Case Study on Nest's "Internet of Energy (IoE)" Business Model: Based on Strategic Choices for Connected Product

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Abstract

The purpose of this study is to investigate Nest Labs (Nest)'s business strategy. The activities based on strategic choices for monetizing connected product are investigated. Nest's capacity and functionality is to offer a seamless integration of devices, platforms, and services and the "Works with Nest" offers an ecosystem fulfilling the needs of different partners. For monetizing customer data, Nest provides a seamless customer experience supported by product incentives. Nest introduces open APIs to connect its connected products to the wider Internet of things (IoT) and open to "If This, Then That." The Nest app controls them from one single place. Nest partners with 32 energy providers as of 2017 and they provide energy from renewable and non-renewable energy sources. Nest also creates a sales channels in direct and indirect route and expands is business model to other industries such as home-rental service, 'AirBnB' to help consumers become more energy-efficient at home.

Keywords: Nest Labs (Nest), Internet of energy (IoE), connected home, business model

1. Introduction

Internet of things (IoT for short) technology continues to develop an industry of Internet connected energy, which can help improve efficiencies of usage at home, in car, in factory and so on. Consumers in energy industry sector are increasingly getting used to IoT technology in their daily lives, so the old method of reading a meter and then receiving an estimated bill won't cut it for very long. Internet of Energy (IoE for short) is the implementation of IoT technology into distributed energy systems to optimize the efficiency of energy infrastructure and reduce wastage. It is achieved by creating connected sensors that have various applications, such as power monitoring and demand-side energy management. It is expected that consumer appliances with IoT functionality could help balance energy demand. For example, a wash machine could be connected to the Internet and only power on when there is enough energy from solar power in the grid. For the consumer, using energy at off-peak times could save them money as well.

This study focuses on the IoE and the playground is home. Internet connected home (Connected home for short) is technically challenging place to live and its service providers are increasing their service delivery

and technical support capabilities. There are 7 categories in connected home: Security & monitoring, safety, energy, lighting, automation, care/assisted living and advanced technical support. Among them, energy is related to Internet connected systems of heating, ventilation, and air conditioning controlling household temperature. These have ability to learn the movements of the occupants of the household and set the temperature accordingly in connected home [1].

Currently, the most representative use case is Nest Labs (Nest for short), a connected home specialist. It has been acquired about US$3.2 billion in 2014. 'Nest Thermostat' controls temperature of the house by itself and reduce energy usage. Based on machine learning, IoT technology, this connected product can learn various patterns of users and remote control is possible by using apps and real-time energy usage information. Google took a step into connected home area with the acquisition of Nest. Before the merger, Nest was only a connected home product manufacturer with a technology platform. In 2018, Alphabet is restructured its Google and Nest divisions together to create a more thoughtful intelligent home. This study aims to investigate Nest's IoE business model, because Nest products have a big potential of connected home.

2. Theoretical Background

2.1 Review of Previous Studies

Google Scholar and Taylor & Frances Online have been searched in search names "connected home (also smart home)" and "IoE (also smart energy)" from 2014 to 2017. The first academic article is a case study in 2014, Rodríguez-Molina et al. [2] insist, smart grid combines efficient energy consumption with avant-garde technologies related to renewable energies and it can provide several beneficial utilities like power monitoring and data provision. The smart grid users can be the most important value creators and a decisive agent of change in terms of electricity usage. They deal with emerging business models for smart grid prosumers, their strengths and weaknesses.

In 2016, Lobaccaro et al. reviewed connected home (smart home) and smart grids technology together. There are numerous technologies and applications that can be installed in smart homes enabling communication between home appliances and users, and enhancing home appliances' automation, monitoring and remote-control capabilities. They introduce concept of smart home and the advent of the smart grid and investigate technologies for smart homes. The technologies of the systems have been introduced and advantages and disadvantages of each technology are explained [3].

2.2 Theory on Strategic Choices for Connected Product

With IoT booming up in 2015, Harvard Business School's professors described how IoT transforms the competitive landscape [4]. Companies compete by producing connected devices. This transformation includes which capabilities are most important, what talent is most essential, what functionality is most critical to customers, how best to differentiate, which business models to pursue. Porter and Heppelmann described four capabilities. With monitoring there is visibility about where a product is, what it is doing, what environment the product is being used in, and the condition of the product. By monitoring a product, it is possible to set acceptable ranges and trigger alerts and alarms. With control, it is possible to embed software that enables bidirectional control over a product, controlling the product from a phone or tablet. With optimization, it is possible to add algorithms to optimize its operation and performance. This can include predictive maintenance to intervene before something bad happens. Lastly, with autonomy, it is possible to create products that act on their own. Then, they created 10 strategic choices: Which capabilities to pursue? Functionality: Embedded in the product vs. in the cloud? Open or closed system? Technology

development: Internal or external? What data to capture? How to manage data rights and access? Disintermediate distribution or service channel? Change the business model? Sell data to outside parties? Expand product scope?

