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# A Reflection on the Product Development Process Integrated with Sustainability

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Academic Work

## Introduction

- The academic debate on sustainability plays a significant growth in several segments
- The debate on integrating sustainability into the Product Development Process (PDP).
- Which are the main references focused on the discussion of the integration of sustainability in the product development process.

## Introduction

- The scientific objectives of the research are to explore and understand phenomenon studied.
- Systematized bibliographical research and content analysis are used as a technical procedure in order to identify and classify the studies found.



## Systematic Bibliographic Research

The systematic bibliographical research is used as a technical procedure, which was developed and structured by its authors especially to obtain this research.

*What are the main discussions about the integration of sustainability in the PDP portrayed in recent research?*

## Systematic Bibliographic Research

- Filters:

Product	Sustainability	Consumption
Product Development Process (PDP)	Sustainability	Competitive Advantage
Product Creation Process (PCP)	Sustainable	Willingness to Pay
Product Design (PD)	Triple Bottom Line (3BL)	Value
Project Management	Footprints	Green Consumption
Quality Function Deployment (QFD)	10 Golden Rules	Green Marketing
Life Cycle Assessment (LCA)	Industrial Ecology (IE)	Market-oriented sustainability
Lean Product Development (LPD)	Design for Environment (DFE) Green Product Development (GPD)	

**Table 1** - Groups of keywords.

# Systematic Bibliographic Research

## Group of resulting keywords

- Green Design
- Ecological Design
- Environmental Design
- Environmentally Sustainability Design
- Design for Sustainability
- Development New Product
- Industrial Design
- Manufacturing Design
- Design Innovation
- Strategic Design
- Design Assessment

**Table 2** - Group 4 - Group of Resulting Keywords

## Results

### ***Disposition 1 (internal)***

- Product group (850 articles that resulted in 169 articles);
- Sustainability group (6,164 articles → finalized 412 articles);
- Consumption (added 1086 articles → resulted in 55 articles).

## Results

### **Disposition 2 (external)**

1750 articles → selected 209 relevant articles.

### **Group of resulting keywords**

2606 articles → selected 158 relevant articles.



## Results

Group/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
<b>Product</b>	7	2	8	11	11	22	24	33	22	15	0	155
<b>Sustainability</b>	4	5	2	4	5	5	10	10	12	19	0	76
<b>Consumption</b>	2	1	1	3	3	10	8	13	8	4	1	54
<b>Disposition 2</b>	4	3	1	1	2	15	11	21	29	22	2	111
<b>Resulting keywords</b>	2	1	4	1	2	15	11	16	16	16	0	84
<b>Total</b>	19	12	16	20	23	67	64	93	87	76	3	<b>465</b>

Table 3 - Number of articles per year.

## Results

- **The 465 searches were categorized according to the following areas:**
- **Area 1:** researches that cover the process of development of sustainable products until the production phase (from the planning of the process to the final result of the product);
- **Area 2:** researches that covers the process of developing environmentally sustainable products;
- **Area 3:** researches that covers the process of developing socially sustainable restricted products;
- **Area 4:** researches that cover the consumption of sustainable products, as well as the profile of the consumer and the value added to the product;
- **Area 5:** researches that covers strategic planning for the development of sustainable products until distribution in the market (the final result of the product and its presentation and targeting to the market);

## Results

- With the filtering by the framing in the areas that the study focuses on and the content analysis, the number of articles resulted in 101.

Group	Area 1	Area 2	Area 3	Area 4	Area 5
Product	16	13	1	3	7
Sustainability	26	14	4	9	17
Consumption	5	3	0	10	3
Disposition 2	14	3	1	5	6
Resulting keywords	19	7	2	7	11

