation and entrepreneurship. [7, 29]
Another reason for entrepreneurship is economic growth. Entrepreneurship encourages economic growth for three reasons; 1) to encourage competition by increasing the number of enterprises; 2) by the mechanism for knowledge spill-over between organizations; and 3) it generates diversity and variety among enterprises [8]. Small companies stand for most of new working opportunities and a large part of new and innovative products and services. In the global financial and economic instability today, when large companies are down-sizing, thinking ´lean´ or closing down the individual must even more think of how to provide for her or his own living and development in new ways.
The situation in developing countries is even more crucial to foster entrepreneurship. Here is the unemployment rate already high and the young generation is rapidly growing. Entrepreneurship is often the only possible solution to survive. In the developing world it has also been more possible for millions of poor people all over the world by new systems of micro-loans. Some of these new providers are Grameen Bank and ICICI Bank, which has helped especially women to start their own small businesses and become entrepreneurs including education in entrepreneurship for their daily living and a better life for their families. [9, 10]
In United States, *Entrepreneurship Education (EE)* has grown in the last decades. What can we learn? Here are some facts from business schools MBA/BS-students: Students from EE-programs are more active in starting new companies compared to traditional schools. Entrepreneurship has become a change agent in education – in general. 253 colleges and universities in the 1980s have grown to about 1600 in 2004 which provide courses in entrepreneurship. EE is not as traditional BS-program to *learn about* but more of *action-oriented learning and doing.* This is not just in business education but also in engineering, design, liberal arts etc. [11].
But to change paradigm and policies in academic institutions take time and it is a great problem worldwide today that talented people at universities today do not get relevant education in designing their future. Still most education focuses learning existing technology or business administration instead of innovation and design linked to engineering, or business creation and entrepreneurship. To succeed with the great challenges for the future of alternatives to employment and meeting the needs of people, we must start rethinking our educational systems in *designing for entrepreneurial mindsets* and support the motivation of the new growing engineering, business-business and social-business entrepreneurs.
The purpose of this paper is to discuss how to design entrepreneurial mindsets in different academic cultures of engineering and management education. The theoretical framework is based on an integrated view of innovation, design and entrepreneurship sciences.

2 METHODOLOGICAL ASPECTS

In focus of this study and paper are three different academic cultures – universities and institutes – with their surrounding eco-systems of partner companies, organizations and national characteristics. Empirical data are collected from Sweden, Ukraine and India and the studies have been carried out over a relatively long period of more than 10 years, 1998-2009. In such a long term study the researchers are focusing more on processes and context and less on specific variables and results and more on exploring than proving in the organizations. [12]. Members of the universities including students are co-actors in the dialogue and creation of activities and implementation. When you as a

researcher also are acting in the processes, a challenge is to balance nearness-distance between researcher and the members of the organization in such an "action-like approach".
The research and development activities are carried out in the field with qualitative methods and the design has developed and grown throughout the research process. By continuously having a dialogue of the processes, findings and results with the members of the organizations and to adjacent studies validity can be achieved. It is also important to describe the actual case carefully and only to draw conclusions that are valid exclusively for similar systems. Researchers and co-actors from different universities as well as practitioners from many companies have influenced and evaluated the processes, the results and the use for the future of this study.

3 THEORETICAL FRAMEWORK

A *mindset* is a person´s way of thinking and their options in her different roles as a working person, a leader, a family person and a citizen. In *Five Minds for Future* the American psychologist Howard Gardner defines an integrated future mindset of cognitive abilities that will command ahead. The first one is the disciplinary mind – mastery of some major schools of academic disciplines and/or of at least one professional craft. The synthesizing mind – is the ability to integrate ideas from different disciplines or spheres. The creating mind – is the capacity to uncover and clarify both new problems and opportunities, both questions and phenomena. The respectful mind – focus on awareness of and appreciation for differences among people and the fifth is the ethical mind – fulfilment on one´s responsibilities as a working person and citizen. [13]
An entrepreneurial mindset includes at the best some of all the five minds. Dealing with innovation and entrepreneurship an *entrepreneurial mindset* should include both thinking and action in a professional way. The entrepreneur is agent of entrepreneurship. She is creative in search for opportunities and is able to synthesize a lot of different skills. Ethics and respect for diversity and our environment must always be present in business as well as in public activities today.
The terms entrepreneurship and entrepreneur were introduced together with innovation – even if these words had been used before – in a macro-economic and scientific context by Schumpeter in the in the early 1930^{ths}. He focused on innovation and the role of entrepreneurship as an act of *creative destruction* that, by introducing new products and processes, increases productivity and promotes economic growth. [14] Both innovation and entrepreneurship have broad views according to Schumpeter. It is not just about businesses for profit, it is also about new ventures and activities with social perspectives and other value-creating activities and objectives in focus. A wide consensus exists, that growth expectations and innovativeness are fundamental aspects of the entrepreneurial process. Drucker has about the same opinion in linking entrepreneurship to innovation, saying that "the term of entrepreneurship, does not just refer to an enterprise´s size or age but to a certain kind of activity. At the heart of that activity is innovation. The effort to create purposeful, focused change in an enterprise economic or social potential". [15, p. 3] Today we regard entrepreneurship as well as innovation and design as disciplines – in research and practice – with their own research communities, methods etc.
Design is also a goal- and action-oriented activity – with professional tools to visualize our thoughts and our creativity into something useful, sometimes elegant and perhaps also tells us a message. For products realized today it is not sufficient with good function, form and aesthetic appearance. The product must also emphasize simplicity and economy of means and low impact but also tells us a message we can identify ourselves with. It could be a mobile phone, a car, a piece of furniture, spectacles or a wheel chair. In the merging processes of technology-innovation-design three types of knowledge are essential. It is knowledge about the user needs, technological opportunities, and product languages. The last component concerns the signs that can be used to deliver a message to the user and the cultural context in which the user will give meaning to those signs. [1][1], see figure 1.

