



**AN EMPIRICAL RESEARCH ON PRODUCT SERVICE SYSTEM (PSS) FOR  
BUSINESS MODEL INNOVATIONS WITH TECHNOLOGY**

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**Abstract**

*'Sustainability' is a significant and improving driver of business change. Its results for innovation are clear – living and working in a world of up to 9 billion people with rising expectations, providing energy, food and resource security, operating with climatic change, atmosphere destruction, improving financial dividend and a number of other interdependent problems which require large change in products, service, techniques, enhance marketing and the particular business models for framework. The main focus of this paper is to develop an understanding of emerging patterns and innovation of management which required to taking an account for emerging opportunities in the business 'sustainability'. In particular it draws on case research of a number of business owner/companies to help response the query of what genuine actions might be taken beyond the over mentioned statements of moving towards greater sustainability of business. This paper has identified **six emerging approaches (Product service systems (PSS), Open innovation, Peer-to-peer innovation, Closed-loop production, Crowd-funding, and Sharing economy)** an empirically tested **Product service systems (PSS) with various age groups of respondents**, with the objective to understand the developing business models for sustainability of business. For the purpose of analysis chi square test has been used.*

**Keywords:** - Product service systems, PSS, Open innovation, Peer-to-peer innovation, Closed-loop production, Crowd-funding, and Sharing economy.



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## 1.1 INTRODUCTION

In experiencing the process of developing a more sustainable designed atmosphere, organization plays a double faceted role. On the one side, business and relevant activities are at the centre of the production–consumption system that is the significant cause of our sustainability problems. On the other side, the expecting the waves of modern business and its potential to innovate and make solutions to current and emerging troubles, together with those related to sustainability, guarantees to be one of the primary sources of new ideas and strategies to deal with the strength difficulties as facing by peoples.

The changes needs business will be more than step-by-step procedure and product innovations. Over the last 20 years this focus of sustainability innovation has certainly brought us clear and more efficient products and services. However, it also need essential

changes to in business models – and the techniques that assistance them – “if we are to meet our existing and future sustainability challenges” (Gaziulusoy, Boyle & McDowall 2013; Ryan 2013a; Tukker & Tischner 2006; Whiteman, Walker & Perego 2013).

Business models have been described as the ‘fundamental components of structure for how companies create, deliver and capture value’ (Osterwalder & Pigneur 2010); innovation does not necessarily require a new technological item or procedure, but rather can involve changing aspects (or the entirety) of a value structure around an offering. As the examples in this report will demonstrate, such changes can sometimes analyze wider system change.

Disruptive changes have happened in various areas with introduction new business models over the past years in areas such as retail music, press and shopping. These emphasize the risk to business management in being satisfied about their existing business model or structure, which can leave them exposed to new competition and markets.

In order to make the business sustainability it’s essential to understand the new and emerging trends, innovation and growth of management.

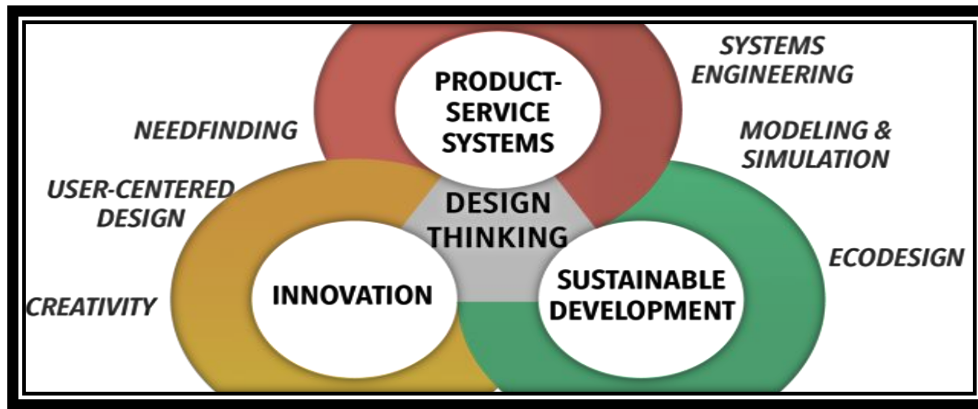
#### **What is innovation?**

Innovation does not necessarily continue linearly from basic scientific research to product development; it is a repetitive procedure for both related market needs to technical abilities and performing analysis to fill gaps in knowledge, whether during product perception or conception, product design, production or manufacturing, marketing, or other stages of the innovation procedure.

