Conceptual Model for the Explanation of the Phenomenon of Radical Innovation in the Disruption of the Internet of Things, on Scales of Smart Objects, Homes and Cities

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Abstract. The Internet of Things is an emerging, mainly technology driven, field, seen as a radical modifier of the semantic relationships between people, objects and cities. Based on the empirical study of various products and systems within the Internet of Things environment, a conceptual model is proposed to explain the phenomenon of Design (Meaning) Driven Innovation and its particular variables, where the radical innovations, make sense in society. It is argued that the variables: Social Willingness to Change, Network of Visionaries, Technology and Meanings are four actors for the construction of new and radical meanings in products.

Keywords: Internet of Things · Innovation · Design driven innovation · Conceptual · Model

1 Introduction

The Internet of Things has the potential to profoundly change society. Gartner predicts that by 2020, 25 billion objects will include connectivity capabilities [1].

Currently, products are being developed in the Internet of Things under three approaches: Technology as the main axis [2]; User Centered Design [3]; the third approach proposes a paradigm shift based on the hidden possibilities of a technology [4,5]. The Internet of Things requires a non-user-centered model to reach its disruptive potential, with an approach that challenges the established paradigms and proposes value from a sociological perspective. Thus, the aim of this paper is to propose a conceptual model that explains the phenomenon of radical innovation in the disruption of the Internet of Things.

2 Theoretical Framework

Design-Driven Innovation states that *technological epiphanies* occur at the meeting point of breakthrough technologies and breakthrough meanings. This proposes a radical approach to innovation which does not give people an incremental interpretation of what they are already familiar with, but proposes different,

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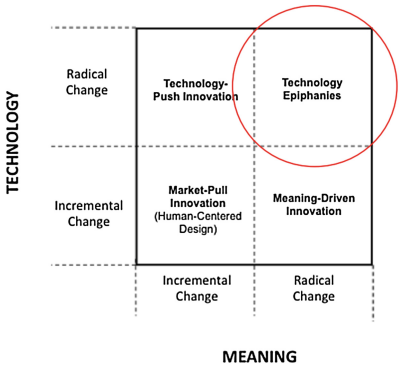

Fig. 1. Conceptual model of radical and incremental innovation [6].

novel and unexpected meanings [6] that end up imposing the new paradigm. The model proposed by Verganti connects the two dimensions of innovation: technology and meaning [7], with the drivers: technology, design and users (see Fig. 1). Thus the model defines four types of innovations: **Market-led Innovations.** The objective is to meet users needs (User Centered Design) [7]. **Technology driven innovations.** They integrate functionality and technology, and come from radical changes in technology without changing the meaning of the product [7]. **Meaning Modification.** These innovations begin by understanding the subtle and tacit dynamics in the socio-cultural models, and result in radically new meanings and languages, often involving a change in the socio-cultural systems [7]. **Technological Epiphanies.** They bring a radical change in the meaning enabled by the emergence of new technologies or by the use of existing technologies in completely new contexts [8].

3 Methodology

A review and analysis of IoT products was carried out. It followed an analytical - deductive process considering: a smartWatch chronology summary, analysis of existing products, identification of potential variables, statement of hypothesis, proposed models, Selecting the most appropriate model, description of the proposed variables, and finally model validation.

3.1 Description of the Proposed Variables

3.1.1 Social Willingness to Change

This variable includes five criteria that build Disruptive innovation: ***Exploring the Benefits of Quantification of Time:*** Technology plays the role of controlling tasks that do not require human supervision, thus contributes transcendentally to important tasks, perceived and unperceived. ***Exploring Transcendence:*** It refers to all the radical innovations that improve life in terms

of time, vitality and health quality [9], that allows people to be recognized as part of an elite, and as such follow their habits and behaviors [10]. ***Exploring Connections in the Sociocultural Context:*** **Subjective Norm:** This refers to a perceived social pressure for making, or not, a decision influenced by the opinions of higher influences or peers [11,12]. **Image:** It is defined as the extent to which the use of an innovation is perceived as improving ones status in a society [13]. **Compatibility:** It is based on emotional, symbolic and aesthetic factors. *Social compatibility* concerns the willingness to be different and independent [10]. *Aesthetic compatibility* refers to the idea of the visual impact that affect the aesthetic response of people; that is a visual display connecting parts in a meaningful way [14]. **Personal Innovativeness:** This is defined as the propensity of certain individuals for taking risks [15] as part of his personality. ***Exploring the new symbolic values and interaction patterns:*** **Narcissism:** Reflects the material conditions of life in a society in which the social level depends more on consumption than on production [16,17]. **Hedonism:** Achieving a real presence in the world, and enjoying the existence jubilantly: to smell better, to taste and hear better and to consider passions and instincts as friends [18,19]. ***Exploring calm in the face of uncertainty:*** It refers to the will of society to minimize the uncertainty caused by a radical innovation as it appears in a particular social environment.