[1] The study *Design Inspired Innovation* was carried out in 2001-2006 in four countries, USA, England, Italy and Sweden with over 100 industrial design, engineering and innovation consultancies and about 20 more large companies. The research team was from Massachusetts Institute of Technology/MIT, University of Manchester, Politecnico di Milano, Rensselaer Polytechnic Institute and Mälardalen University of Sweden. The findings were published at conferences and in a book with content as What makes products great; Creating design classics; Managing the design process; The work of designers; Design-inspired innovation and the design discourse; Broadening human possibilities through design. Design and engineering students from Sweden were also contributing with their projects.

Figure 1. Design as the integration of technology, needs and language. [1]

The most of academic education is however still characterized of analysis and argument and not by a broad design perspective. With analyses we are interested in *what is* – to describe the cause of a problem and to solve it. Professional work as well as education in design, innovation and entrepreneurship is more interested in *what could be* – to create or develop something new. This thinking is not just for some people with talents in the field, it is for all to use and to develop. All people have abilities and capacities to learn and develop different mindsets including different kinds of creativity. It is not a question *if* you are creative, it is *how* you are creative and how you are allowed and encouraged to use your mind talents [16]. For example engineers need engineering design tools in component and product development. But they should also need some insight in industrial and interaction design tools to better understand the customer needs and the message the product will give. From a design approach a more holistic view on products and processes is also present.

We can find a similar difference in thinking in problem-solving or in opportunity finding. If our thinking style is focused on problem solving, we will miss or are less open to the variety of opportunities. It is a huge difference in thinking – and in cognitive mindsets – in getting a problem to be solved or disappear compared to search for new opportunities in creating something new. Of course we need both thinking styles, but we now need a changed balance between them. Divergent versus convergent thinking are other words to discriminate these thinking styles. [17]

Divergent thinking – and production – is linked to creative thinking. It is the generation of information from given information, where the emphasis is upon variety and quantity of output from the same source; likely to involve transfer. Divergent thinking is characterized by intuition, search and uncertainty. It is more of a creating than problem solving activity.

Convergent thinking and production is in the area of logical deductions or at least the area of compelling inferences. Convergent production rather than divergent production is the prevailing function when the input information is sufficient to determine a unique answer. Convergent thinking is characterized by logic, analyses, systematic, control and rationality.

In organizations and product development the two different thinking styles work in different ways and with different objectives. When convergent thinking dominates, a more bureaucratic, mechanical and administrative organizational and management style is prevalent. If convergent thinking is applied on product development, it is merely on problem solving with specified claims from customers, when the objective is to develop an inquired, good and correct solution. When divergent thinking dominates, a more open, democratic and need finding organization develops. Openness to product development will also open up for many alternatives to new products or innovations to new markets. A more traditional *engineering or mechanical mindset* based on control and predictability of technology is obvious in the former and a more *entrepreneurial mindset* based on idea generation, risk-taking and change is present in the other. But with risk-taking more failures also can happen. Most often the two mindsets co-exist in the same organization more or less. The difference is obvious also in management, communication, organizational climate and learning. [4]

In the framework of Global Entrepreneurship Monitor (GEM) – the largest single yearly study of entrepreneurial activity in the world – individuals start a business for two main reasons: They want to exploit a perceived business opportunity – *opportunity entrepreneurs*, or they are pushed into entrepreneurship because all other options for work are either absent or unsatisfactory so called *necessity entrepreneurs* [18]. Central in the GEM approach is the hypothesis of a causal relationship between entrepreneurial activity in the economy and the level of economic growth. The demand side is represented by entrepreneurial opportunity and the supply side by entrepreneurial capacity. These are affected in different ways by demography, education, economic infrastructure, culture [8], Figure 2.