Unlike the previous silo system of IT which helped firm's productivity, the IoT affects companies' strategies to open or not and how companies differentiate themselves, create value, and compete, and change the structure of industries. Porter and Heppelmann insist that winners make the right choices among 10 strategic questions and get the basics right. They also emphasized, technology makes an amazing array of functionality possible, but winners focus on functionality providing value that customers are willing to pay for. The emergence of connected products with embedded technologies is likely to drive consolidation among companies with complementary product portfolios, also resulting in new players with new products and business models. These technologies are transformational, with major implications for companies' strategies, for how companies compete, and for which companies will win and lose.

3. Research Design

3.1 Research Question

In the platform businesses, the boundaries between suppliers, customers and competitors can shift rapidly. A platform provides the infrastructure and rules for a marketplace that brings together producers and consumers. The players in the business ecosystem fill four roles such as producer, provider (service or device), and consumers, but may shift rapidly from one role to another. Understanding the relationships both within and outside the business ecosystem is central to platform strategy. [5]. Based on ten strategic questions for creating business models of the connected product, this paper categorized these questions again into four groups based on the four components of business model by Christensen, Bartmen, and van Bever [6], because platform industry requires new business models different from the traditional ones of the previous pipeline industry. Christensen described four components as follows:

1) The value proposition: A product that helps customers do more effectively, conveniently and affordably a job they have been trying to do.
2) Processes: Ways of working together to address recurrent tasks in a consistent way: Traning, development, manufacturing, budgeting, planning, etc.
3) Resources: People, technology, products, facilities, equipment, brands, and cash that are required to deliver the value proposition to the targeted customers.
4) Profit formula: Assets and fixed cost structure, and the margins and velocity required to cover them.

Based on the four components of business model in 2016, adjusted strategy framework of connected product is as follows: Product capabilities and functionality are related to the value proposition. The platform access (whom to let onto the platform) and governance (what consumers, producers, providers, and competitors allowed to do there) means ecosystem planning and development and it is related to the processes. Platforms consist of rules and architecture. Their owners need to decide how open both should be. An open architecture allows players to access platform resources, such as app developer tools, and create new sources of value. Open governance allows players other than the owner to shape the rules of trade and reward sharing on the platform. Data is key resource and distribution method is related to the profit formula.

The research questions regarding Nest are as follows:

Question 1.   What is the value proposition of Nest in terms of product capability and functionality?
Question 2.   How are the processes of Nest in terms of ecosystem planning and development?
Question 3.   How is the data resource of Nest created and managed?
Question 4.   What is the distribution and monetization method in terms of profit formula?
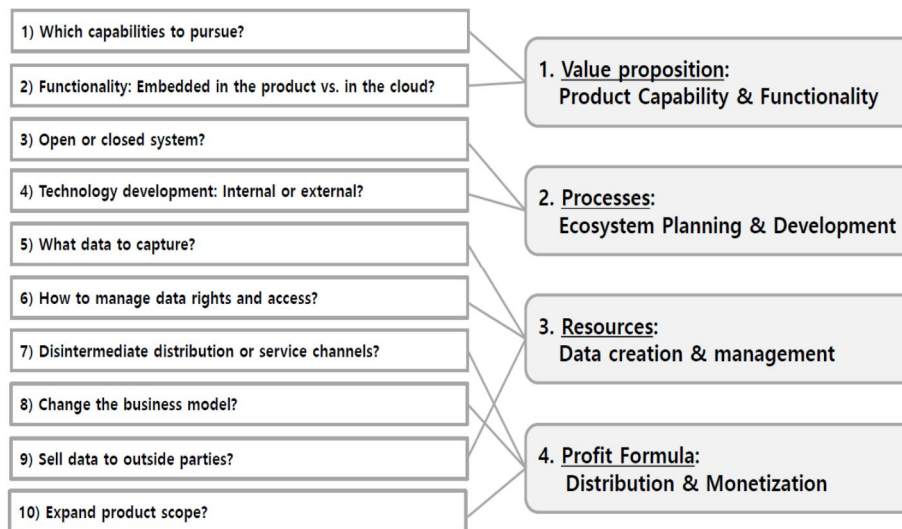
Figure 1. Research Framework for creating IoE business models

3.2 Methodology

This study covers a global company. Therefore, the analysis is along with extensive tracking of IT and financial data released by secondary source such as global research company, OVUM analysis reports & trackers and domestic company such as fnguide.com during 2014~2017, because the year 2014 is considered Google's acquisition year of Nest. In addition, the information released by newspaper and press release was thoroughly examined and academic journals, periodicals, and financial report from stock market were investigated. In addition, publicly available information from company websites, together with press releases, announcements, and company reports are searched.

