This is an author produced version of a paper presented at Medicinteknikdagarna 2012

This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the published paper:

**A TRIPPLE-HELIX MODEL FOR REFINING BIOMEDICAL ENGINEERING RESEARCH INTO INNOVATIONS AND SPIN-OFF COMPANIES**

Olof A Lindahl¹,²,³, Britt MAndersson¹,⁴, Ronnie Lundström¹,³, Josef Hallberg¹,²

¹ Centre for Biomedical Engineering and Physics, Umeå University, Umeå, Sweden
² Department of Computer Science, Electrical and Space Engineering, Luleå University of Technology, Luleå, Sweden
³ Department of Radiation Sciences, Biomedical Engineering, Umeå University, Umeå, Sweden
⁴ Department of Applied Physics and Electronics, Umeå University, Umeå, Sweden

Access to the published version may require subscription. Published with permission from:

[The Authors]
A TRIPPLE-HELIX MODEL FOR REFINING BIOMEDICAL ENGINEERING RESEARCH INTO INNOVATIONS AND SPIN-OFF COMPANIES

Olof A Lindahl1,2, Brit M Andersson1,4, Ronnie Lundström1,3, Josef Hallberg1,2
1 Centre for Biomedical Engineering and Physics, Umeå University, Umeå, Sweden
2 Department of Computer Science, Electrical and Space Engineering, Luleå University of Technology, Luleå, Sweden
3 Department of Radiation Sciences, Biomedical Engineering, Umeå University, Umeå, Sweden
4 Department of Applied Physics and Electronics, Umeå University, Umeå, Sweden

Abstract
Triple-Helix activities within the center for biomedical engineering and physics (CMTF) have generated growth in academic research as well as industry in Northern Sweden in the field of biomedical engineering. Currently CMTF holds 26 ongoing research projects involving more than 150 researchers. So far a total of eight spin-off companies have resulted from research in CMTF since the year 2000. A researcher-owned company, CMTF Business Development Co Ltd, has been established for business development of the research results from the CMTF, which so far have launched two spin-off companies and 15 new business leads for business development. The activities have also increased the interest for innovations and entrepreneurship among the scientists in the center.

Keywords: Spin-off companies, Triple-helix, Biomedical engineering, business development, innovation.

1. Introduction
The Centre for Biomedical Engineering and Physics (CMTF) started 2000 at Umeå University (UmU) and since 2007 includes Luleå University of Technology (LTU). CMTF has formed an organization for triple-helix cooperation between scientific research, biomedical industry and health care, for commercializing biomedical research in northern Sweden. Currently CMTF has a budget of 12 million Euro through the European Regional Structural Fund, North Sweden (2008-2014) and additional about 0.5 million Euro per year from other funds.

The aim was to form a strong and sustainable organization for scientific research and business development in northern Sweden. A further aim was to form a model for the development of new biomedical viable spin off companies from the research results from the center through triple-helix activities.

2. Method
The practical work at CMTF was organized in a number of research projects (26 in May 2012) and one management. The board of directors for CMTF was assigned by the universities. The board was chosen to give the CMTF a stable leadership and a broad professional expertise to guarantee high competence for handling as well as scientific matters.

Before joining the CMTF, all research projects were evaluated by the board concerning three criteria; scientific excellence, clinical and industrial relevance and scientific research management. About 150 researchers and supporting staff were engaged within CMTF at the start of 2011. A majority of the projects in CMTF had both scientific and industrial cooperation with international partners both within and outside EU. CMTF has arranged workshops and conferences together with industry and established spin off companies twice a year.

A research company, CMTF Business Development (CMTF BD) Co. Ltd, was established in 2007 to support with the business development of the scientific research results from the center. The owners were the scientists/project managers within CMTF as well as representatives from the regional innovation system Uminova Innovation Co. Ltd and LTU Holding. Co. Ltd. This was in order to form an organization that could be a part of the existing innovation system but with a special emphasis to launch the biomedical engineering research results on the health care market. The project leaders signed over the IPR to the CMTF BD through an agreement. For identified research innovations, a contract was signed with the scientists about the sharing of future profit from the innovation, a so called incentive agreement. A majority of CMTF BD was funded with support from private means from the scientific leaders, Uminova Innovation Co Ltd, LTU Holding Co. Ltd. and the County councils in Västerbotten and Norrbotten. Two business advisory boards were formed (in Umeå and Luleå) to enhance the evaluation process of the most potentially projects for commercialization. The board of directors of the CMTF BD finally decides about further investments.

3. Results and conclusions
CMTF has built an academic and industrial network for triple-helix cooperation. Currently about 15 national and international companies are involved in the CMTF projects. CMTF research has produced eight spin-off companies. Six of them were based on patented innovations and one is the CMTF BD. CMTF BD has started two new company that is currently performing a multi-center study for the CE marking process. More than eleven patents have been filed from the research in CMTF and 15 innovations are currently under business verification through CMTF BD and the innovation systems in Umeå and Luleå. The cooperation with investment companies and other financers is intense in order to finance new company start-ups. The triple-helix activities have also increased the knowledge and interest for innovations and entrepreneurship among the scientists in the center. The CMTF BD has also become a place for the CMTF scientific leaders to meet and discuss business and innovation issues. Thus the company has contributed to the encouragement of entrepreneurship. CMTF has also been very successful to attract necessary funding. The CMTF research network and CMTF BD are today an established triple-helix organization for the development of research into spin-off companies in the area of biomedical engineering. This has resulted in an increased growth of the biomedical engineering activities both in academia and in the industry in northern Sweden.

Acknowledgement
The study was supported by the European Regional Structural Fund, North Sweden