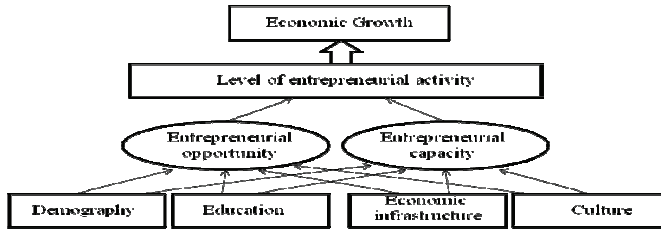

Figure 2. The GEM approach to measuring entrepreneurial activity. [8]

Scholars of entrepreneurship in a variety of disciplines agree that age, gender, work status, education, income, and perceptions are all significant socio-economic factors in a person's decision to start business – to become an entrepreneur. People with post-secondary or graduate educations are more involved in early-stage entrepreneurial activity. Established business ownership in both middle and high income countries does not show a similarly strong correlation with educational attainment. The relationship between entrepreneurial activity at all stages and education is unclear. This is perhaps because, that entrepreneurial ventures are the response to a variety of circumstances and present a variety of characteristics. [8, 18]

To summarize the present research on entrepreneurship on successful entrepreneurs we can identify some of the factors that affect the likelihood of establishing a venture. These include a combination of those which are largely inherent or given, and those which can be more easily learnt or influenced like; family and ethnic background, psychological profile and formal education and early work experience. If a parent, a sister or a brother is entrepreneur, it is more likely that more of the family members will follow. Most research agrees on, that entrepreneurs have some more common personal characteristics of thinking and acting in the society. Entrepreneurs have a relentless pursuit of opportunities, think different, are risk-takers and want to eliminate pre-existing routines. Their behaviours and focus are on both intuition and execution. [19, 20, 21]

4 DESIGNING ENTREPRENEURIAL MINDSETS – EMPIRICAL STUDIES

Around the world free markets have replaced planned and command economies. Traditional hierarchical structures are replaced by open, democratic and flexible forms of network on developing and producing new products and services. Markets and needs are rapid growing in industrialized and especially in developing countries. Nowhere is the *entrepreneurial revolution* so present than in Eastern Asia. [22]. In China and India this is extra ordinary. In *Billions of entrepreneurs* Kahnna writes about how China and India with their large young generation are much more motivated in reshaping their futures with entrepreneurship today [23].

The competition of talented and well-educated young people is fast growing in the corporate world as well as between universities around the world. Production and also innovation and development of new products and services are transferred from western to eastern parts of the globe. In this era of rapid changes and development of new markets, entrepreneurship is a growing and global important phenomenon.

Our empirical studies have a focus on university education of implementing processes of designing entrepreneurial mindsets in three different countries – Sweden, Ukraine and India. The three countries are representatives of three different parts of the world and also with quite different cultures and also with different academic cultures. This *R&D* started for more than ten years ago in Sweden 1998, continues in Ukraine 2005 and in India 2006, and is still going on.

4.1 Sweden: Innovation, Entrepreneurship & Design in Education and Research

Sweden is a small country with about 9 million people in North West of Europe within European Union (of 27 countries and about 400 million people in 2008). The GDP per capita is USD 33.890 (2006). On international ranking lists Sweden is always one of the top nations. Sweden is most often ranked among the top 5 nations in the world on innovation index and competitiveness as No 1 in 2005 on Innovation Index by UNCTAD and No 3 in 2006 by World Economy Forum in competitiveness including social factors as health care and education. It has one of the most knowledge & research

based economies (per person of GNP) in the world. The organizational structures and management are characterized by openness, team-work, democracy and consensus in decision making.
Sweden is also characterized by its proportion of large and multi-national companies (MNCs) as Ericsson, Volvo, ABB, Astra Zeneca, IKEA, but rather small proportion of small and medium size companies (SMEs). People and companies are bringing a lot of innovations to the market *but the number of new entrepreneurial companies is small in comparison to innovations.*
About ten years ago, some of us at Mälardalen University (www.mdh.se/idt), asked ourselves, if we could change this situation of high innovation but low entrepreneurial capacity? We realized that young people – students – at our likewise young university (just about 30 years old), want to develop their own ideas if they had the opportunities and a stimulating and supporting environment integrated in their daily studies to start their own companies. The time spirit was growing among the young generation of a more holistic and cross-disciplinary education. We felt, that the education system of traditional academic disciplines must be challenged by alternatives, when cross-functional work is growing out in the society and industry.
We put together a faculty team of teachers and researchers from different disciplines at our department and created a concept to be implemented in several programs in engineering, design and business education. Our objectives were a multi-disciplinary and an action-oriented teacher and student team-work, a student idea based learning style and a close cooperation with the surrounding industry and public organizations. Innovation and entrepreneurship were our key word.
An entirely new and multidisciplinary program was introduced for education, *The Innovation Program-IMTO®.* Half of the 3-4 years study period the students make a choice of either technology, or industrial design, or information design, or psychology or economics. The other half of the program focuses on innovation science and management with entrepreneurship. We combined student teams from the different and mentioned disciplines in a *Medici-way*. In this part we worked in theory and practice with innovation processes, creativity and tools for idea generation, intellectual property rights, business creation and planning, sales management etc. This program was awarded by The Swedish Entrepreneurship Foundation in 2000 as *The Best Entrepreneurial Program of the Year in Sweden*. In parallel we build a research program in Innovation Science and Management.
We removed our traditional engineering program and ´flagship´ of *Mechanical Engineering* and created the new five year civil engineering program of *Innovation & Product Design*, which included product and process development from a broad perspective from idea generation to market implementation. It included necessary engineering skills but also industrial design, innovation, entrepreneurship, management and personal leadership. Important to say is that we had full support from the university management and our industrial partners. The program became the most popular engineering program in 2002 at our university – and still is. The balance between male and female students is about equal and also between hard and soft skills. We cut down a lot of compulsory mathematics – also supported from our partner companies as Volvo and ABB – and made more efforts on creativity, team-work and social competence skills as communication.
We employed new teachers with experience from industry, design and entrepreneurship. Our teachers and researchers at our department represent a diversity of about 30 academic disciplines as engineering, computer science, economics, ergonomics, psychology, design and art, linguistics, journalism and natural sciences.
To support students – and teachers and researchers – at our department we established an *Idea Lab* (Idélab®), www.mdh.se/idelab as an incubator and more hands-on arena for development of entrepreneurship and to show alternatives to employment. It became a place – a milieu – where students, inspired by their courses and ideas, to get support. For some students the idea was most important, for some of them the idea and the Idea Lab was a starting point of develop their entrepreneurship in practice. The main objective of Idea Lab was to help the idea carriers to realize their ideas in a stimulating milieu, employed professional business advisors, mentors from the industry and to find ways of funding.
A lot of inspirational activities are running continuously as Idea competitions, Pre-incubation and Incubation workshops, Incubation work places for student incubators, Sales training, Open lectures by successful entrepreneurs etc. Idea Lab has so far of the first ten years been successful in supporting about 30-40 new companies to be established every year out of about 400 business ideas every year. In total more than 400 companies have been started up to 2008. Many more students are motivated for entre- and intrapreneurship and learn how create and develop business ideas for their future. A lot of