#### **What is Technological innovation?**

Technological innovation is the act of developing and putting to use new product and procedures. It may be unique in product/process/service or applying for both.

Innovation therefore includes not only the growth of new products, procedures, and services that create new programs, but also the growth of new product, procedures, and services for use in innovative programs (e.g., integrated circuits replacing vacuum tubes in electronic applications), or the use of a pre-existing product, procedure, or support in a new application (e.g., manufacturers of flat panel displays adapted semiconductor manufacturing equipment to their needs).



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## 1.2 REVIEW OF LITERATURE REVIEW

**Schot and Geels (2008)** had given empirical findings and conceptual elaborations of the last 10 years in strategic niche management research. The strategic niche management research approach suggests that sustainable innovation journeys can be facilitated by creating technical niches i.e. restricted spaces that allow the experimentation with the co-evolution of technology, user practices, and regulatory structures of framework. The assumption was that if such niches were constructed appropriately, they would act as building blocks for broader societal changes towards sustainable development. The research paper shows how concepts and ideas have progressed over time and new complexities were set up.

Research focused on the role of various niche-internal procedures such as learning, social media, visioning and the relationship between local tasks and international concept sets that guide acting professional behavior. The scientific results revealed that the research of these niche-internal measurements needed to be accompanied with attention to market exterior procedures. In this regard, the multi-level viewpoint showed useful for contextualizing SNM. This contextualization led to a change in statements about the characteristics of sustainable innovation trips. Areas are to be considered crucial for bringing about program changes, but they cannot do this on their own.

Linkages with continuous exterior procedures are also important. Although substantial ideas have been obtained, the SNM approach is still an incomplete research program. They recognize various appealing research guidelines, as well as policy effects.

Some of these studies emphasize disadvantages of the SNM strategy as described in **Kemp, Schot, and Hoogma (1998)** and **Hoogma et al. (2002)**. For example, **Brownish et al. (2004)** and **Harborne et al. (2007)** stress that participation of outside stars and second-order studying do not happen easily by themselves. It requires the existence of particular motorists

and situations. They point to the value of a sense of emergency and the role that a procedure for organized recurring visioning could play.

In similar line of thinking, **Hegger, van Vliet, and B.J.M. van Vliet (2007)** claim that the strong concentrate on tests with technological innovation in many business presentation tasks is not favorable to wide studying and outsider participation. It might strengthen the technological innovation force personality of actual tests. They offer divert the main focus of market tests towards ideas and concept, thoughts and directing ideas rather than technological innovation, and toward using social factors first, at the same time without ignoring the socio-technical personality of the change procedure.

Finally, the transition management strategy or approach endorsed by **Rotmans, Loorbach** and others, which like SNM features the value of tests and experiments, emphasizes the value of creating thoughts before starting experiments (**Rotmans, Kemp, and van Asselt 2001; Loorbach 2007; Kemp, Rotmans, and Loorbach 2007**). TM encourages picturing methods in so-called 'transition arenas', which involve program actors, market actors and strangers or outsiders. Thus definitely is designed to impact the program, using market encounters and alternative thoughts to impact the intellectual frames of regime actors.

**Grin (2006)** makes identical factors about the major power of impacting intellectual supports, which he recognizes as a critical facet of reflexive government (**see also Bos and Smile 2008, forthcoming**). Grin claims that tendencies and restrictions in current organizations can be getting over by giving stars with a meta-vision that helps them deal with the task of developing essential change.

### **1.3 EMERGENCE OF NEW DYNAMICS FOR BUSINESS**

Sustainability is recognized as a key driver for innovation in business or organizations (**Nidumolu, Prahalad & Rangaswami 2009**). The idea that companies can obtain ideal benefits through innovation that is created to deal with sustainability problems is not new. **Michael Porter and Claas van der Linde** argued in the mid-1990s that properly designed, stringent environmental regulation and guidelines would influence and facilitate innovation in business (**Porter & van der Linde 1995**).