3.1.2 Network of Visionaries

It is responsible for visualizing future scenarios to use, and for proposing new ***Cultural Prototypes***, that are a medium which encodes and reveals new visions and interpretations of a company. It is described as cultural because, it refers to a new meaning or new language [6]. ***Personal Attitude Towards Technology:*** The Social Constructivism of Technology is an inherently social process, where non-technical elements play a decisive role in its genesis and consolidation [20]. ***The Will to Transcend:*** It is the personality characteristic of a visionary to move toward new ways to face reality and everyday life; the desire to offer products based on technology, as a new and seductive approach to changing the world. ***Personal Innovativeness:*** It refers to the willingness to take risks and accept them as a personality characteristic of the Visionary, not as a consumer, but as social and technological researcher. ***Skills and Knowledge:*** It is a professional team with experts such as: Engineers and IT experts, Sociologists, Semioticians, Interdisciplinary Designers, Artists.

3.1.3 Technology

It addresses the quantification of people and their activities. The characterization of this variable implies: **Perception:** The sensors convert those physical aspects of reality into digital numeric arguments. **Connectivity:** Connectivity allows access to the network and compatibility [21]. **Intelligence:** The merging of computing and algorithms produce a new generation of smart product experience, where Big Data, Data analytics, Data Management are the way that technology proposes new ways to create value. **Expression:** Allows interaction

between people and the tangible world. This characteristic includes interfaces and user experience [21].

3.1.4 Meanings

The Meaning variables are stated as follows (see Fig. 2): ***Innovative Culture of the Firm:*** Characterized by the ability of the firm to provide adequate space for the proposal of new concepts, new opportunities and exploring future scenarios yet to be designed. ***Technology Integration:*** The role of technology integration is to act as a facilitator for the realization of the proposed radical design innovation, by applying a technology process of social constructivism. ***Seductive Power:*** It refers to the ability of the network, to deliver new ideas and dissemination of different cultural prototypes generated by the proposed design discourse of the firm [6]. ***Value:*** It refers to the perception of people on the radically innovative design proposal, it includes the four criteria below: ***Perceived usefulness:*** Seeks to explain the short-term consequences. Is the design product perceived as helpful? [15]; ***Ease of use:*** The evaluation of the extent to which interaction with a technology system is free from mental effort [15]. ***Novelty:*** It has the role of imposing an induced interest in the new meaning of the proposal [6] ***Socio-cultural assessment of the new Meaning:*** At the ***social level***, this raises the concept of behavioral belief: Does my social group value this new proposal? [6,15]. At the ***individual level***, the concept of normative belief arises: How much does my person improve, socially speaking, when I use the product or service? [6,15].

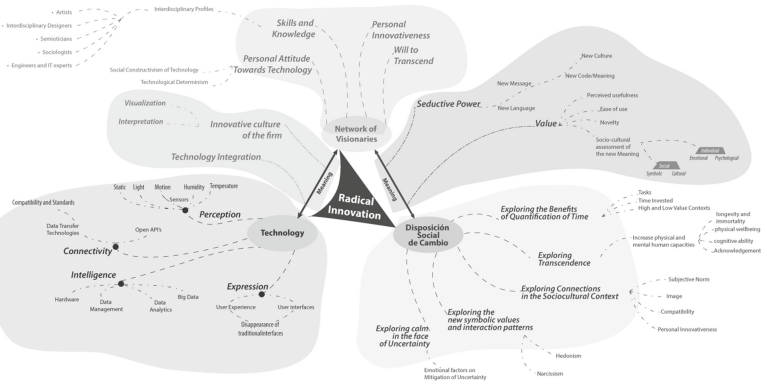

Fig. 2. Model C, described in detail.

4 Results and Discussion

The model was validated by a network of twelve visionaries. The summary of their views: ***Network of Visionaries*** was understood as the source of value

in the proposed model since its not user centered. ***Technology*** was understood as the muscle that builds the proposed Innovation. ***Meanings*** are seen as novel paradigms, where the proposal of innovation is offered through the seductive power of the visionaries. ***Social Willingness to Change***, its an element to leverage innovation proposals as a means of support for connecting with people. Respondents agreed with the potential of art to explore new paths, new expressions that generate novel paradigms involving new meanings.

4.1 Conclusions

The adoption of radically innovative proposals in the Internet of Things aims to improve such values as the extension of life with quality, improved social and self-image, novelty, ease of use and perceived usefulness. This applies to the three scales of application considered in this work.

Diversity in the Network of Visionaries is essential for building design discourse, and a diversity of views generates greater and better results and possibilities of interpretation of the design discourse.

Personal user needs are not meant to be satisfied as such, they have a paradigmatic basis, but this kind of innovations are proposals made by firms that integrate a high level of innovation, and that challenge the established paradigm, while creating a new niche where the firm can enjoy a level of control around monopoly, at least for a while.

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