patents have been realized. About 80 percent of the new companies survive the first year. Some of the new companies have also been started by doctoral students and faculty members in their teaching or in their research.
The products and companies are working in a lot of different areas of products, services and processes in engineering, in retail, in design, in experience services etc. Companies have also been started from other departments of the university as energy and environmental protection, economics, computer science and informatics, robotics and also from teacher education, liberal arts and nursing areas. Two examples of ideas which have become companies and with their own products and patents are Desarollo and Zeal Core. The first is founded by one of the Innovation program students. It has now four patents of different products in four new companies. One product is a safety cable for large trucks (www.cableone.eu). Scania Trucks, one of the largest truck manufacturers in the world, is one of the customers. Zeal Core is another new company offering accelerated troubleshooting – a ´black-box´ recorder – of embedded software systems (www.zealcore.com). It is an emerging company with patented products in development and maintenance of advanced real-time systems in manufacturing industry. The founders are all researchers (doctoral students, doctors and professors) in computer science with focus on real-time systems.
In 2007, after about ten years from the start of our innovation and entrepreneurship initiative with new programs and Idea Lab, the university as a whole has pointed out innovation and entrepreneurship as core values for all departments in both education and research. The university is now organized in four multi-disciplinary schools. Idea Lab is now independent from the four schools by its own organization, but to support all schools with entrepreneurship training. In our School of Innovation, Design and Engineering we have established a new arena, *The Product Realization Center,* for building an intensive co-production of research and applied knowledge in *Innovation & Product Realization* close to present and future needs in industry and public organizations. Recently the university obtained ten year funding from The Knowledge Foundation in Sweden for implementing this strategy. Design Science with theory and methods from The Design Society and our findings from our research project (and book) on Design Inspired Innovation is a platform in our work. See Figure 3, a model of our concept of education and research. [1, 24, 25]

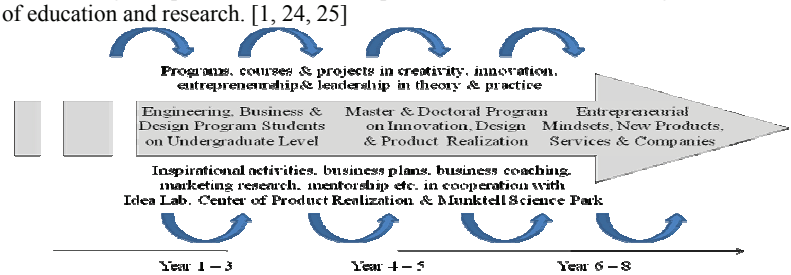

Figure 3. A model of educational and research programs in Engineering, Business and Design integrate with courses and projects on creativity, innovation, entrepreneurship, and to our incubators.

Our research profile of *Innovation & Product Realization* includes opportunities of entrepreneurial training with external mentors – entrepreneurs – for our doctoral students in cooperation with our partner Munktell Science Park (www.munktellsciencepark.se) and its Business Incubator. The objective is to develop an entrepreneurial mindset further on and integrated with his or her doctoral work and thesis.

