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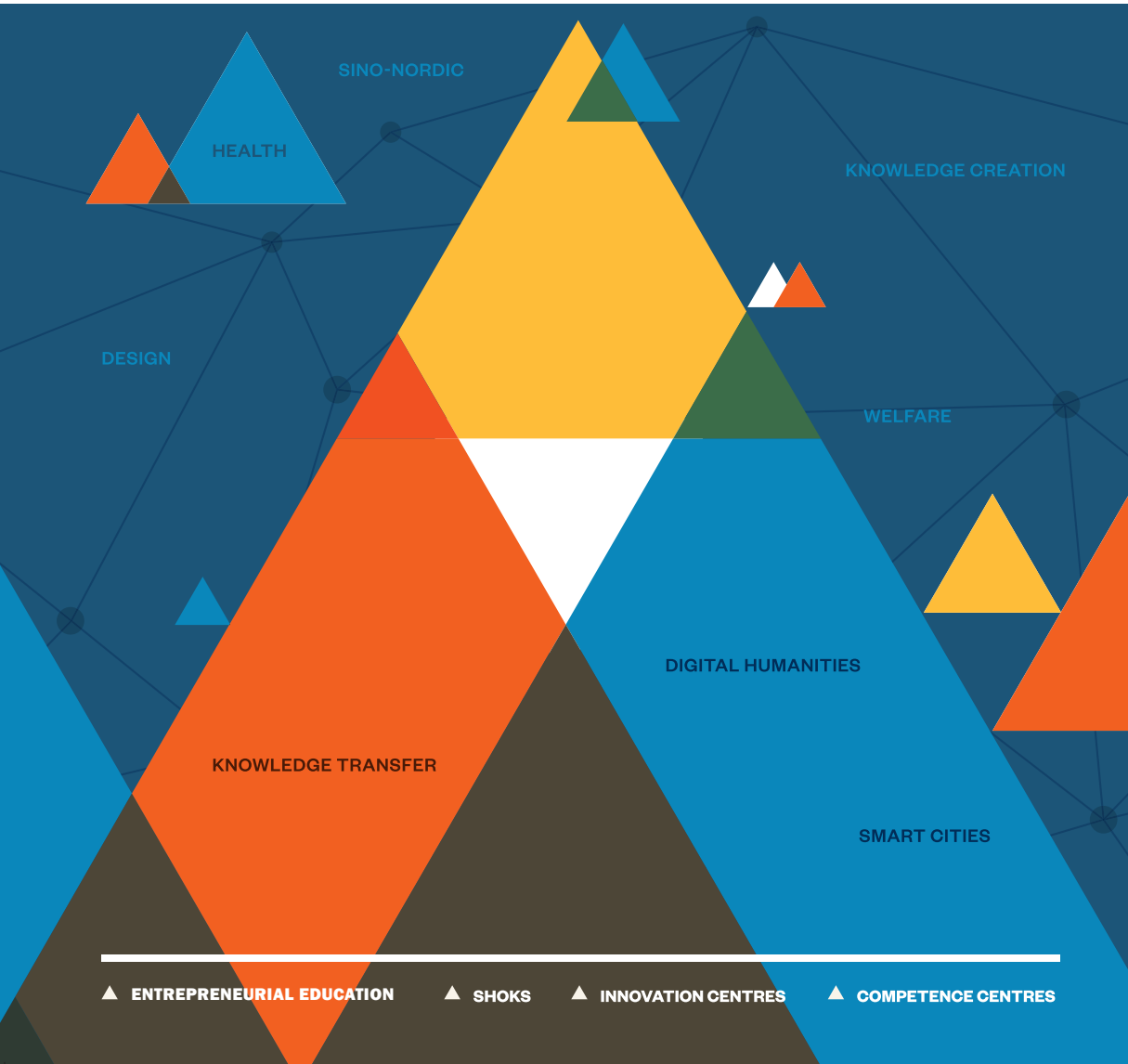
Methods and Tools in Design, Culture, Smart Cities, Health, Welfare and Entrepreneurship



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Halina Gottlieb and Monika Mörtberg Backlund

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Contents

papers, acting as discussants and participating in the discussions. Furthermore, they regarded highly the multidisciplinary nature of the course and the opportunity to learn to approach issues from many different angles. Also engagement with various stakeholders was valued. Two NGOs participated in the research workshop, but some of the participants would have liked to see more of them at the event. All in all, the doctoral training workshop was very successful. It contributed in several ways to the networking of young researchers with established scholars, NGOs and various research institutes, and also promoted their professional development towards a more flexible, innovative and multidisciplinary direction. The workshop was also a useful learning experience for the organizers, who could benchmark good doctoral training practices.