4. Results and Discussion

4.1 Value proposition: Product Capabilities and Functionality [7]

Nest has several connected products. For instance, 'Nest Thermostat' is programmable, self-learning WiFi-enabled and has auto-schedule, auto-away, remote-control, and sensors for temperature, humidity, near and far-afield activity, and ambient light allowing home support compatible with 24V heating and cooling systems including gas, electric, forced air, heat pump, radiant, oil, hot water, solar, and geothermal [8]. Nest's products monitor home temperature and the presence of smoke. They track when people wake up, leave and return home as well. By incorporating hardware and software and using sensors and algorithms to learn behavior, they control remotely with a smartphone application. The optimization includes predictive maintenance to intervene before something bad happens. Nest products know everything they can about customer at home. The more they're tied into users' everyday lives, the more they can deliver optimized products and services. Ultimately Nest products can be in autonomy to create capabilities that act on their own.

In terms of functionality, Nest's cloud computing function to offer a seamless integration of devices, platforms, and services is a key part of its connected home strategy. All of Nest's products are designed to act as hubs in and of themselves with the hope that third-party developers would use them as a foundation from which to build more smart devices, platforms, and services. 'Nest Weave,' a protocol providing direct device-to-device communications across networks and allows numerous devices to interoperate seamlessly.

With it, Nest made it possible for any smart solution to connect with Nest, encouraging at the same time the creation of new automated experiences at home. Nest products are designed to work together, acting as hubs in and of themselves. For example, if there is a carbon monoxide leak, 'Nest Protect' can send a command to 'Nest Thermostat' to turn off the heat. The Nest's app also controls them from one single place. Nest improved this functionality that further automates integration.

4.2 Processes: Ecosystem planning and development [7]

In Nest's "Works with Nest" development community, 'Thread' is a first wireless low-power network protocol created to connect and control devices in the connected home and it is compatible with ZigBee. Nest has a key role in the development of Thread together with other companies such as ARM, Qualcomm, Samsung, and Yale Security. In 2014, Nest introduced open APIs to connect its smart devices to the wider IoT. The program provides the necessary tools to connect Nest products with other devices, such as lights and appliances. In 2015, Nest launched 'Nest Weave' which runs on IPv6 over Thread and WiFi and provides direct device-to-device communications across home networks allowing devices to talk directly to each other and to Nest products. In 2016, Nest released 'OpenThread,' an open source implementation of the Thread networking protocol and initial version of OpenThread has been distributed by Nest on GitHub.

By opening its technology platform to third-party developers and partners, Nest has made it possible for any solution to connect with Nest, encouraging the creation of new connected home. One of the important milestones of "Works with Nest" program is the wider availability of Nest Weave which allows devices to talk directly to each other, meaning low latency when compared to WiFi and Bluetooth. The protocol can run on a single battery for many years due to its compact size. Nest Weave can deliver reliable messages across multiple self-healing mesh networks. If one device crashes or the WiFi goes down, the other devices will not cease to work. When running over Thread, each powered device can act as a wireless extender, expanding the reach of WiFi. Nest Weave has a dedicated layer of security running on top of the network layer and it provides encryption keys for each application, so that hackers can't compromise one device by gaining access to another. These benefits help connected products interact more easily with each other, bringing renewed business opportunities for third-party connected home manufacturers keen on increasing current adoption levels. Thread is the key networking standard and OpenThread shows how committed Nest is to the developer community.

For using external technology, Nest promotes the adoption of connected home technology through incentive programs for external technologies. Nest's strategy is based on a seamless end-to-end experience and its philosophy is set on the premise that all products are designed to work together and interoperate with other smart solutions through internal mechanisms or with the help of external web services such as IFTTT (If This, Then That). Nest provides rich product functionality and interoperability with third-party solutions to enable a seamless end-user experience that keeps customers continuously engaged. By making Nest products IFTTT-enabled, Nest can give their consumers the possibility to create their own commands to automate different tasks and connected products.

