



**SUSTAINABLE INNOVATIVE MATERIALS IN HIGH TECH APPLICATIONS (SuMac)**  
A Multidisciplinary Approach to Engineering Technology and Chemistry of Environmental Sound  
Products and Productions

**1. Researchers of the Consortium**

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**2. Updated abstract of the project**

The ongoing SuMac research project began in 2007 and will continue to the end of 2010 in the Sustainable Products and Production research programme. The scientific competence of the project is in elaborating product life cycle thinking and innovative proactive design for sustainability. The project approaches the phenomenon of sustainable development by conceptualising the essence of design and production processes from the perspectives of natural sciences (material technology, i.e. chemistry) and human-centred research (user-centred design research and wellbeing at work i.e. ergonomics). The partners of the consortium share a passion to understand how end-users of the sport products and production, environment, and empowerment of workers in industrial production processes are related to each other, and how they can support the concept of a sustainable society from the outset of the product development process.

Discussion in the field of sustainable production has revolved around sustainable design and the know-how involved, though brands that support the environmentally conscious behaviour of end-users and lead-users of sustainable products and services have yet to be developed. A particularly salient focus in this work is to determine how the scientific approaches identified might be used in elaborating research models and strategies for re-thinking and designing for the environment, well-being and empowerment, and to advance environmental impact assessment strategies for industrial ecology in the area of sport and leisure time activities and also wellbeing for workers at workplaces. The development of the methodological tools such as ethnographic videotaping is based on a conception of the end-users as active generators of research knowledge. The consortium research frame consists of five parallel workpackages: Challenging the Traditional Sustainable Products and Production, Scenarios and Concepts for Radical Eco-Innovations, Sophisticated Research Tools and Strategies for Environmental and Ethically Sound Research and Design, Sustainable and Ergonomic Product Chains, and Emergence of Environmental Sound Sport Brands.

In our understanding, the environmentally sound products and design are a mixture of the sustainable and ethical aspects as well as the pleasurable and high-oriented properties of products. The project is producing knowledge on cleaner production, research models, design tools and strategies. Principles of sustainable development require anticipation of the total environmental, social and economical impacts from-cradle-to-grave, already taking consumption, waste management, recycling and reuse potential into consideration, in the design phases.

The vision of the project is implemented through the fundamental question of *How to design, produce and market the kinds of products, which are ecologically, economically and socio-culturally sustainable*

*for the producers and the end-users of the products?* The research question is split into four sub questions: 1) How the needs of today are met eco-efficiently without compromising the ability to meet the needs of tomorrow' when designing and producing high tech application by using the sustainable innovative materials? The possible risks of the materials in applications to human health should also be taken into consideration (ecological sustainability). From the economical sustainability point of view we ask: 2) What kind of research tools, design strategies and practices facilitate the economically sustainable behaviour in future oriented, design intensive companies? Finally the last the sub questions from the socio-cultural point of view are: 3) How to take into the consideration the end users for whom sustainable high-tech products represents a significant improvement in quality of life, and ability to function?, and 4) How to provide fundamental mental, social and physical protection for workers during production, faced with the challenges of global economics?

### **3. Publications and presentations**

#### *3.1 Articles in refereed international scientific edited volume and in refereed international scientific conference proceedings*

Pitkänen M, Naumanen P, Ojanen K and Louhevaara V. (2008). The Ergonetti – Web-based Ergonomics Studies: A Qualitative Case Study. *The Open Education Journal* (1): 29-36. Available at: <http://www.bentham.org/open/toeduj/openaccess2.htm>.

Uotila, Minna (2008): Clean and Luxurious as the Object of Design and Consumption. A paper presented in International Design Conference Cumulus Kyoto 2008, March 28-31, 2008, Kyoto, Japan.