This discussion has been reinforced by a body of practical or empirical research (**e.g. Greenstone 2003; Taylor, Rubin & Hounshell 2005**). A number of the influences that cause company to move towards more sustainable methods consist of regulation and standards, source restrictions, a need to be a market innovator, customer pressure, investor and worker stress, and broader stakeholder stress such as provide sequence actors (**e.g. Anton, Deltas, & Khanna 2004; Brown & Wahlers 1998; Charter et al. 2008; González-**

**Benito & González-Benito 2006; Hart 1995; Henriques & Sadorsky; 1996; Orsato 2009; Wheale & Hinton 2007).**

They recognized and identified **nine emerging** approaches used in emergent or developing business models or structure that are pertinent to sustainability. There is only a limited body of knowledge on the importance of other techniques or approaches to sustainable company and innovation as these appeared or started to be used more commonly in the past few years. They include crowd-funding, shared consumption of resources and other techniques or approaches depending on heterodox financial aspects, such as the gift economy. The emerging production model, which relies on additive production or manufacturing, or 3-D printing, has been of interest to government authorities and businesses as well as it is approved to be game-changing, with major economic, ecological and social implications.

After Reviewing above literature author has been find out six major approaches which further analyzed through various statistical test with the help of SPSS software.

#### **1. PRODUCT-SERVICE SYSTEMS (PSS)**

PSS have been mentioned in the literary works on design and innovation for sustainability as a good approach for sustainability for more than a several years. A product–service system is a set of solutions and services capable of together satisfying a user’s need (**Goedkoop et al. 1999; Mont 2000**). PSS can help companies to flourish their role in the market to better organize, coordinate and control the mix of products and services to meet needs of people while lowering overall ecological and social impact (**Tischner, He & Vezzoli 2009**). **Tukker (2004)** recognizes eight archetypal PSS categories).



## **2. OPEN INNOVATION**

The traditional ‘closed’ approach or strategy to innovation has been a model of powerful self-reliance by organizations in holding out R&D, generating ideas, making investment choices, developing, funding and marketing new products/services/technologies through techniques of intellectual property protection, control and privacy.

## **3. PEER-TO- PEER INNOVATION**

In addition to the now ‘traditional’ model of open innovation, which includes a organization or range hitting into the knowledge of audience through concept challenges, innovation produced by peer to- peer techniques or network through open-source allocated for manufacturing abilities is even more ground-breaking in terms of its effects for business and community. Peer-to-peer innovation is based on collaboration of generally linked, allocated individuals who share resources and results without depending on market alerts or top-down instructions in hierarchical firm structures (**Benkler 2006**).

## **4. CLOSED – LOOP PRODUCTION**

The assumption of circular models is reducing or removing waste and increasing source performance in production–consumption techniques. It is suggested that this can be accomplished by closing content cycle in produced items through design, a perception made popular as ‘cradle-to-cradle’ **McDonough and Braungart (2002)** (even though the word or term has been in extensive use in eco-design research since the mid 1990s), or by building symbiotic networks of organizations within which waste from one business is used as raw content by another, known as ‘industrial ecology’ (**Ayres & Ayres 2002; Frosch & Gallopoulos 1989**), or ‘industrial symbiosis’ (**Chertow & Ehrenfeld 2012**).

## **5. CROWD – FUNDING**

Crowd-funding (also known as crowd financing and crowd investing) can be described as the process of a party inquiring and obtaining economical or other sources from many individuals with the objective of understanding a specific project. Investors are provided some kind of come back on, or compensate or reward for, their investment, which may or may not be financial (**Mollick 2014; Vorbraak 2011**). Crowd-funding is generally mediated through on the internet systems or through online platforms.

## **6. SHARING ECONOMY**

In addition to crowd-funding, which provides an alternative approach to funding public and private tasks as well without reliance on many or venture capitalists, the discussing economic system as an emerging social movement, again assisted by information and interaction technological innovation an internet-based public networking, provides some new business



models with the potential for troublesome innovation. While 'sharing' can be regarded one of the domains of PSS growth, it is deserving of discussion in its own right.