4.2 Ukraine: Developing University Business Development Centers (UBDC)

Since 2005 we have been working on transferring and developing relevant parts of our concept of innovation and entrepreneurship together with Munktell Science Park to universities in Ukraine.
Ukraine is one of the largest countries in Europe with almost 50 million people and a part of what is called ´Eastern Europe´. The GDP per capita is USD 1.940, with a dominating mining industry in the eastern part. In the western part with closer links to Western Europe, a more differentiated industrial life is growing especially in the computer software sector – the Lviv region. Ukraine has declared clearly that is sees its future in the European Union and aspired for membership. It has a long history of both independence and of dependence and was for a long time part of Soviet Union and has also

been a part of Poland. From the collapse of the Soviet Union, Ukraine has been independent but with close links to – and pressure from – Russia.
Inspired by the friendly *Orange Revolution* in 2004, Ukraine is entering an open market driven economy. But the promises of the Orange Revolution are still unfulfilled. Lack of political stability and lack of trust from people to politicians and the state are low. The informal or so called shadow economy is large (~50 percent). The plan-economy with a bureaucratic structure from the Soviet time is still dominating and citizens are still to a large extent relying on ´someone else´ solving their problems or taking care of common goods. [26] The words *business* and *entrepreneurship* are still ´negative loaded´ in semantic terms for many people in Ukraine. They are not used to think in such terms. But there are important and positive signs of a more democratic and open society and in peoples´ attitudes to change.
Sweden is the largest bilateral donor among the EU Member States and one of the largest bilateral donors. Because of our experience of working with innovation and entrepreneurship at Mälardalen University, the Swedish Government by The Swedish International Development & Cooperation Agency (Sida) asked us at Mälardalen University together with Munktell Science Park to start a four-year project in 2005-2009, *The University Business Development Centers – UBDC – Project.* Our two partner universities are some of the largest state universities in Ukraine, The National Technical University of Ukraine in Kyiv and Ivan Franko National University of Lviv. The Ministry of Education and The President´s Office of Ukraine are also involved.
In the academic field Ukraine has a well developed education and research structure in most of the traditional disciplines and sciences as natural science, liberal arts, computer and engineering science etc. But in business, entrepreneurship, innovation and design there are few and those who work in these fields are private universities and institutes. The challenge is to introduce entrepreneurial thinking and acting as alternatives to traditional employment in state owned companies and public organizations and to open up the universities to the surrounding society and industrial eco-system.
In the 4-year project *University Business Development Centers (UBDC)* in Figure 4, below, the most important objectives and activities in the four phases July 2005 – June 2009 are summarized.

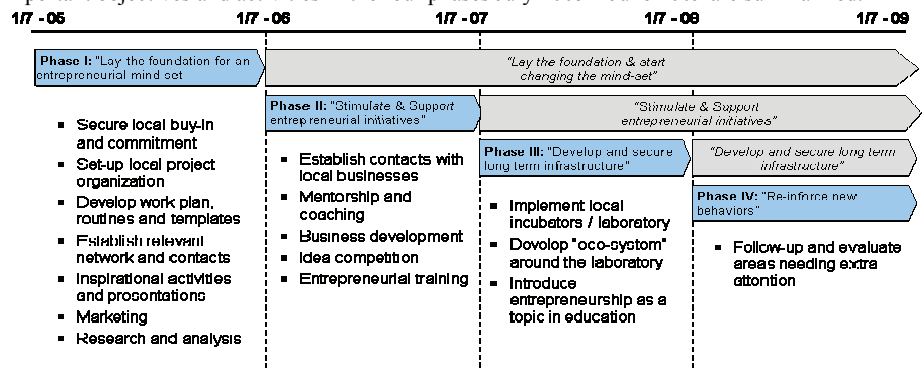

Figure 4. Overall objectives and activities in the 4-phased approach of entrepreneurship.

Together we set up and continually develop a project organization with people from the Swedish partners and from our universities (students, faculty and management), companies, business networks and external entrepreneurs and business advisors but also with Ministry of Education and President´s Office. The Swedish Government through The Embassy of Sweden and Sida in Ukraine is financing most of the project. But the universities have a commitment to finance some parts.
Throughout the project we have implemented a lot of activities as Inspirational Activities, Creativity Workshops, Innovation Open Lectures, Idea Competitions, Business Coaching and Business Interactive Games. The universities have implemented local incubators (Idea Labs) and a Science Park in Kyiv. Lviv City will start a City Incubator in autumn 2009. About 2000 students at the two universities have been involved in different activities in innovation, design and entrepreneurship.
In one of the universities (Lviv) we have together started master courses in Creativity, Innovation & Entrepreneurship (theory and practice). The before mentioned Medici-thinking is a guidance for our work also here [27]. In the course of 2008-2009 there are students from six different universities in

Lviv and from nine different disciplines as engineering, computer science/informatics, applied mathematics, psychology, international economics, philosophy, art/dancing, linguistics and medicine. New pedagogical methods are also implemented and the students participate in an Innovation Week in Sweden every year together with the winners of the Idea Competitions in both Lviv and in Kyiv. All these students are good ambassadors for entrepreneurship in their universities to facilitate different and entrepreneurial thinking. (www.idea4life.org.ua)
The participants pointed out learning outcomes as Knowledge and skills in using Creativity Tools, Innovation Development & Management; Opened up for new opportunities and self-confidence; Cross-faculty team spirit and joint knowledge building in idea generation and idea competition processes; Understanding how to find out about market presence and needs of products and services. Some student quotations were; "Now I can advice others in this direction, because now I know that when you step out from your own box you can see a lot of opportunities." (Student of Psychology); "...this knowledge will be of great use to me and to my country." (Student of Applied Mathematics & Informatics); "The course has changed my view to the world of business and entrepreneurship. I am inspired to start my own business." (Student of Engineering) [27]. A lot of business and social ideas has been developed by students (some with patent applications) in energy saving technology, consumer products, tourist and culture services, computer applications, biotech products etc.

