Sustainable Innovation 2014
19th International Conference
Cities & Regions as Catalysts for Smart & Sustainable Innovation
3rd – 4th November 2014
KADK
Copenhagen, Denmark
www.cfsd.org.uk

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The Fuzzy Front End of Sustainable Innovation: a Case Study on the Pulp and Paper Industry

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Sustainable innovation is nowadays a broadly discussed topic. However, research on the fuzzy front end of sustainable innovation still received little or no attention (Bocken et al., 2014), although the integration of aspects of sustainability obviously makes it even more fuzzy. Within the initiation phase of the innovation process, other sources such as secondary raw materials or ecological considerations can be possible starting points. Further on, different actors, e.g. suppliers of those secondary raw materials, have to be included in the innovation process. And criteria to assess the innovation potential have to be adapted and complemented by additional ones such as legal demands and life cycle assessment.

So, the main objective of this paper is to adapt and enlarge the fuzzy front end to suit to sustainable innovations. We first analyse different starting points for such sustainable innovations that are different to conventional ones. Second, we develop criteria to critically assess the strengths and weaknesses of the ideas created within the fuzzy front end. And third, based on these criteria, we investigate possible directions for ideas with sustainable future potential.

To evaluate practical application of this adapted fuzzy front end for sustainable innovation, the paper investigates a case study within the pulp and paper industry. During the pulp production numerous by-products are formed. Next to tall oil, turpentine and resin, lignin is the most important by-product. Lignin is currently used mainly thermally in recovery boilers which are located directly in the pulp mills. Since thermal recovery forms the lowest level of the recycling hierarchy, this is the starting point of the innovation process for sustainable innovation. At the beginning, the product of lignin itself as well as its value chain has to be critically assessed to find appropriate and sustainable alternative applications. New production technologies have to be considered as possible solutions for a sustainable recovery of lignin. One concrete application seems to be the production technology 3D-printing. By this method, new and innovative products with specific properties can be manufactured substituting traditional materials such as plastics and metals. Hence, 3D-printing of lignin seems to be a technically feasible option. However, all these considerations are just first intentions. To evaluate such sustainable ideas in an early step of the innovation process the structured methodological framework fuzzy front end of sustainable innovation has to be considered.

At the beginning of the paper, we investigate the literature on the already well researched fuzzy front end topic combining it with the topic of sustainable innovation. Based on the theoretical analysis, the model for the fuzzy front end of sustainable innovation will be developed and applied to the case study of paper and pulp and its by-products, in specific lignin. As a result, alternatives for a sustainable application of lignin will be analysed and evaluated. Finally, a conclusion and further limitations will be discussed at the end of the paper.