5.9 Applying the Knowledge Triangle to Food and Nutritional Care at Hospitals – Case-Insights from the Sino Nordic Food4Growth Network Program, Bengt Egberg Mikkelsen, Aalborg University

5.9.1 *Introduction*

Malnutrition in hospitals is a major problem that causes decreased quality of live, poor treatment outcomes and increased cost due to increased length of stay. Prolonged admissions are very costly for the hospitals and measures that can be used in bringing down the average number of admission days is the focus of much research and development in both Nordic countries and in China. Studies have found that 1/3 of the patients that are admitted to hospitals are, or will become malnourished during their stay at the hospital. This is critical to the patients' ability to recover and their well-being. As a result, individual nutritional risk screening and a follow-up process are being implemented in many hospitals as part of the nutritional care services at hospitals. Traditional screening using paper and pen which are carried out by nurses and assistants who manually monitor the dietary intake of patients in the hospital is time consuming

and troublesome and as a consequence often neglected in hospital wards. As a consequence there is considerable interest in many countries to develop routines, procedures and technologies that can improve food nutritional care services at hospitals. This is the background for the Food4Growth project that was initiated in 2013 and is bringing China and Nordic researchers and practitioners together.

It is estimated that nurse or assistant dieticians will spend approximately 20 minutes on every patient to be able to give an estimate of amounts of food that the patient has eaten. This amount of time could be spent on other activities adding value for the patients. The aim of the Food4Growth project is to contribute to better health outcomes for patients at hospitals. One of the important activities has been to explore new means and ways to improve the nutritional risk screening and follow-up procedures for patients. This paper takes the knowledge triangle as its point of departure and looks at how this has been applied to food and nutritional care services at hospitals, and how the Sino-Nordic Food4Growth network program has contributed to the advancement of this important area of public and clinical nutrition.

5.9.2 Network Activities

The Food4Growth network joins research groups from Aalborg University Copenhagen (AAU-CPH), Center for Nutrition and Intestinal (CET) from Aalborg University Hospital, JAMK University of Applied Sciences, University of Tromsø and Shanghai Fudan University and the Huadong Fudan University Hospital as well as the Zhongshan Fudan Hospital. The activities in the network have revolved around network meetings hosted by the Food4Growth partners.

Food4Growth opened its activities with a kick-off meeting that was held in Copenhagen, 28th October – 1st November 2013. The program from the week is published on the internet. As one of the first activities the project group carried out an assessment of strengths and weaknesses as well as opportunities and threats for future joint undertakings. The idea was to identify partners' expectations and capture untapped potential in the planned cooperation. Discussions on development of protocols for joint research projects were started and plans for visibility, communica-

tion and dissemination were adopted. The program included a focus on novel methods for dietary assessment and the potentials of using intelligent devices for dietary intake monitoring. An open seminar on these potentials was held in Aalborg featuring leading intelligent device scientist Prof Mingui Sun from Pittsburgh University. The 2nd network meeting included excursions to best practice cases in Aalborg and Copenhagen and an open conference. The program and a protocol for preparation of a 2nd workshop were developed. The protocol includes a template for mapping of best practices and educational programs in the countries.

The 2nd Food4Growth workshop week was held in the spring of 2014 at Shanghai Fudan University. The workshop included visits to local hospitals to get an understanding of the Chinese healthcare system and the way that food and nutritional care is dealt with. Part of the program was on methods for dietary assessment and the potentials of using intelligent devices such as the Dietary Intake Monitoring System – DIMS (Ofei *et al*. 2014). The meetings also included discussions on F4G's contribution to the conference "Health Services in Transition" that was planned to be held at Fudan University in the fall of that year. The meetings also included the planning of the summer school in 2015.

The 3rd Food4Growth Workshop was held in the early fall of 2014 (28 September – 3rd October) at the JAMK University of Applied Sciences in Jyveskyla in Finland. This workshop picked up on the results/conclusions from the previous workshops and the work that has been carried out since the Shanghai meeting. The meeting included discussion on how to carry out a comparative study where routines of food and nutritional care services in the participating countries could be mapped. The idea was to develop a better foundation for the technology development activities of the project.

The last workshop of the Network is held between 24th and 28th August 2015 and is a joint undertaking between University of Aalborg and the University of Tromsø. The meeting activities include activities in Copenhagen and Oslo. The week includes a training school and an open seminar and technology and devices is the overall theme for the week.

5.9.3 Research

The research activities have mainly evolved around the carrying out of a comparative study of routines of food and nutritional care services at hospitals. This line of research takes as a point of departure a survey carried out in the Nordic countries on the level of nutritional knowledge among different groups of health care workers that is involved in carrying out nutritional care services at hospitals (Move *et al*., 2007). The survey has been translated into Chinese and will now be carried out among a representative sample of nurses, doctors and dieticians at 2 universities in Shanghai.

In addition, the network has developed concepts around the idea of New Public Health. The idea is that food and nutritional care services at hospitals as an integral part must involve activities of prevention and health promotion in the adjacent communities that the hospital is a part of. This part of the activities was presented at the Health Services in Transition International Conference on Chinese and Nordic developments that was held 20th–21st October 2014 at the Nordic Fudan Centre, Shanghai. The paper on *New public health and the role of food and nutritional care hospitals – case insights from Denmark and China* (Mikkelsen *et al*., 2015) was presented on the subtheme "Empowering the patient".