Business models motivated by a new production model Preservative and digital production, or as it is more generally known, 3-D printing, has become a new paradigm for production or manufacturing.

#### **1.4 RESEARCH DESIGN**

The research design is the blueprint of the research and describes the methods used for collection, measurement and analysis of data. According to **Kerlinger (1986)**, research design is the plan and structure of investigation so conceived as to obtain answers to research questions. The plan is overall scheme or program of the research. It includes what the investigator will do from writing hypothesis and their operational implications to the final analysis of data.

A research design expresses both the structure of the research problem and the plan of investigation used to obtain empirical evidence on the relations of the problem **Kerlinger (1986)**.

**Cochran (2006)** suggests essentials of research design:

- An activity- and time-based plan
- A plan always based on the research question
- A guide for selecting sources and types of information
- A framework for specifying the relationships among the study's variables
- A procedural outline for every research activity

For the present study both **exploratory and conclusive research** methods were used. The conclusive research method here is descriptive in nature and the research design is single cross sectional. In this study primary data has been collected through questionnaire method. The research was conducted with the help of a questionnaire measuring the perceptions and feedback from business man on technology and innovation for their business sustainability. The chosen research design mainly emphasizes on the discovery of ideas and development of insight into the subjects under study.

#### **1.5 ANALYSIS AND INTERPRETATION**

For the purpose of analysis following hypothesis have been formulated

**H<sub>01</sub>**:- **There is no significant difference amongst various age groups of respondents and their perception about the product service system for their business sustainability.**

**H<sub>11</sub>**:- There is no significant difference amongst various age group of respondents and their perception about the product service system for their business sustainability.

**Table 1:- Case Processing Summary**

Case Processing Summary						
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age * Cagg	150	100.0 %	0	0.0%	150	100.0 %

**Table 1** shows the case processing summary of various age groups and **product service system** and related variables. This shows that total number of observation were 150.

**Table 2:- Cross tabulation**

Age * Cagg Crosstabulation								
Count								
		Cagg						Total
		Missing	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
Age	25-35	6	2	28	38	24	0	98
	35-45	0	1	10	22	10	2	45
	45-55	0	0	0	4	2	1	7
Total		6	3	38	64	36	3	150

Above **Table 2** illustrates that major portion of the respondents were neutral about the **product service system** for sustainability of business. Maximum respondents were from 25-35 age groups (who filled the questionnaire) out of 150 respondents.

**Table 3:- Chi-Square Tests**

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
<b>Pearson Chi-Square</b>	31.852 <sup>a</sup>	10	.000
<b>Likelihood Ratio</b>	24.258	10	.003
<b>Linear-by-Linear Association</b>	9.024	1	.003
<b>N of Valid Cases</b>	150		

a. 11 cells (61.1%) have expected count less than 5. The minimum expected count is .16.

From the above **Table 3** it could be interpreted that Asymp. Sig. (2-Sided) column values are less than .05 so we reject the null hypothesis that there is no significant difference amongst various age groups of respondents and their perception about the product service system for their business sustainability.

It could interpret that according to various age groups of respondent's perception about product service system (PSS) may be change. It is true because business man who are under



the age group of 25-35 having the capacity of taking risk as compare to all other groups. As the young business man having the good knowledge about innovation and technology so they efficiently using these services for their product service system.

**Table 4:- Symmetric Measures**

Symmetric Measures					
		Value	Asymp. Std. Error <sup>a</sup>	Approx. T <sup>b</sup>	Approx. Sig.
<b>Interval by Interval</b>	<b>Pearson's R</b>	.209	.056	3.066	.002 <sup>c</sup>
<b>Ordinal by Ordinal</b>	<b>Spearman Correlation</b>	.157	.062	2.321	.016 <sup>c</sup>
<b>N of Valid Cases</b>		200			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					
c. Based on normal approximation.					