An eco-system has been created in the Lviv-region (~1 million people and 12 universities) with companies, entrepreneurs, business advisors, organizations and Lviv City Council, where the project has been growing successfully the last year. The Idea Competition Concept from Mälardalen University has been developed to an *Idea Marathon Process,* where about 100 students from Lviv and Kyiv in 2008 and 2009 are working to sharpen their ideas to become business or working social ideas for implementation. External business coaches and business coaches from Mälardalen University and Munktell Science Park are supporting the idea carriers in their processes to present their ideas to external venture capitalists in October 2009 in Lviv at The IX International Fair of Investments. Universities from all Ukraine, together with governmental representatives from Ukraine and Sweden are invited to workshops together with the created eco-system of companies etc and our students. The objectives are to establish new companies and to transfer our findings from the UBDC-Project on national level. An expected outcome is the creation of *Lviv Innovation System* to be established.

The media on both regional and national level, especially TV, have been following the project the last two years with great interest. At our latest activity, the Kick-Off of the Idea Marathon, more than ten different local, regional and national TV-stations were reporting. The greatest challenge is to get the eco-system and the new mindset at the universities to be sustainable after the Swedish support has ended in 2009. The successful development in Lviv is however very promising.

4.3 India: Developing an Innovation Culture and New Management Concepts

India with its about 1.1 billion people is a fast growing economy, about 9 percent GDP growth per year (from 2006). The GDP per capita is USD 560 (2006). About 40 percent have been estimated to live on less than 2 USD per day. The needs of proper health care, employment opportunities, rural development and education are enormous, but also for modern products and services. A forecasted GDP growth from the Swedish Trade Council in 2006, estimates that India will quintuple its GDP to 2025. The middle-class of India today is also estimated to about 300 million people, which is about the same size as the whole population of United States. Religion, family tradition and hierarchical structures are strong influencing peoples´ life both in private and in work. But most of the traditional structures and values are challenged today by globalization and a national rising self-confidence, especially in young peoples´ minds.
India has the youngest population in the world and the world´s largest number of software engineers. The software and the manufacturing industries are the most fast growing sectors today. India also has high-tech in many other fields, as the space industry, car manufacturing, advanced health care services as heart surgery and in textile and fashion. About 250 universities, 8000 colleges for general education and a fast growing number of private academic and research institutes. The Indian Institutes of Technology (ITTs) are high-ranked on the world academic arena. But today only 8-9 percent of a one-year population will gain availability to a college or a university education. The demand and need from young people are huge of more education.
In 2006 Mälardalen University and Welingkar Institute of Management Development & Research started their collaboration in innovation, design, entrepreneurship and leadership. The research project

and the book on *Design Inspired Innovation* was the starting point to our collaboration with an invitation from Welingkar. We thought it also would be interesting for us to test, evaluate, develop and implement our multi-disciplinary concept in a quite another culture, different to Europe and at one of the most emerging markets in the world. From our side at Mälardalen University we were eager to learn more about the emerging India, its values, great diversity, strategies in education and research and in culture.

Welingkar Institute – with campuses in Mumbai and in Bangalore – is a private institute and among the "Top 5" master business schools (of 1800) in India, doing pioneering work as a frontrunner in the field of contemporary and futuristic management education on master level. It has initiated the concept of *design thinking* in business and management education in its management programs. We found very soon that Welingkar has a visionary leadership and an organization of faculty, staff and students open to learn on innovation and entrepreneurship and also sharing their ideas. Together in 2007 we signed an Agreement of Collaboration of academic exchange of students and faculty members and in development of an *innovation culture and climate* in the organization as a whole – for students, faculty and non-teaching staff at Welingkar. Creativity and innovation management are in focus for our cooperation on education, research and external network relations. We are frequently cooperating since 2006.

The activities of cooperation are diversified. We carry out lectures, workshops and seminars with more than 1000 master students from different programs on creativity, innovation, leadership, business creation and entrepreneurship from both business and from social perspectives. The course *Creativity and Innovation Management* is running at Welingkar with Mälardalen University faculty as teachers in visits in India. Most of the students have their undergraduate background as engineering students and have also been working for some years in industry.

We have arranged Global Internship Programs for a delegation coming to Sweden every year with about 20 students and 5 faculty professors including the President/Director of Welingkar and the Chairman of the Board. The overall purpose is to broaden and deepen our common understanding and knowledge in *Innovation, Design & Management in the Global Economy* from a Swedish as well as from and Indian perspective. A focus is on Sweden as one of the world leading innovation nations. Both scientific and industrial perspectives are studied. From MDH are students, doctoral students, faculty and management participating in different parts of the two-week programme and also partners in our company/industry network. The learning outcomes have been high on thinking different (out of the box) and on innovation management skills according to the delegation evaluation.