Uotila, Minna & Ryttilahti, Piia (2008). Ethically Sound Innovations. The phenomenology and taste of the outdoor elite. In the web proceedings of Changing the Change. Design, Visions, Proposals and Tools. Available at: <http://www.allemandi.com/cp/ctc/list.php>. Changing the Change –conference. 10–12 July 2008. Politecnico di Milano, Politecnico di Torino, Turin, Italy.

#### *3.2 Other scientific publications, such as articles in non-refereed scientific journals and conference proceedings, and publications in university and department series.*

Ryttilahti, Piia (2008). Social Value of Old and New Luxury. In T. Keinonen (Ed.) *Design Connections – Knowledge, Value and Involvement through Design*. Working papers – työpaperit. Publication series, F 34. University of Art and Design Helsinki, pp. 46–53.

Uotila, Minna, Ryttilahti, Piia, Talvenmaa, Päivi and Louhevaara, Veikko (2008). Sustainable Innovative Materials in High Tech Applications. A poster presentation on the Ambience'08 Conference (Smart Textiles – Technology and Design). 08, 02-03 June 2008, Borås, Sweden.

Kähkönen, Susanna (2008). Sustainable development from the Perspective of Work-related Wellbeing. Systematised literature survey. Master Thesis. University of Kuopio, Faculty of Medicine, Department of Physiology, Ergonomics.

#### *3.3 Press releases/public presentations*

“Lenkkarisi käyttöikä pidentyy”. *Taloussanommat* 9.4. 2008. Available at: <http://www.taloussanommat.fi/omatalous/2008/04/09/lenkkarisi-kayttoika-pidentyy/20089962/139>

Urheiluvaatteiden kestävyystestä. Piia Ryttilahti's interview in a local newspaper *Lapin Kanssa* 16.4. 2008.

“Harrastajat odottavat urheiluvaatteilta yksilöllisyyttä, kestävyyttä ja ekologisuutta”. Piia Ryttilahti's interview in a local newspaper *Salonjokilaakso* 24.4.2008.

Minna Uotila's, Veikko Louhevaara's and Päivi Talvenmaa's interview in *Tiedelinko*, Yleisradio 16.5.2008.

"What is Luxury?", Piia Rytilahti's interview in *Welcome to Finland Magazine Autumn/2008*, pp. 75-77.

A poster as a part of the KETJU research program presentation. An entrance hall display in the Academy of Finland. Medita Communication Oy, December 2008 - January 2009.

#### **4. The impact of the research**

Present state of SuMac research project; presentations and interviews in scientific breakfast in the Academy of Finland 9.4.2008 (LaY, TUT, UKu).

A meeting with KETJU programme co-ordinator in Rovaniemi, Spring 2008 (LaY, TUT, UKu).

Participation in Working Group for Organic, Green and Ecotextiles of European Committee for Standardization (CEN/TC248/WG32), meetings 27.6.08 and 7.11.08 in London (TUT).

Participation in Chemical Working Group organized by the Federation of Finnish Textile and Clothing Industries for finding out harmful and dangerous chemicals and substances and produce instructions for manufacturers, importers and retailers in the frame of REACH and other regulations (TUT).

Abstract " Sustainable Innovative Materials in High Tech Applications to Promote Health and Wellbeing" for IEA-Conference organized in August 2009 in Beijing, China (TUT, UKu, LaY)

Abstract " Mediating links between sustainable development and occupational wellbeing: A systematic literature review" for IEA-Conference organized in August 2009 in Beijing, China (UKu)

Factors promoting sustainable development and occupational wellbeing in production and service organizations; visit, presentation and interview in Fortum (Espoo) 11.4.2008 (UKu).

Sustainable development and wellbeing at work: visit and presentation in State Railways (Helsinki) 11.4.2008 and the City of Helsinki 14.5.2008 (UKu).

Education at the University of Lapland at the Faculty of Art and Design: Course on Sustainable Design, Fall 2008; Master's thesis guidance of sustainable design theme (LaY).

Sustainable development in the ergonomics studies at the University of Kuopio; description of education program on ergonomics (UKu).