4.3 Resources: Data creation and management [7]

For data management, artificial intelligence (AI for short) solution, 'Google Assistant' is a key for the whole connected service including Nest. It understands multiple contexts throughout the conversation. Collected data enables a natural dialog with the personal assistant and enhances the overall user experience. For energy sector's data utilization, Nest develops various programs with its partners to provide important savings on energy bills. It means that the IoE at home is not only delivering home monitoring and control,

but also tangible financial gains for connected home customers. The issue is data privacy because Nest share a certain amount of data gathered by its devices. Nest advocates transparency and insists not to share sensitive customer data when customers join specific rewards programs.

Adding value through sharing device data, the customer experience has been improved and Nest is offering benefits in the shape of savings, safety, and comfort. The program sharing consumer insights with partners is a good way and it allows some partners to take advantage of Nest's customer insights by gaining access to data that enables them to improve their decision-making processes and business performance. Nest started to sign partnership agreements with different types of industries such as consumer hardware, energy, telco/security, insurance, home services, and hospitality. For each type of partner, Nest developed a partnership program considering their specific needs. In terms of IoE, Nest designed a program for its energy partners that helps to reduce the load on the electrical grid during times of high demand of energy.

Nest expands the list of energy partners at a global level and the program has the best reception in the US to alleviate current energy shortages. Some energy companies offer a thermostat at no cost when the customer signs up with them. Other provide discounts. The energy providers offer 3 options: self-installed, contractor-installed, and utility-installed. For the latter, some providers arrange for a certified home service professional to perform the installation for free. Other provide the service at an additional cost. Some companies give instant money rebates after program enrolment to lower energy demand during peak load times. There are two options: Winter and Summer Rush Hour Rewards are separate programs. Some companies offer both, while others offer only one. With 'Seasonal Savings Program,' the thermostat provides savings by making small adjustments to the temperatures in the user's schedule as the weather changes and it provides savings of 5-10% on heating and air conditioning. Time of Use (TOU) plans set different energy prices during the day. Nest automatically reduces heating or cooling use when electricity costs are higher. The energy partner shares the electricity rate plan with Nest.

Consumers, Nest, and energy providers offering important savings for its customers have their benefits: For energy providers, the different programs help reduce the load on the electrical grid during times of high demand for energy and the utilities can gain access to usage data which allows them to improve their business performance and the efficiency of their investments. For Nest, it has created a significant revenue stream by taking advantage of its customer insight around usage. Considering that product life expectancy can surpass a decade, revenue from utilities is likely to be greater than the direct revenue from thermostat sales. Consumers also have an easy way to make important savings in energy consumption per day and season.

4.4 Profit formula: Distribution and monetization [7] [8]

As of 2017, Nest's solutions have been available in North America and Europe, and majority of partners capable of providing support services are based in the US. Nest needs more partners and learns the lessons from the recall of Nest Protect due to a product flaw [8]. Nest created the product and developed technology platform combining hardware revenue with revenue from the monetization of data as mentioned above. Nest needs to have global expansion for monetization. Nest develops the service channel for the diverse distribution.

For direct distribution, Nest uses its own store including Google's store. It creates a sales portal offering Nest products, 'Nest Pro' installation services, and selected products from "Works with Nest" partners. 'Nest Store' gives customers access to multiple solutions in one place. This strategy enables the customer to create a 'Nest home,' allowing Nest to not only materialize its home vision, but also demonstrate its commitment towards its partners. Since the acquisition of Nest, Google's online store offers Nest products together with

other Google devices. After reunion between Google and Nest in February 2018, there is a promotion which can help Nest buyer save energy bill each month and get a free Google Home Mini.

For indirect sales, Nest offers a variety of sales channels expanding on a regular basis through new partnership agreements. Nest products are available on online, e-commerce sites like eBay and available from retail stores such as Best Buy, Target, Staples, Walmart, Home Depot, Lowe's, John Lewis, and Maplin. All Nest certified installers also can resell Nest products together with installation services. They can purchase the Nest products at a local Nest distributor or 'Nest Pro' store. For instance, energy providers resell 'Nest Thermostat' at discounted prices as part of fixed-term bundles including optional installation services at no extra charge or at an additional fixed or variable price depending on the type of installation.

