



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 environmental sound 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, design research models, 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 are the needs of today's consumption met eco-efficiently without compromising the ability to meet the needs of tomorrow's consumption when designing and producing high tech applications? 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 and design intensive companies? Finally the last sub questions relates to the socio-cultural aspects of sustainability: 3) How to take into the consideration the end users of products i.e the lead-users or cultural creatives¹ for whom sustainable high-tech products represents a significant improvement in quality of life?, and 4) How to provide fundamental social, physical and mental protection for workers of the creative and cultural industries², faced with the challenges of global economics?

3. Results of the research (publications, patents)

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

Heidi T, Pitkänen M. University Teacher Training – Innovative Solutions for the Promotion of Quality University Teaching. 23rd ICDE World Conference on Open and Distance Learning. 7-10 June 2009, Maastricht, Netherlands.

Pitkänen M, Louhevaara V. Mediating links between sustainable development and occupational wellbeing in the Finnish context. IEA 17th World Congress on Ergonomics, 9-14 August 2009, Beijing, China.

Talvenmaa P, Louhevaara V, Pitkänen M, Uotila M, Ryttilahti P. Sustainable Innovative Materials in High Tech Applications to Promote Health and Wellbeing. IEA 17th World Congress on Ergonomics, 9-14 August 2009, Beijing, China.

Ojanen K, Louhevaara V, Pitkänen M. Network of Professional Competence, 2004-2007. USE2009: Understanding Small Enterprises - a healthy working life in a healthy business. International conference 20–23 October 2009 in Elsinore (Helsingør), Denmark.

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

3.3 Press releases/public presentations

Kestäviä ratkaisuja tuleville sukupolville. *Kuopion yliopistolehti* 1/2009. Veikko Louhevaara's ja Marja Pitkänen's interview of SUMAC project.

KETJU-seminar, 10.-11.2.2009. Helsinki, Suomenlinna.

Pitkänen M. (2009). Kestävä kehitys – vesilintujen suojelusta työntekijöiden suojeluun. Suomen Akatemia, tietysti.fi-sivusto. Tiede uutiset. Tätä tutkimme. Available at:

¹ Ray, Paul H. and Anderson, Sherry Ruth (2000), "The Cultural Creatives". New York: Harmony Books.

² Florida, Richard (2002), *The Rise of the Creative Class. And How It's Transforming Work, Leisure and Everyday Life*, New York: Basic Books.

http://www.tietysti.fi/fi/T/Tiedeuutiset2/Tata-tutkimme/Kestava-kehitys---vesilintujen-suojelustatyontekijoiden-suojeluun/?id=15518_40251&PreviewURL=True (published 16 November 2009)

A poster as a part of Material Week organized by Department of Materials Science of TUT in Konetalo building, 19-23.10.2009.

4. The impact of the research

IEA 17th World Congress on Ergonomics, 9-14 August 2009, Beijing, China (oral and poster presentation). See: <http://www.tsr.fi/tutkimus/uuttatutkittua/hanke.html?id=109230>

Member of Working Group for Organic, Green and Ecotextiles of European Committee for Standardization (CEN/TC248/WG32), meetings 27.2.2009 and 23.10.2009 in London (TUT)

Abstract *Innovation for Sustainability; sustainable innovative materials in high tech applications* for Eco-Efficiency Conference, organized in June 2010 in Egmond aan Zee, Netherlands (TUT)

Supervisory and evaluation of the Bachelor thesis (Heidi Hilden): *Phase Change Materials in Textiles - Life Cycle Assessment*, 2009 (TUT)

Education at Tampere University of Technology at Department of Material Science: Course on Sustainable Product Design, spring 2009

Revision of the scientific article elaborating comparative Life Cycle Assessment of Textile Products for Textile Research Journal, 2009 (TUT)

Abstract *Muotoilun kulutustutkimusta bourdieulaisessa viitekehityksessä (Bourdieu's frame of reference in the research of design consumption)* for Sociology Festival in 20-21. March 2009, Helsinki, Finland. (LaY) available at: <http://www.valt.helsinki.fi/sosio/sosiologipaivat09/sosio/tyoryhmat/kulutus.html>

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 socio-cultural context of the research reaches for the creative industries including the professional knowledge-based services.

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 was filtered in focus through the user-data (N=37). The lead-user 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 these lead-users. The fundamental

inconsistency between high tech sport production/products and sustainability issues comes with the novelty value of the high tech.

Researcher Piia Rytilahti's dissertation work on design consumption is progressing well. The public defence of a doctoral dissertation times in 2011-2012 due to her maternity leave during 11.7.2009-24.5.2010. The dissertation contributes to the disciplines of sociology and design research. Fall 2009 the research is continued by MA students, Laura Seppälä and Hanna Söder who collected end-user data from snowkiters and climbers. They also developed a model about sustainable responsible outdoor clothing design for a tool to designer. The tool can be used as guideline when designing environmentally friendly outdoor apparel.

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.

Research work under the main topics of innovative materials and solutions is continued. Further life cycle related software systems supporting sustainable product development are reviewed and as a result of this work Gabi4 Software System have purchased by Department of Materials Science of TUT. Orientation and exploitation possibilities of this Gabi4 Software are in process.

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's dissertation work sustainable development and well-being at work is progressing well. Pitkänen received a stipend for her dissertation work from The Finnish Work Environment Fund. Since November 2009 she has been a member of the IEA (International Ergonomics Association) Technical Committee "Human factors and Sustainable Development".

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 was also in 2009 accompanying project management and co-ordination.

The SuMac Consortium likes with this research to increase understanding on how product design, production chains, environment and wellbeing are related to each other and how to promote sustainability in sports and leisure time activities.