With the whole faculty of about 100 people and also the whole non-teaching staff of about 130 people we have carried out workshops on creativity, innovation, entre- and intrapreneurship. More than 600 ideas have come up at these sessions and workshops, many of these are now on preparation for implementation in the Welingkar organization as security issues, new courses, improvements in information systems etc.

On the corporate level we have had executive education in both Mumbai and in Bangalore with about 200 executives from more than 100 companies as Tata, Accenture, GM, Infosys and MindTree. We have established a new cooperation with Ericsson Telecom and Tata Consultancy Services/TCS in both Sweden and in India. Welingkar and Mälardalen University have run executive education in workshops for managers in the existing collaboration between the two world class companies on *Culture, Innovation and Management.* In this cooperation students from Mälardalen and Welingkar have also been collaborating in their master thesis in studying the cultural differences in innovation strategy and management philosophy in Ericsson and TCS. We intend to expand this kind of cooperation with more Swedish and Indian companies in both our networks.

By inspiration from our concepts at Idea Lab at Mälardalen University and Create Incubator at Munktell Science Park, Welingkar has established its own Innovation Lab, named innoWE LAB in Mumbai campus in 2007. Here students, lab managers and external business advisors meet for developing business ideas, innovations, social entrepreneurial ideas and new companies. A close cooperation and inspiration comes through one of India´s most successful entrepreneurs today in India, Kishore Biyani and his *Future Group*, known as the ´Rajah of Retail´ [28].

Idea competitions are running every year with student idea carriers and potential entrepreneurs. In the new Bangalore campus (2008) an in-house incubator has been established, where also external companies will be invited to have their own innovation activities. The Bangalore campus is situated in

the ´hot spot´ of Electronic City in Bangalore with a lot of innovation and design companies from India as well as from other countries.
The collaboration between Mälardalen University and Welingkar Institute is based on frequent idea workshops with the management and the faculty design team of professors. Students, faculty and non-teaching staff have developed and internalized a creativity and innovation mindset to use both in intra- and entrepreneurial activities. This can also be seen in the new corporate identity values of Welingkar, for example in some of their *Mission Statements*: "To focus on inventive education by offering practical, innovative and technology driven programs; to provide managerial talent with risk-managing ability, passion for learning and creative thinking and values in rapidly evolving economic and social environment; to contribute significantly to Indian corporate world by preparing management graduates with global mindset." (www.welingkar.org)

5 CONCLUSIONS

Some of the issues introduced and discussed in this paper were: What are the motives to introduce entrepreneurship education and entrepreneurship for students? Is it possible to create an entrepreneurial personality mindset and to learn entrepreneurship? Which factors are influencing entrepreneurial mindsets and real entrepreneurship? Which are the obstacles and resistance? How to introduce and what methods are appropriate to develop entrepreneurial mindsets and entrepreneurial behaviors in practice?
Mälardalen University is one of the leading Swedish universities imparting academic education and research in the field of Innovation, Design, Entrepreneurship and Engineering. The School of Innovation, Design and Engineering has a unique multidisciplinary approach to produce entrepreneurs, designers and engineers on undergraduate, graduate and doctoral level. In ten years we have developed our approach and network in regional, national and international level. This paper has introduced our approach and also how we have introduced and implemented innovation and entrepreneurship thinking and acting in academic milieus in different cultures as Sweden, Ukraine and India.
Young people in different parts of the world are open to changes and they live frequently global in real or virtually constantly with Internet and cell phones. The young generation of today is motivated to realize their ideas into new products, services and companies. They do not want to be controlled but to control their own lives. Entre- & intrapreneurship education is growing globally. From many countries good examples can be found, especially from United States. This article shows that new curriculums and approaches can be developed with success also in Sweden, Ukraine and India.
Entrepreneurship and entrepreneurs are the sources to bring innovations out to the market and society to work. In every field of our global society the need for new entrepreneurs are strong, to earn their own living, to develop their desires and to introduce novelties. The mindsets of innovators and entrepreneurs differ a lot from many other mindsets in our society, due to its focus on opportunities, thinking different, like changes, taking risks and execution. This kind of mindset can be learnt, but needs also new pedagogical methods as action and idea based learning and engaged development of personal leadership for students.
The obstacles of change and innovation are many in the academic culture. One problem is the traditional thinking from faculty members of teachers, researchers and also from managers, who still think in disciplines or that universities should not mix their scientific activities with ´real´ business. With an open and global society, motivation and management from academic leaders even these obstacles will decrease in time. Hierarchical structures of ´old time´ will not survive in the long run in the era of innovation.
In our own examples from Sweden, Ukraine and India, we have seen how important the leadership and a creative and innovative climate can be at School of Innovation, Design & Engineering in Sweden, with a focused Head of Department, also awarded in 2001 as *The Entrepreneur of the Year in Sweden in Academic Leadership* (also one of the authors of this paper). At Welingkar Institute a visionary and strong academic president/director and is the ´driver´ of development and with a great confidence from its faculty and staff. If most of the faculty does not want change – as we have experienced in Ukraine – other forces have to be used, as these positive faculty members who actually want change and students as ambassadors and facilitators and to open up the academia to more external input as from companies and entrepreneurs. The cultures are different and the driving internal and external forces have to be applied to different circumstances, time frames and ´maturity´ of the academies.