From the above **Table 4** it could be interpreted that the value and Approx Sig. columns that the relationship between the average score of business man response and **product service system** variables are **positively significant**. Observation was performed by Pearson's and Ordinal by Ordinal analysis was performed by Spearman Correlation at different intervals. Correlation found **positively significant** by observed values, like for Pearson's that was (0.056) and for Spearman that was (0.062). Their Approx Sig. value for Pearson's R was 0.002 and for Spearman Correlation was found 016.

**Table 5:- Frequency Table of Respondents of product services system familiarity**

Familiar product service system					
		Frequency	Percent	Valid Percent	Cumulative Percent
<b>Valid</b>	<b>Don't Know</b>	24	16	16.55	16.1
	<b>Some What Know</b>	14	9.33	9.65	26.2
	<b>Know</b>	98	65.33	67.5	93.7
	<b>Know Very Well</b>	9	6.0	6.2	100.0
	<b>Total</b>	145	96.6	100.0	
<b>Missing</b>	<b>System</b>	5	3.33		
<b>Total</b>		150	100.0		

**Source: Primary Data**

According to **table 5**, it could be interpreted that out of 150 respondents, 24 (16%) respondents have no idea about product service system, 14 (9.33%) were somewhat know, 98 (65.33%) were knowing and 9 (6%) were know very well about product service system in business and 5 respondents have not given any answer. Results shows that maximum 71.33 % respondents know and very well know (65.33 + 6.0 = 71.33%) about the term product service system (PSS).

**Table: - 6 Importance of emerging approaches for sustainable business**

	<b>Product service system</b>	<b>Open innovation</b>	<b>Peer-to-peer innovation</b>	<b>Closed-loop production</b>	<b>Crowd-funding</b>	<b>Sharing economy</b>
<b>Unimportant</b>	8	4	7	4	6	7
<b>Casual</b>	2	12	8	7	7	4
<b>Neutral</b>	12	9	20	9	15	10
<b>Important</b>	15	106	46	108	102	92
<b>Very Important</b>	103	11	58	14	10	25

Above **table 6** is showing that maximum respondents are agreed that product service system are very important tool for sustainability of business where as they have also given importance to tools like Closed-loop production, Open innovation, Crowd-funding and Sharing economy for sustainability of business.

**Lastly it can say that for the sustainability of any business, innovation must be fit for business and business goals.**

**Innovation must be fit for firm or business and their corporate goals**

Firms must also choose whether a new technological innovation or new styles suits in with their wider business objectives. While it may seem that any innovation developed by an organization would, by meaning, be connected with the marketplaces and technological innovation that the organization wants to engage in, this is not always the case. Often researchers will—by following their own passions or intuition, or through genuine serendipity-develop a cool item or procedure at the level of a model or prototype. Once the researcher has knowledge of the innovation, he or she can try to persuade business control over its potential, and can identify the existing situation for production or manufacturing.

At this point, the business must choose if the innovation suits in with its business objectives. Business often determines their technological innovation objectives along three dimensions (though most strategies are a mixture of all three): technological innovation which mainly focuses on **Product**, **Service** focus, and **System (PSS)** focus.

A technology-focused organization uses technological innovation to achieve an advantage against their competitors in the industry, and will get into marketplaces that combine a fixed set of primary technological innovation.

After analyzing all concepts it has been found current trends in management which are essential for all types of business which helpful to understand their business sustainability with the following tools and trends.

## CURRENT TRENDS IN MANAGEMENT



## CONCLUSION

The design and development of sustainable business models is still in its beginnings and this document has only offered a flavor of the types of new business designs for durability in the built atmosphere that may emerge and generate disruptive change.

This research has also brought up questions and offered ideas to help develop the plan of sustainable business model with special reference to **Product Service System (PSS)**. For example identifying the architectural and social concerns of business model more clearly and considering how the company concept can be enhanced to be more easily useful beyond for-profit organizations, so as to include other venture actions and businesses. Some of the real-life illustrations offered in this review will not gain further grip and some will don't succeed, yet they are seen as motivational and so might shape other business improvements in the future. Analysis and learning is a main powerful of the advancement and conversion process, and the unavoidable problems of some business designs will not prevent impressive thinking in sustainable business model design.

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