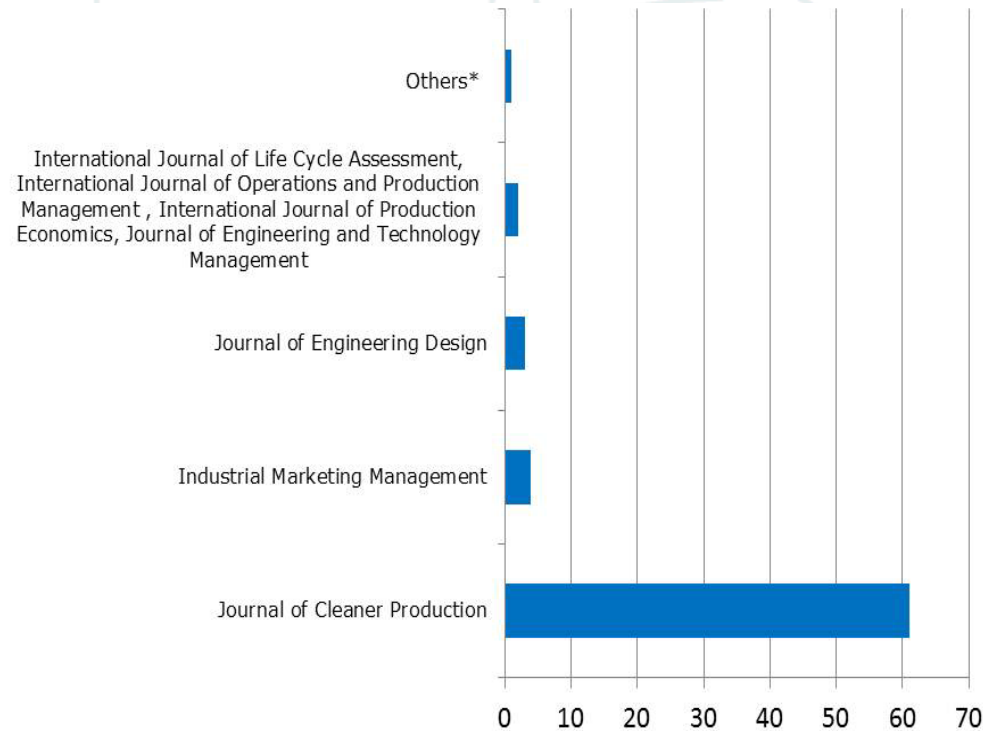
Table 4 - Framing of research by area.

## Results

Groups/Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
Product	1	1	1	2	2	2	3	4	3	1	0	20
Sustainability	3	4	1	1	4	2	4	2	5	3	0	29
Consumption	1	0	0	0	2	3	2	1	1		1	11
Disposition 2	0	0	0	0	0	3	1	4	4	5	0	17
Resulting keywords	2	1	1	0	2	3	1	2	7	5	0	24
<b>Total</b>	<b>8</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>10</b>	<b>13</b>	<b>12</b>	<b>13</b>	<b>21</b>	<b>15</b>	<b>1</b>	<b>101</b>

Table 5 - Number of articles per year.