Sustainable development at the University of Eastern Finland (Kuopio and Joensuu); recommendations for the new strategy of the University of Eastern Finland (UKu).

*Luxury of Tomorrow* research project (2009) together with eleven companies, Tekes, and the University of Lapland.

*Futupak* research network together with eleven companies, Tekes, and the University of Lapland.

#### **5. The progress of the research versus the original plan**

The research establishes a conceptual framework offered by the theoretical bases of the design research, ergonomics and material technology for sustainable goods and services relative to their environmental impacts. The empirical research subject is user-centred and worker-centred focused on sustainable

and safe products, product chains and life styles in the frame of outdoor sport and leisure time activities. The research consortium consists of three partners: University of Lapland, Tampere University of Technology and University of Kuopio. The main research areas are design research, material technology (chemistry) and ergonomics. In this R & D project the focus is in the basic and theoretical research. For example user-centred research done during 2007-2008 is concentrated in investigating ecological and sustainable life style preferences and consumption as well as the phenomenon of empowerment and occupational wellbeing of workers.

*The University of Lapland* focuses on strategic design and environmentally sound brands. The key issue is to explore how the technologically added value of the products could facilitate sustainable development and brands in products that support the health, wellbeing and the adoption of new skills among end-users. Lead-user research, usability and acceptability of the more sustainable solutions in sports design are the main perspectives of the study. During 2008 a specific sport is filtered in focus through the user-data (N=37). The life style addressed to climbing is turned out to place a high premium on ecological and ethical values. In scenarios and concepts for radical eco-innovations (workpackage 2.) is suggested that the durability and high quality of the sport products is prized by the lead-users. The sport equipment and apparel are even carefully repaired and maintained instead of buying new. At the moment the fundamental inconsistency between high tech sport products and sustainability comes with the novelty value of the high tech. The international data gathering among the end-users is still going on. The latest group of climbers left to Italy 22.12.2008 for Christmas and New Year. The group is gathering ethnographic video data. The climbers are also interviewed by the participatory research assistant.

Researcher Piia Rytilahti's dissertation on working title ethical elitism is progressing well. The public defence of a doctoral dissertation times in 2010 and contributes to the discipline of sociology of design.

*Tampere University of Technology* yields knowledge of sustainable innovative and proactive high technology materials and solutions that have applications in the sport and leisure sector. Tampere University of Technology provides environmental assessment on product life-cycle, review and define indicators for major environmental impacts of the materials and product chains during the whole life cycle and results knowledge about innovative and proactive high technology materials on the background of sustainability. Cooling and heating materials, safeguarding materials and future challenges involved in nanotechnology are studied.

*The University of Kuopio* creates strategic and operational concepts and models for promoting sustainable development in the context of wellbeing at work (workpackage 3.): worker's capabilities, work and work environment, organization and leadership and professional competence. These concepts and models will be utilized to outdoor leisure settings.

Researcher Marja Pitkänen has working with SuMac since 1.3.2008. During this time she has also prepared her dissertation "Sustainable development and Ergonetti studies for promoting wellbeing at workplaces". Her first article "The Ergonetti - Web-based Ergonomics Studies: A Qualitative Case Study" was published in The Open Education Journal. Her second article's manuscript "The role of learning in sustainable development and wellbeing at work: A hypothetical model and systematic literature review" is in progress. Pitkänen's application for the dissertation work is processing in The Finnish Work Environment Fund.

Project management is co-ordinated through a web-based shared workspace to the researchers through the Discendum Optima learning and working environment and with videoconferences. Optima is used to store all current project related information: contractual documentation and reports, documentation of meetings, workpackage activity reports, management reports, conference and journal papers, document templates, etc. The videoconferencing is also in 2009 accompanying project management and co-ordination.

The SuMac Consortium wants by way of this research to understand how product design, production chains, environment and wellbeing are related to each other and how to promote sustainability in sports and leisure time activities.