Finally, entrepreneurship and innovation should be seen in a broad sense and promote benefits to the society even beyond new ventures. These mindsets and skills should be considered as a general attitude that can be usefully applied in any activities as well as in everyday life. Everyone at some stage of his or her life needs to become an entrepreneur or to display idea creativity in thinking and action. In fact, entrepreneurship can be viewed as a cross-curricular and horizontal aspect, or as a teaching methodology, besides being treated as a specific subject. [27, 29] A multi-scientific view should always be present, and the combination of innovation and diversity are key factors for university renewal of education, research and leadership for *a Future Innoversity*.

REFERENCES

[1] Utterback, J.M., Vedin. B.A., Alvarez, E., Ekman, S., Sandersson Walsh, S., Tether, B. and Verganti, R. *Design-inspired innovation,* 2006 (World Scientific Publishing).
[2] Johansson, F. *The Medici Effect,* 2004 (Harvard Business School Press).
[3] Larsson, U. (Ed.) *Cultures of Creativity,* 2006 (Science History Publications).
[4] Ekvall, G. Creative Climate, in *Encyclopedia of Creativity,* Vol. 1, 1999, pp. 403-422 (Ac. Press).
[5] Chesbrough, H.W. The Era of Open Innovation, in *MIT Sloan Management Review*, Vol. 44 No.3, 2003, pp. 35-41.
[6] von Hippel, E. *Democratizing Innovation,* 2005 (The MIT Press).
[7] Lindgren, M., Lüth, B. and Fürth, T. *The MEWE Generation,* 2005 (Bookhouse Publishing).
[8] Burns, P. *Entrepreneurship and Small Business,* 2007 (Palgrave Macmillan).
[9] Yunus, M. *Banker to the Poor,* 1997 (Public Affairs).
[10] Prahalad, C.K. *The Fortune at the Bottom of the Pyramid,* 2006 (Pearson Power).
[11] Wallon, J. *Utbildning i entreprenörskap – vad kan Sverige lära av USA?* A2004:021 (Swedish Institute of Growth Policy).
[12] Ekman, A. *Lärande organisationer i teori och praktik. Apoteket lär*, 2004 (Doctoral Thesis, Acta Universitatis Upsaliensis).
[13] Gardner, H. *Five minds for the future,* 2006 (Harvard Business School Press).
[14] Schumpeter, J.A. *The Theory of Economic Development*, 1934 (Harvard University Press).
[15] Drucker, P. The Discipline of Innovation, in *Harvard Business Review*, Nov-Dec, Vol. 44 No 3, 1998, pp. 3-9.
[16] de Bono, E. *Serious Creativity,* 1996 (HarperCollins Business).
[17] Guilford, J.P. *The Nature of Human Intelligence,* 1967 (McGraw-Hill Books).
[18] Bosma, N. and Harding, R. *Global Entrepreneurship Monitor, GEM 2006 Summary Results,* 2006 (Babson College and London Business School).
[19] Chell, E. *The Entrepreneurial Personality,* 2008 (Routledge).
[20] Bagchi, S. *The High Performance Entrepreneur,* 2006 (Penguin Portofolio)
[21] Gunther McGrath, R. and MacMillan I. *The Entrepreneurial Mindset*, 2000 (Harvard BSP).
[22] Dana, L.P. *Asian Models of Entrepreneurship,* 2007 (World Scientific Publishing).
[23] Kahnna, T. *Billions of Entrepreneur,* 2007 (Penguin Viking).
[24] Clarkson, J. and Eckert, C. *Design Process Improvement,* 2005 (Springer).
[25] Ekman S. and Jackson M. The need for a ´new´ innovative product development approach, in *9th International Design Conference, the Design Society,* Vol. 1, Dubrovnik, 2006, pp. 519-526.
[26] The Embassy of Sweden, Kyiv. *Planning Document 1 – Ukraine,* 2008.
[27] Katernyak, I., Loboda, V., Ekman, S. and Ekman, A. Pedagogical Approaches and Creativity in Culturally Diverse Virtual Education Community. Paper to 2008 *International Conference on ICT in Teaching and Learning*, May 30, 2008 in The Open University of Hong Kong SAR.
[28] Biyani, K. *It Happens in India,* 2007 (Rupa & Co).
[29] Walstad, W. and Kourilsky, M. L. *The E-Generation. Prepared for the Entrepreneurial Economy,* 2000 (Kendall Hunt Pub Co).

Contact: Sten Ekman, Mälardalen University, School of Innovation, Design & Engineering, Box 325, 631 05 Eskilstuna, Sweden. Phone: +46 16 153635. Fax: 46 16 153610. sten.ekman@mdh.se
Sten Ekman is senior researcher (PhD) at Mälardalen University (MDH). He is responsible for international R&D projects at MDH in India and Ukraine in innovation, design and entrepreneurship within the research profile Innovation & Product Realization. He is co-author of the book Design Inspired Innovation (2006 at World Scientific).