A case study on the path from academic practices to commercialization in student projects

Gunnar Andersson
Østfold University College, Norway
gunnar.andersson@hiof.no

Sissel Larsen[1], Frode Aamodt[2], Kristine Degnes[3]

***Abstract* - The Bachelor in technological innovation and entrepreneurship provides students with a variety of opportunities to learn commercialization skills in an academic/real world environment that combines theory and practice. The program has an explicit focus on problem based learning and practice problem based study projects in all three years.**

Using problem based study projects we try to make visible the entire width of the commercialization process: idea development, product development, technical and market feasibility analysis, business planning, and venture funding. Key learning activities to enforce the processes are venture-contests, student enterprise and final year projects in/for companies.

To illustrate how these academic practices may be implemented in a bachelor program we will present experiences and reflections from the case "Concept Living". "Concept living" has gone from an academic practice for students to a real commercialization and company formation. Milestones in this process (after graduating) are confidence and funding from The Research Council of Norway and Innovation Norway (promotes nationwide industrial development) made possible by the quality in the student work.

We will also link this case to earlier problem based study projects and outline the program design creating the learning environment and try to isolate success criteria and challenges.

Index Terms – commercialization, technological innovation, student project.

INTRODUCTION

Autumn 2003 Østfold University College started up a bachelor program in technological innovation and entrepreneurship. This was the first bachelor of this kind in Norway. This College has got a very central position in this area within the university colleges and universities in Norway due to a large activity within this area from 1994.

The background for the study in the region Østfold was an increasing need in Norway for more jobs to be created in the future, as the traditional industrial branches have decreasing number of employees. It was a great demand for entrepreneurs in new and existing businesses.

The bachelor in innovation has as an overall goal to:

- Train students to be result oriented and independent.
- Give ability to tackle challenges and to work under pressure
- Give competence to organize and manage innovation – and entrepreneurship in own and new enterprises.
- Give competence to efficient and independent learn new knowledge and skills.

The key competence Østfold University College is aiming to give the students is: The right attitudes, ability to work under stress a large capability to take defeats and to be very persevering [1].

It is important to emphasize that this paper is based on a single case. It is not our intentions to generalize findings and experiences to a model valid for all commercialization projects. But we do think our findings and reflections, shared among students and teachers, could benefit others in their process towards finding good models of learning organization and thereby making higher education better to fulfill the goals on higher commercialization.

ACADEMIC PRACTICE PHASES

The Bachelor in technological innovation and entrepreneurship provides students with a variety of opportunities to learn commercialization skills in an academic/real world environment that combines theory and practice. The program has an explicit focus on problem based learning (PBL) and practice problem based study projects in all three years. This focus is now widely recognized in higher education plans but in our view not in practice. Very often are the projects named PBL just more advanced versions of the traditional Tayloristic learning organization (top - down) rooted in higher education institutions.

To illustrate how these academic practices may be implemented in a bachelor program we will present the way from academic practice for students to the decision on real commercialization and company formation.

[1] Østfold University College, Norway, sissel.larsen@hiof.no
[2] Amplio AS, frode.aamodt@amplio.no
[3] Amplio AS, kristine.degnes@amplio.no

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Technological problem based learning projects

The TIE curriculum is influenced by an integrative and holistic approach to engineering education with early exposure to practice and design. The learning activities are structured around projects and cases with complex and authentic tasks, objectives, questions and problems.

The curriculum is based on problems that create a demand for key knowledge, problem-solving skills, work in teams and adjustment of learning strategies. The process is based on a systematic approach to solving problems or meeting challenges.

Examples of technical projects met by the students are:

- Autonomous Lego vehicles introduction
- Science Camp to study earthlights in the Hessdalen Project
- Full size Bridge-models on statics and mechanics
- Robotics-Case using Evolution Robotics
- Rocket technology at Andøya Rocket Range
- Energy from wind building of windpower plant model

The complexity in the cases increases with the progress of the program [1] [2].

Innovation and entrepreneurship projects

Using problem based study projects we try to make visible the entire width of the commercialization process: idea development, product development, technical and market feasibility analysis, business planning, and venture funding.

Key learning activities to enforce the processes are

- Venture-contests
- Student enterprise
- Final year projects in/for companies.