Furthermore, Nest has more partnerships with other platforms for new business models. An example of business partnership is a partnership agreement with AirBnB. Nest and AirBnB signed a sales agreement to provide free 'Nest Thermostat' to selected AirBnB hosts in the US from 2014. Its primary purpose is to expand the distribution channel, but AirBnB can make its own home-rental service more environmentally friendly and hosts can save energy while increasing Nest brand's visibility. As part of the deal, AirBnB hosts using Nest can have free access to 'MyEnergy,' a platform tracking energy consumption and helping consumers be more aware and energy-efficient. In November 2015, AirBnB introduced a new product suite with several tools and services for hosts. One of them is 'Host Assist,' which allows an easy key exchange and keyless entry to a property and it connects AirBnB accounts with several partner products including Yale Locks and its new "Works with Nest Linus lock". It allows hosts to create guest passcodes through the Nest's app based on specific check-in and check-out dates. It also provides notifications about guests' arrival. Additionally, the connected lock shows a caution symbol when there is CO in the property thanks to its integration into 'Nest Protect'.

5. Conclusion

The key activities based on strategy framework can be summarized as figure 2. Nest's capacity and functionality is to offer a seamless integration of products, platforms, and services and the "Works with Nest" offers an ecosystem that can fulfil the needs of different partners. For utilizing and monetizing customers' usage data, Nest provides a seamless end-to-end customer experience supported by product incentives. Nest also introduces the Nest Developer Program and Nest APIs to connect its smart devices to the wider IoT. Nest is open to external technology, IFTTT. "If This, Then That," free service allows users to design their own conditional commands known as "recipes" to create solutions integrating devices and applications. Based on the capabilities and functionalities, Nest builds 'Nest home'. Nest products are designed to work together. If there is a carbon monoxide leak, 'Nest Protect' sends a command to 'Nest Thermostat' to turn off the heat. The Nest app controls them from one single place. Nest made an ecosystem, "Works with Nest program" and thanks to the support of numerous partners and third-party developers, all Nest products interact with other products, platforms, and services. Nest partner with 32 energy providers as of 2017 and they provide energy from renewable and non-renewable energy sources. Nest emphasizes how the consumer can benefit from sharing data with their energy and insurance provider. Even if 5% is not a significant discount on insurance premiums, the use of economic incentives has the big potential to make consumers more responsible about preventing hazards by using SHE technology at home. Nest has a sales channels in direct and indirect route. Very interesting is that as part of the sale deal, AirBnB hosts who use Nest can have free access to 'MyEnergy,' a platform tracking energy consumption and helping consumers become more energy-efficient.
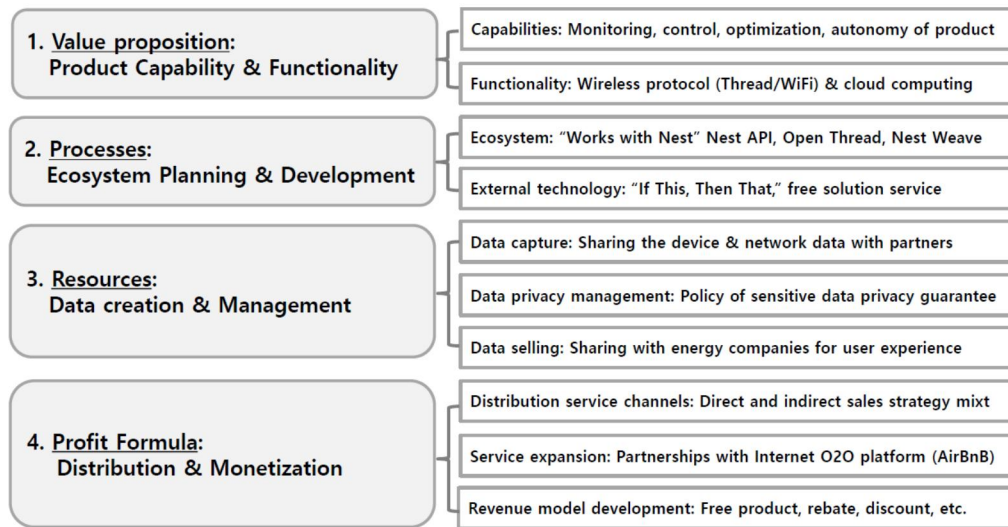
Figure 2. Key summary of the result

In conclusion, by opening its technology platform to third-party developers and partners, Nest has made it possible for any IoT solution to connect with Nest, encouraging at the same time the creation of new automated experiences at home. The results of this study are subject to some limitations to have a qualitative analysis and to analyse only one company. However, this study offers significant basis where provides the strategic options for creating business model of connected product and shows a use cases to benchmark IoE business. Further study is suggested to compare companies in competition along four business models and ten strategic choices.

Acknowledgement

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