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Social platform innovation of open source hardware in South Korea

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ABSTRACT

This paper proposes the use of OSHW to successfully penetrate the Internet of Things (IoT) market by using a social platform with a new interdisciplinary perspective rather than through the use of existing technical approaches. Snowball sampling was used in this study to survey 300 people who work and have had experiences with online brand communities for open source hardware (OSHW) at Fab Lab Seoul. The findings of this study indicate that content, consumer support, user interface, and reward are among the five factors that trigger an online brand community to develop a social OSHW platform. However, this study also found that brand reputation was insignificant relative to activating a social media platform for open-source software. In addition, activating a social platform for OSHW can positively affect to the brand community's loyalty for OSHW, which means that social platform innovation for OSHW can help form the positive attitude necessary to develop and diffuse an OSHW culture in a rapidly changing ICT ecosystem. This can be an important strategy for OSHW business and can contribute to the growth of the IoT market in South Korea.

1. Introduction

Do-it-yourself (DIY) is an emerging trend that embodies the concept that users can make what they want themselves without the need to buy monotonously designed products, and recently, information communication technology (ICT) has been incorporated into traditional DIY culture, so the scope and concepts of DIY have been expanded to become an ICT DIY phenomenon (Shin, 2011). ICT DIY is a subgroup of the larger DIY culture, and it is an area of increased interest since it allows for a wide variety of inexpensive products to be produced without compromising price and function as is often done for the traditionally manufactured equivalents (Shin, 2014). Furthermore, ICT DIY has attracted an increasing amount of attention due to the expectations of a hyper-connected society that communicates using the Internet of Things (IoT). IoT refers to the connection of all things through the Internet to create and provide tangible and intangible services. In order to enable IoT, the development of various things must be preceded by ICT DIY, which can be easily used to realize ideas using open source hardware.

Open source hardware (OSHW) is an attempt to bring the same freedom and power to physical devices, but it is still in a nascent stage relative to open source software (Lock, 2013). The open source software movement has had an enormous impact on today's technology, and more recently, it has changed the way many tech companies do business and has therefore changed our society. Unlike open source software products, such as those offered by the Apache Software Foundation, open source hardware products will always have some form of involvement form a manufacturer either when purchasing

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building blocks to develop a product or in the manufacture of the product itself (Acosta, 2009). Pearce (2013) also discussed how the open-source paradigm is now enabling the creation of scientific open source hardware by combining three-dimensional (3D) printing with open source microcontrollers that run on free and open-source software (FOSS). The goal of open source programs is to create an open source ecology where an efficient open source ecosystem increases the rate of innovation through open collaboration. Thus, the development of IoT can be deeply related to the open source ecosystem that in turn is part of the larger IoT DIY community. As a consequence, the success of IoT on a larger scale depends on end-users' participation in IoT during the creative process. Thus, the ICT DIY community allows members (often called "makers") to do precisely this, and as such, the progress of IoT depends on strong support within the ICT DIY ecosystem (De Roeck et al., 2012).

In 2015, Facebook announced the launch of the Korean OSHW community (Lim, 2014). As part of the open computer project (OCP), the Korean OCP community is a platform where external experts, individuals, and corporate members can freely participate, and the members are able to test systems designed through a social platform, donate existing hardware and software technologies to the project, participate directly in ongoing initiatives in the OCP, and provide new ideas for projects in the community. The launch of Facebook demonstrates the importance that a social platform can have for developers and users, including individuals, organizations, companies, and governments. Thus, a DIY ecosystem for IoT must not only be supportive and inspirational for the community while also fostering innovation, but should also be liberal in the variety of projects that it supports and should also be open to members of any skill level (De Roeck et al., 2012).

OSHW is experiencing significant growth, but the corresponding business models and interdisciplinary aspects are not well known. To this end, this paper suggests how OSHW can be adopted to succeed in the IoT market by using a social platform where developers and consumers can be expected to develop for OSHW in an interactive manner rather than developing exclusively through a technical approach. Naturally, the additional requirements for the ecosystem aim to spread IoT to the consumer market in order to commercialize new inventions and products (Frolund et al., 2014).

2. Literature review

2.1. Definition and challenge of OSHW

Since OSHW is a compound term, it is necessary to go back to the original concept of open source software in order to understand how OSHW works. Open source software is not distinguished by the programming language, operating environment, nor application domain but rather by the license(s) that govern the use, distribution, and, most importantly, the rights to access and modify the software's source code (Tiemann and Initiative, 2009). These rights allow anyone to study, without limitation, the workings of software released under an open source license, improve on it, and freely redistribute derivative work (Lock, 2013). The same concept is applied to open source hardware in terms of the electronic hardware design that is freely available under one of the legally binding and recognized open source licenses. Open source hardware includes schematics, diagrams and design rules that can be used, studied and modified without restriction and can be copied and redistributed in a modified or unmodified form either without restriction or with minimal restrictions that only ensure that further recipients can do the same (Acosta, 2009).

Even though the concept of OSHW is derived from OSS, both hardware and software development can be divided into four phases: design, manufacturing, distribution, and upgrade. In the design phase, both the software and hardware products derive maximum utility out of the "Open Source" concept since both software and physical products can be viewed as information-based products that are defined using required functions and detailed designs that can be recorded and shared electronically (Von Hippel, 2005). During manufacturing and distribution, open source software thrives on the time invested an individual or a team without incurring capital costs and can be started with minimal tools, such as an individual's computer. In addition, as the final product, a software program can be easily and widely distributed over the Internet. In contrast, open source hardware requires storage costs for machines, devices, and other physical things that are manufactured or prototyped. This is a process that directly involves cost issues. Namely, OSS is relatively free when compared to OSHW in terms of the cost and distribution structure. During an upgrade phase, software updates can be distributed and applied by simply recompiling code and sharing the revised code on the Internet. However, hardware product upgrades involve physically replacing sections and/or an entire units, which are neither automatic nor free of cost.

A comparison between OSS to OSHW makes the characteristics of OSHW seem to be overwhelmingly disadvantageous. In reality, many people have been skeptical of OSHW because it is relatively more difficult to copy and modify physical products than it is to do so for software. However, several successful business models and initiatives have been recently applied successfully for OSHW. Acosta (2009) described the applicable business models for companies working with OSHW that are nearly identical to those presented for OSS. Creators and distributors of a broad range of electronic modules for hobbyist and prototyping purposes are one such groups of companies that have been successful. For example, SparkFun Electronics had a staff of 115 individuals and revenue of $27.5 million during 2011, and Raspberry Pi is a small, low-cost single-board computer that was originally intended to teach computer science in schools. It sold over 700,000 units in only one year after its release in February 2012 (Lock, 2013). Furthermore, field-programmable gate array (FPGA) technologies have significantly changed the playing field. These allow the hardware development process to more closely resemble the software development process in order to become more affordable and more advanced. Furthermore, open source concepts have been applied in various fields, including 3D printers, electronic prototyping platforms, cars, prosthetics, machine tools, robots, and other