Venture contests

Industry, and regional government representatives are looking for new product ideas and new business opportunities, and the international business-plan contest Venture Cup is one of the means to accomplish this. Venture Cup has regional competitions all over Europe.

Venture Cup was a great possibility to get access to money and business partners, and Østfold University College decided to participate with so many business ideas as possible. This was also a great possibility for the business incubator Østfold Innovation. This business incubator is located at the engineering department, and is partly owned by the Østfold University College together with partners from industry and governmental institutions.

The business plan initiative was named Generator:

- Information: Web site and marketing brochures was produced and sent out to 3500 students.
- Idea Swarming: Students was invited to two days business idea development at a hotel. Accommodations were for free, and specialists from different organizations made speeches and helped out with the development of the ideas.
- Workshops in business-plan development: After the two days of idea swarming, Østfold innovation gave three work-shops in business plan writing, before the plans was sent to Venture Cup.

The Generator initiative was a success both academic and commercial. In 2003 students from Østfold University College submitted 23 business ideas out of a total of 161 to the Venture Cup. That is 15% of the total number in Norway from a small local university college! The quality and number of ideas have increased drastically from the start in 2002 [3].

Student enterprise

Student Enterprise is a learning method that allows students to start and run their own business for the period of one academic year. In such an arrangement, students form a business, create, sell, and market products, and attempt to generate profits to be distributed to shareholders. Key issues are knowledge and skills in business plan development necessary in a later commercialization phase.

During one academic year the students will go through several phases including:

- Develop business idea
- Register business
- Raise start-up capital
- Write business plan and annual report
- Protection of a patent and protection of a design
- Production, management, keep the accounts, sales, marketing, …

> "*Research published in 2002 showed that 20% of students who had experienced our programs, had then gone on to start a real business of their own. The normal rate of business start-ups in the general population in Norway is around 4%.*"
>
> Young Enterprise Norway

The Student Enterprise gives an excellent training in starting up/closing down companies, earning money and dealing with shareholders. This course is excellent as a "live" course in business development, and has a central part in the bachelor in technological innovation and entrepreneurship program at Østfold University College [4].

Final-Year Project

The studies conclude with a final-year project undertaken in collaboration with external companies or institutions in both the public and private sectors. In this project the students work with real engineering tasks, and give a written and oral presentation of their work. The project is also assessed on the basis of its presentation at EXPO, an exhibition of all final year projects.

Concept Living started out as a 15 credits (European Credit Transfer System) final-year project the last semester before graduating. Concept Living was a joint project between Lindegas AGA and the student group of Frank

Robert Frydenlund, Frode Aamodt and Kristine Degnes – all from the Technological Innovation and Entrepreneurship program at Østfold University College.

The project goal was to implement initiatives to increase the sales potential on bottled propane. Lindegas AGA challenged the students on initiatives reducing the usual seasonal fluctuations in propane sales.

The student group developed an exciting total solution for gas applications in houses and office buildings. The use of gas for different purposes is increasing in Norway as an alternative to electricity – the traditional energy carrier in Norway. An overall concept for handling early skepticism on gas is central for the student group. The concept includes several technological innovations that make the concept unique. The group is in discussions with a large Norwegian insurance company on preventive safety initiatives based on Concept Living.

Central factors in Concept Living are:

- Safety
- Distribution
- Marketing

On safety the group have presented a new system for detecting gas leaks. The use of gas is increasing in Norway for heating and cooking. But the fear of gas leaks and explosions may lead to reduced potential for use. The system sniffs on a regular basis for any gas leak and on gas leak detection will the installation shut down automatically.

On distribution the concept include installation, automatic refill and maintenance. Concept Living monitors the local installation and will refill the bottles when necessary and maintenance the system as scheduled.

On marketing the group stress collaboration with suppliers [5].

Details on the project are low because of an ongoing patent application. Concept Living won first price for best project 2006 assessed on the basis of its presentation at EXPO, an exhibition of all final year projects.

FIGURE 1
WINNER EXPO 2006 ØSTFOLD UNIVERSITY COLLEGE.

The different projects and activities are loosely linked and aimed at an increasing degree of problem based learning and prepare for a post-degree commercialization using many steps; building confidence, skills and knowledge needed. A two by two matrix is useful for indicate the relationship between the individual projects in a learning organization perspective.