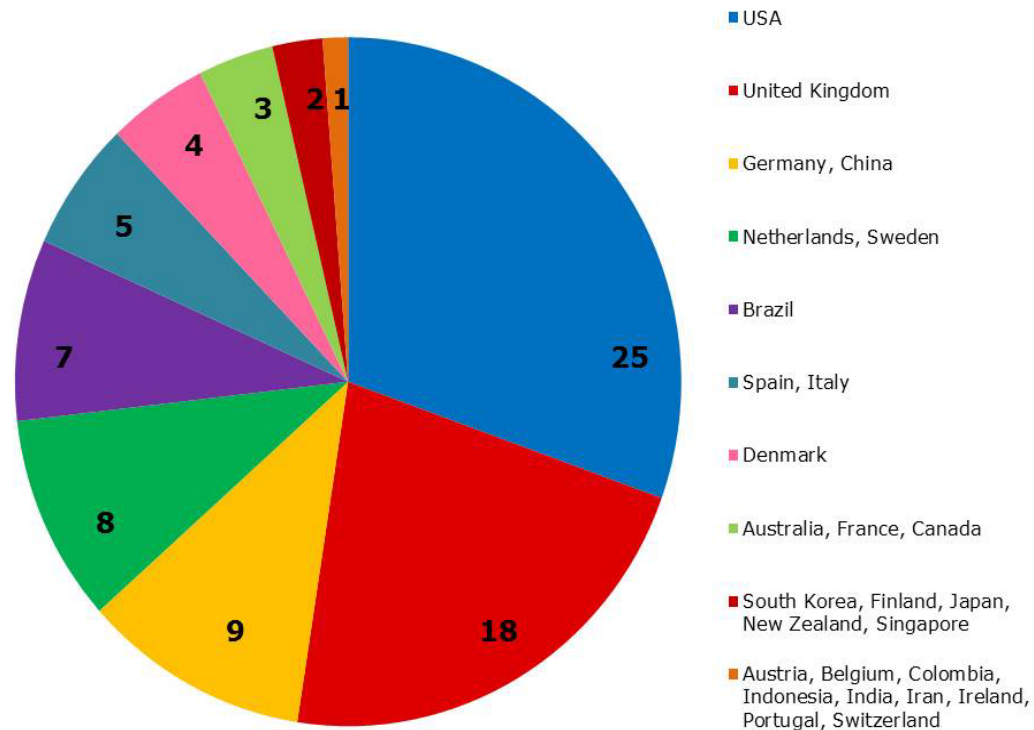
## Results



\* Expert Systems with Application, Design Studies, MIS Quartely, Journal of Industrial Ecology, Concurrent Engineering: Research and Applications, Research-Technology-Management, Clothing and Textiles Research Journal, IEEE Transactions on Engineering Management, Technovation, Benchmarking: An International Journal, Marketing Intelligence & Planning, Journal of Macromarketing, Journal of the Academy of Marketing Science, Business Strategy and Environment, Management Decision, European Business Review, CoDesign, Industrial Management & Data Systems, Annual Review of Environment and resources, European Journal of Operational Research, Bulletin of Science, Technology e Society, Ecological Engineering, European Journal of Innovation Management, International Journal of Design, Computers and Chemical Engineering

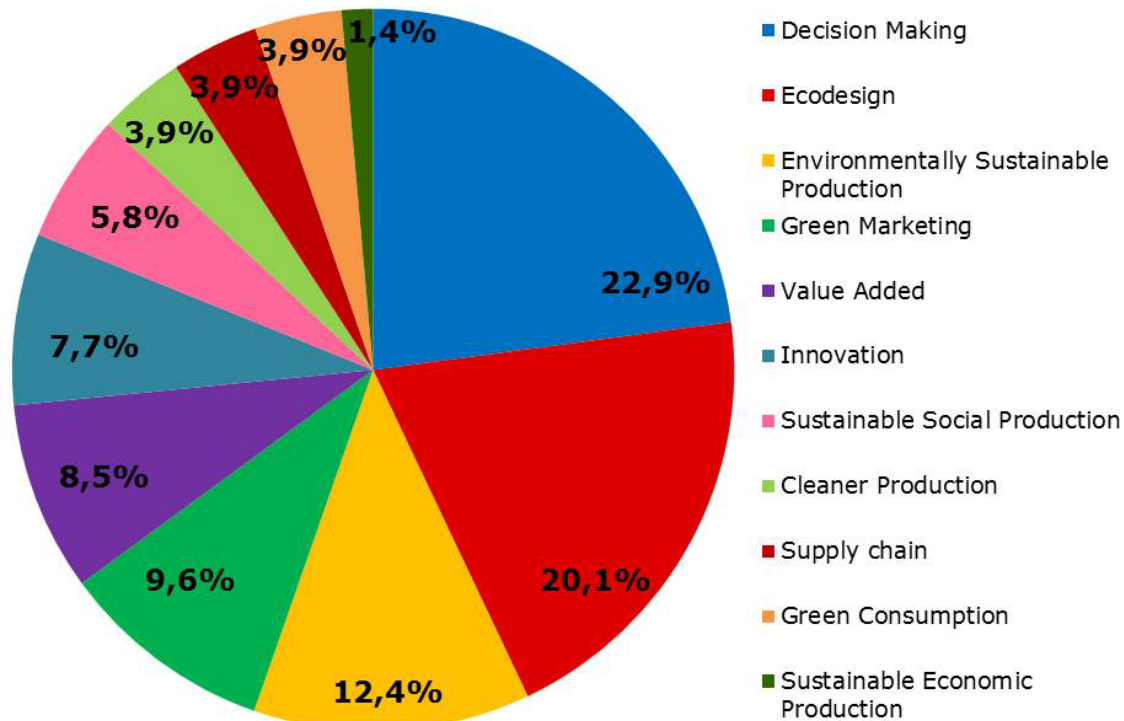
**Graph 1** - Published journals.

## Results



Graph 2 - Geographic distribution.

## Results



Graph 3 - Areas of knowledge.

## Final Considerations

- The methodology developed for this systematic bibliographic review was effective for the accomplishment of the objective of the work and for the generation of additional information regarding the subject that should be studied and explored in the future.



## Final Considerations

- Despite the concentration being higher in certain locations and in some periodicals/journals, the index of development of studies dedicated to the subject is increasing more expressive from 2011.
- Also, the debate must continue to be distributed, indicating that there is a common and multidisciplinary interest in advancing the of this subject.