5.9.4 Innovation

The network has resulted in a range of different activities all related to improving the quality of food and nutritional care services at hospitals. One of the important activities has been the exploration of how technology can be used to assist the nutritional care process. One of the main efforts has been around testing and the evaluation of the dietary intake monitoring system (DIMS) – an ICT assisted method to monitor patient intake and convert it into an estimate of nutrient level. The DIMS technology (Ofei *et al*., 2015) is an example of hardware and software that can be combined to further facilitate and simplify the nutritional care process. The application has been developed in cooperation between research, enterprise and education – three important components of the knowledge triangle. The Dietary Intake Monitoring System (DIMS) is a device for capturing accurate data on a patient's meal both before and after consump-

tion in a foodservice setting and is used for assessment of food intake and plate waste (Ofei *et al*., 2014; Ofei *et al*., 2015).

The DIMS was originally developed within the framework of the FoodServInSPIRe project with Aalborg University, SyscoreAps as lead partners and with the AAU FoodScapeLab and with Aalborg University Hospital as the test site. The DIMS1.0 is able to estimate the type and amount of food on a plate using an integrated technology based on imaging, weighing scale, IR thermometer and ID technology. The DIMS is used in a sequential mode: first the plated meal is recorded and second the returned plate is recorded. The 2 recordings then return the intake and the plate waste. The results so far indicate a substantial innovation potential since it will be able to lead to a new achievement on three levels: a commercially available welfare technology, new commercially available and easy2use food-waste monitoring and a new scientific breakthrough in the field of ICT assisted automated dietary assessment technology.

5.9.5 Education

The educational level as a part of the knowledge triangle has played a strong role in the technology development part of the network. The first prototype of the DIMS was developed by students from the Integrated Food Studies (Mikkelsen *et al*., 2015). The graduate program is offered at Aalborg University in its Copenhagen campus. It is 120 ECTS and lasts 2 year as a full time study. The curriculum builds on a trans-disciplinary approach resting on three pillars. These are Public Health Nutrition & Meals Science, Gastronomy & Design and Policy & Innovation. The teaching is based on the Problem based learning approach (PBL) and the conceptual foundation originates from foodscape studies. The students work the last semester on a Master's thesis. A number of the projects have been developing prototypes for technologies to assist dietary intake estimation and they have been evolving around food related laboratory experiments in the Foodscapelab (www.foodscapelab.aau.dk).

Besides the graduate level, the doctoral level has also been involved. At the PhD level the Food4Growth network has functioned well. The technology part has been strongly rooted among PhD students at Aalborg University Doctoral School, but also PhD students from Fudan University have

been involved. A group of the students will attend the August 2015 training school. For the PhD students the network activities have functioned as an effective training in how to run international scientific networks.

Besides the educational component of the triangle, the commercial part has played an important role in the technology part of the network activities. The company is Syscore and has been the technology and ICT provider in the different prototypes for measuring food and nutrition behavior that have been developed with the Foodscapelab as the greenhouse. As part of the further development of the DIMS 2, graduate students from the Royal Architectural and Design School have been involved in developing a robust 2nd generation of the DIMS. The version 1.1 was taken to a first field test and showcased at the ICCAS conference in June 2015 at Montclair State University and subsequently to a technology workshop at Pittsburgh University on new ICT assisted methods for dietary intake data collection.

Besides the 4 major network meetings, activities have been related to maintaining the Food4Growth website and exploring funding opportunities for joint research and education: The F4G network has been promoted in educational programs at the involved university partners and has resulted in a number of Master's projects related to F4G. These projects will inform the upscaling of protocols for joint research to be carried out at "all 4 countries' level".

5.9.6 Discussion

Research, innovation and education – all important cornerstones in the knowledge triangle are increasingly getting internationalized. Students expand their world view and are getting involved in international exchange, research is, to a far larger extent than earlier, organized in and dependent on cross-national consortia configurations, and innovation is more and more taking place in cross disciplinary teams. The proceedings from the Sino-Nordic Food4Growth network program is a good demonstration of these dynamics. The network has increased the insight into how the knowledge triangle can be applied to food and nutritional care at hospitals.

The cooperation however has also pointed to some of the challenges related to international cooperation in multidisciplinary environments

and to the involvement of multiple educational levels. Working across borders is one important challenge. Differences in organisational cultures make leadership an important task. In the case of Food4Growth, the activities have been a mixture of formal meetings, seminars with scheduled presentations, excursions to on-location places as well as open outreach conferences. This mixture has been well suited for attracting different types of stakeholders involved in the network activities including students from both graduate and doctoral levels, entrepreneurs, researchers and practitioners across cultures and across borders between the entities in the knowledge triangle.

The importance of leadership and a strong project plan seem to have been decisive and a learning lesson from the project. In the case of the innovation part, an important experience has been that it is important to involve university resources with expertise in taking prototypes and experimental versions of technology to further necessary steps. To involve small entrepreneurs into more firm types of relations at university opens up for new informal types of exchange of ideas between the commercial side and the students. Involving entrepreneurs as lecturers at campus has been further beneficial for both parties and in this case also for the network. In general, research that involves the concrete development of devices, applications and technology will be able to benefit from engaging expertise at an early stage on intellectual properties rights issues, proof of concept thinking and eventually also the scouting for venture capital that can take the ideas into commercial applications with a market potential.

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