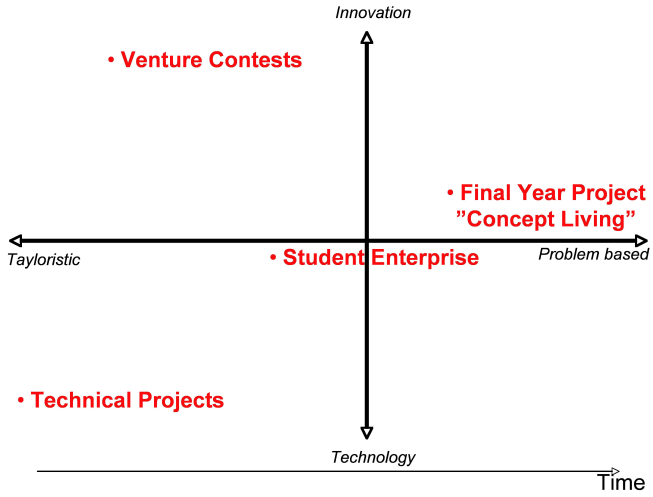

FIGURE 2
PROJECTS IN A LEARNING ORGANIZATION PERSPECTIVE.

COMMERCIALIZATION AND COMPANY FORMATION PHASES

Milestones in this phase are confidence and funding from The Research Council of Norway and Innovation Norway (promotes nationwide industrial development) made possible by the quality in the student work. Other milestones were building of a company network of partners and possible customers.

Funding

Forny

The FORNY-projects funded by The Research Council of Norway are infrastructure funding available for the university colleges. They are meant to stimulate academics and students on commercialization of research, development and project ideas. In 2006 Østfold University College applied for and got about €12000 in funding dedicated for business plan initiatives to support ideas with a commercialization potential. We chose to split the sum in two.

Concept Living was one of two projects chosen in 2006. The funding was used to improve further the final year project business plan for applying public funding (from for example Innovation Norway) as support in the start up phase of the company. This funding is important for getting past the first period with limited revenue and large expenses.

Innovation Norway:

In 2004 the new state owned company Innovation Norway replaced The Norwegian Tourist Board, the Norwegian Trade Council, The Norwegian Industrial and Regional

Development Fund, SND and the Government Consultative Office for Inventors, SVO. Innovation Norway promotes nationwide industrial development and contributes towards innovation, internationalization and promotion.

In December 2006 the students applied for and got about €50000 in incubator grant from Innovation Norway. Incubator grant is one of few resources available in the start up phase of a new company.

Østfold Innovation

After graduating spring 2006 the student team was offered office location and services at the local incubator Østfold Innovation. The establishment of the business incubator Østfold Innovation in 2001 inside the university college campus gave the faculty of engineering an excellent "laboratory" for entrepreneurship activities [3].

In this period funded by Forny and applying for incubator grant the students were located at the local incubator Østfold Innovation. As part of the agreement with Østfold Innovation the student got support from the incubator and a free period of rent pending the answer from Innovation Norway. The location at Østfold Innovation also gave the students access to a large network including public agencies and venture capital.

The company

Amplio is an idea and product development company based on the final year project Concept Living. They offer customers product development services and consulting services on technological innovation, construction, prototyping and business concepts development. Concept Living is continued as the core project in the company portfolio.

Amplio was established in 2006 and are run and owned by four persons with diverse work life background and bachelor degrees in technological innovation and product development.

Commercialization and company foundation summary

The road from a final year project to foundation of a commercial company in this specific case may be outlined as a two-step process with input on networks, services and funding.

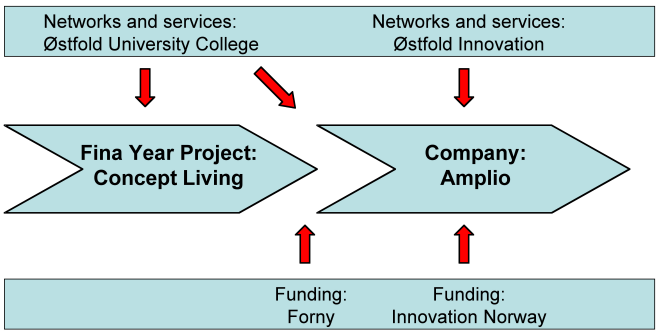

FIGURE 3
FROM COMMERCIALIZATION TO COMPANY FOUNDATION

REFLECTIONS AND ANALYSIS

In dialogue between academics and students/entrepreneurs we have tried to isolate success criteria and challenges on going from academic practices to commercialization.

