

# Accepted Manuscript

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PII: S0959-6526(15)01388-8

DOI: [10.1016/j.jclepro.2015.10.007](https://doi.org/10.1016/j.jclepro.2015.10.007)

Reference: JCLP 6238

To appear in: *Journal of Cleaner Production*

Received Date: 24 June 2014

Revised Date: 24 September 2015

Accepted Date: 2 October 2015

Please cite this article as: Vīgants E, Blumberga A, Timma L, Ījabs I, Blumberga D, The Dynamics of Technological Substitution: the Case of Eco-Innovation Diffusion of Surface Cleaning Products, *Journal of Cleaner Production* (2015), doi: 10.1016/j.jclepro.2015.10.007.

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# 1 THE DYNAMICS OF TECHNOLOGICAL SUBSTITUTION: 2 THE CASE OF ECO-INNOVATION DIFFUSION OF SURFACE 3 CLEANING PRODUCTS

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## 10 **Abstract**

11 Some eco-innovations have already reached a mature state, but they diffuse slowly. There is  
12 little known about the importance of various factors on the diffusion process of eco-  
13 innovations. The aim of this research is to propose a conceptual model for eco-innovation  
14 diffusion, where particular case study of eco-innovation – micro-fibre cloth (MFC) for surface  
15 cleaning purposes – is given. The work will study the relative importance of various  
16 motivations on diffusion processes as well as the influence of information campaigns. This  
17 novel methodology has been developed under the system dynamics framework and is coupled  
18 with the logistic regression model. Structural validation tests were done for the proposed  
19 model. The methodology is proposed, then the integrated empirical study and system  
20 dynamics model are completed. The results of the logistic regression models show that the  
21 overall attitudes and social influence has the most dominant impact on intention to use the  
22 studied eco-innovation products. The most sensitive parameters in the system dynamics  
23 model were found to be the adoption fraction of information received by word-of-mouth,  
24 households adopting micro fibre cloth at the beginning of the simulation, and the contact rate  
25 per household. The proposed methodology, and developed mathematical model can also be  
26 used as the basis for other studies of other diffusion processes, since system dynamics  
27 modelling is a white-box modelling approach, and the structure of the model can be enhanced  
28 with the latest results from other studies.

## 29 **1. INTRODUCTION**

30 The exponential growth of the population has generated similar patterns in final  
31 consumption. As a result, this leads to boosts in the economy, resource consumption, energy  
32 consumption and, consequently, environmental degradation. As the founder of system  
33 dynamics Jay Forrester (1961) pointed out: growth cannot be limitless in a finite system;  
34 when the system reaches its carrying capacity, a collapse occurs. Therefore, we believe that  
35 sustainable reductions in both production and final consumption are the key challenge for  
36 modern society.

37 Eco-innovations are related to sustainable production and consumption; they are  
38 increasingly used to substitute existing products or services (EIO, 2011). In our work we  
39 review one particular eco-innovation: micro fibre cloth for surface cleaning purposes. In  
40 substitution theory, buyers' decisions are based on both a generic function and additional  
41 functions performed by the product (Porter, 1985). In our studied case, when the substitution  
42 of a product is made by an eco-innovation, it performs the same generic function as the  
43 product being replaced; however, the product itself is very different. Micro-fibre clothes have  
44 the same generic function as other wipes and an important addition property substitution of  
45 cleaning agents. In the context of this research, the traditional scope of eco-innovations,  
46 which is to reduce the material inputs and waste outputs, has a broader and more  
47 comprehensive view – absolute reductions.

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