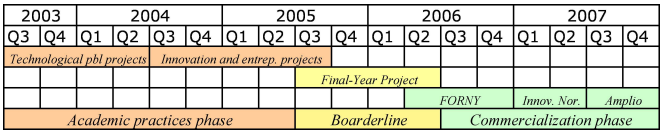

FIGURE 4
FROM ACADEMIC PRACTICES TO COMMERCIALIZATION

Success criteria

Interdisciplinary: The interdisciplinary profile and broad approach of the program is fundamental for training entrepreneurs. The balance between technological courses like mechatronics and construction and innovation and entrepreneurship courses are what differ this program from other more traditional engineering programs.

PBL: The explicit focus on problem based learning (PBL) and problem based study projects in all three years is important. The curriculum is based on problems that create a demand for key knowledge, problem-solving skills, work in teams and adjustment of learning strategies. The process is based on a systematic approach to solving problems or meeting challenges giving the students important knowledge, training and hands-on experiences before starting up in real.

Formal competence on entrepreneurship: Knowledge, skills and attitudes on innovation and entrepreneurship are vital. As the first Bachelor program in Norway on Technological innovation and entrepreneurship we followed similar programs from Sweden, Denmark and USA with a course portfolio including entrepreneurship, innovation, product development, student enterprise and patent rights. By studying these topics the students acquire formal competence in entrepreneurship vital when starting up own company.

Multidisciplinary cooperation: Collaboration with students from other departments when own knowledge was not enough characterized the students the last two years. They knew enough to order the job done.

Diverse work life background and personalities: The group consists of student with diverse work life background and personalities. Both the manager personality, the inventor personality and the engineer personality are represented in the group.

Early goal to start up own company: In the first year several of the students in this group signaled an ambition to start up own company. They had the skills and the motivation before graduating – a necessary blend for commercialization.

Early start up of final-year project: Traditionally most students start their final-year project in March. This group started working with the external company the summer before. The time schedule allowed for common understanding and reduced uncertainty.

Funding available during start up: Funding from Forny and Innovation Norway was essential for handling the start

up period of the new company. Even though limited, the funding made it possible to come through the start up period.

Challenges

Networks: As a student you are part of several networks both internal academic networks and with industry and public organizations. Many students loose these networks after graduating. Keeping the networks is a central challenge both for the individual and the university college.

Need for further education: Companies and people develop and change. New skills and knowledge are essential in this change perspective and create a demand for further education; not master but relevant courses on specific topics like industrial design, electronics and construction.

Low on resources: Newly established companies are low on resources like laboratories, commodities, production facilities and office facilities. Little access to these resources is a challenge.

Need for mentors: After graduating the students are low on experience. The loss of mentors used early in the process is a challenge

Funding: New companies need support for the early stage commercialization. Forny and Innovation Norway are today not a solution for a wide support for commercialization based on student work from the university college. Funding is a challenge.

DISCUSSION

Why is it so difficult to take the step from academic practices to commercialization? We have outlined the path from academic practices to commercialization in the company Amplio. We have linked this case to the program design creating the learning environment and tried to isolate success criteria and challenges. Some preliminary conclusions and measures may be read out of the reflections and analysis so far.

It seems clear that formal competence on entrepreneurship and experience in working project oriented is one key to success. There are very few commercializations from more traditional run program in comparison to the program outlined.

Student enterprise that allows students to start and run their own business for the period of one academic year have been removed from most programs at our university college, but seems to lower the threshold for starting up own company.

Timing is another important aspect. Several success criteria refer to early starts. This experience is important to share with new students and all programs.

In our opinion should both the approach to engineering education and learning and learning environments be discussed?

Another challenge placed on the university college is the demand for further education, access to campus resources, access to networks and mentors. Is it possible to extend the obligations to more than the traditional three years on campus?

The third challenge placed on the university college is funding. New companies need support for the early stage of commercialization not available today in Norway. There are few resources available in the stage before venture capital and banks are natural. Is it possible for the university college to initiate seed corn fund like them often linked to universities in USA and UK.

The fourth discussion necessary to undergo is how we design and develop student groups to create the right blend of personalities, knowledge and skills. Is it possible without an explicit focus and training during all three years?

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