



INNOVATION MANAGEMENT 2.0 - ACQUIRING SUSTAINABLE COMPETITIVE ADVANTAGE THROUGH THE INTERNET OF THINGS

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The Internet of Things is a new concept that has been significantly increasing in the past few years. The latest trends related to innovation in telecommunications constitute nowadays a prerequisite in any product development. Internet of things consists of a variety of elements connected to each other; while building cooperative systems to achieve common objectives. It is already evidenced the impact Internet of Things will have in business users, corporations, and society in general; bringing a large number of opportunities to individuals and enterprises, contributing to economic expansion. Considering the Internet of Things will set the basis for the creation of a sustainable competitive advantage, it is essential to understand the role it plays in business models. Considering Robert Bosch GmbH, it is assessed how Internet of Things is incorporated into the firm's business model, to shed light on the applicability and relevance this new technology will have in firms.

Keywords: Internet of things, innovation management, business models,

1 Introduction

The international socioeconomic environment has changed significantly during the past couple of centuries, altering completely the traditional balance between customers and suppliers. Historically, a firm's productive capacity depended mainly on capital and labor. However, since the industrial revolution there has been a change of paradigm. Technology started playing a key role in the production process, consequently determining the enterprise's productive capacity. As technology evolved, a world of possibilities opened for firms to take advantage of. With this, corporations started growing outside their traditional economic activity, creating new industries, becoming international operators, using the global population as their marketplace.

Information and Communications Technologies (ICT) was the technological advancement that enabled open global trading and connections between firms in diverse parts of the world. Additionally, ICT enabled companies to relate to their customers faster and more easily, thus creating products and services that directly tackle their demands. Furthermore, ICT permits to know the success of each good placed in the market and re-evaluation of the strategies in time, without spending resources in elements which will not be successful, and re-orienting the efforts towards a highly efficient and effective use of assets. Business and innovation management have been the drivers of successful business strategies and the creation and reinforcement of competitive advantages. The higher the advancements in ICT, the greater the adaptability of the business strategy and innovation management is needed.

Among the most recent innovations in the field of ICT is Internet of Things (IoT), which is defined as a worldwide network infrastructure in which virtual and physical objects are linked through the maximization of communication capabilities and data capture (European Commission, 2009). IoT will provide sensor and connection capability, together with object identification as the starting point to develop autonomous cooperative services and applications. In doing so, the elements shall be independent in transferring events, capturing data, interoperability and providing network connectivity. Hence, IoT comprises the starting point for a new paradigm, where firms can create a highly effective and efficient supply-chain model. Furthermore, it contributes in the design of products and services, allowing for a specific adaptation to consumer's new needs. In addition, IoT enhances customer relationship management, as corporations can have more accurate information regarding market demands.

In this context, creating a sustainable competitive advantage is based on the application and implementation of innovations, IoT related. Since this latest technological advancement will be part of the day-to-day life in two decades, it is essential for firms to adapt their business model and innovation management in order to take advantage of this ICT. The present study assesses the evolution of business models in terms of innovation management and how firms should incorporate IoT as a business strategy in order to achieve a sustainable competitive advantage. The analysis will be conducted on a corporate level, considering that enterprises should now be viewed and studied as a whole, which includes all the diverse branches, franchises and other stores under the company's brand name, consolidated trademarks and collaborating agents. In doing so, the business model for innovation management used by the firm Robert Bosch GmbH will be analyzed. Future similar study cases can support the evidence presented on this analysis.

2 Literature Review

Evolution of society has shaped economic and business models, changing the roles, relationships and essential missions of the agents operating in each market. Additionally, communications have also been significantly modified, particularly with technological advancements. While firms' objective was traditionally to obtain profit, today's main goal of corporations is to deliver a product/service with high value added and sustaining their business in the long run. New models arise from such socio-economic changes, along with the appearance of agents, organizations, relationships previously nonexistent.

2.1 Business and Innovation Management Models

Business models can be defined as a framework for production processes and customer relations, which determines how a firm creates goods or services and delivers value to its consumers. These models also articulate how the use of resources is translated into delivering value added to consumers, through the analysis of cost effectiveness, investment valuation, and profits. According to Teece (2010), the elements that contribute to value creation, induce payments and convert payments to profit are: (i) selecting technologies and features to be embedded in the product or service, (ii) determining the beneficial elements the consumer will get from the purchase or acquisition of service, (iii) identifying market segments to be targeted, (iv) confirm available revenue streams, and (v) design mechanisms to capture value. These elements can be combined in different ways according to the business model implemented by the firm.

There is no established business model theory related to either business or economics studies. Considering the high relation between business models and innovation management, for the purpose of the present paper, the elements that contribute to value creation will be analyzed from the innovation management perspective. Baring in mind production of goods and services is based on constant evolution of these elements offered, it is crucial to understand the process through which these advancements are made. In studying innovation management, during 50s and 60s it was believed that the market was driven by a "technology push", hence new technologies would determine the products consumers would want. Later on, in the 70s, it was understood that market needs were essential to create products or services which would satisfy them, therefore the approach moved from a supply perspective, to a "demand pull" view. During the later twentieth century and early twenty first century, innovation was considered to be a multi-party collaboration instead of a single firm creating conducting research and development autonomously. Consequently, instead of having a 'closed' process of innovation in which only one firm participated, an 'open' model for production of innovations arose based on collaborations between companies (Fagerberg, 2003; Chesbrough, 2003 and 2006).

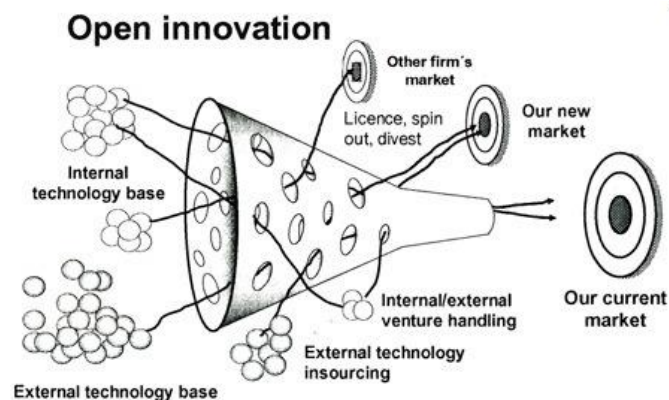


Figure 1: Open Innovation. Source: Chesbrough (2006).

As opposed to closed innovation, the open innovation model integrates supply chain agents in order to create and deliver value to consumers. In this context, it is highly relevant to have an optimum level of coordination between these parties. Recently, Almirall and Casadesus-Masanell (2010) established business models based on open or closed innovation highly depend on the costs of divergence and the benefits of product/service discovery. On the one hand, the first element makes reference to costs arising from partners who have different goals, therefore it becomes difficult to determine which technologies will be applied. The second element on the other hand, demonstrates that when collaborators have the same objectives, they can discover new combinations of products or service which would be of interest for consumers.

Osterwalder (2004, 2010) depicted the various descriptions of business models and conceptualizations integrating them into a single reference model based on stereotypical elements incorporated. These concepts are: infrastructure, including key activities, resources and partner network; offering, comprising quantitative (price and efficiency) and qualitative (client's overall experience and outcome) value propositions; customers (mass and niche markets and segments, together with multi-sided platforms and diversification); channels to deliver products and services; customer relationship (personal assistance, self-service, automated services, communities, co-creations, etc.); and finance (cost structure and revenue streams). This contribution, depicted as the "Canvas model" (Figure 1) summarizes the fundamentals of a business to be successful and on which elements it is basing its value proposition.

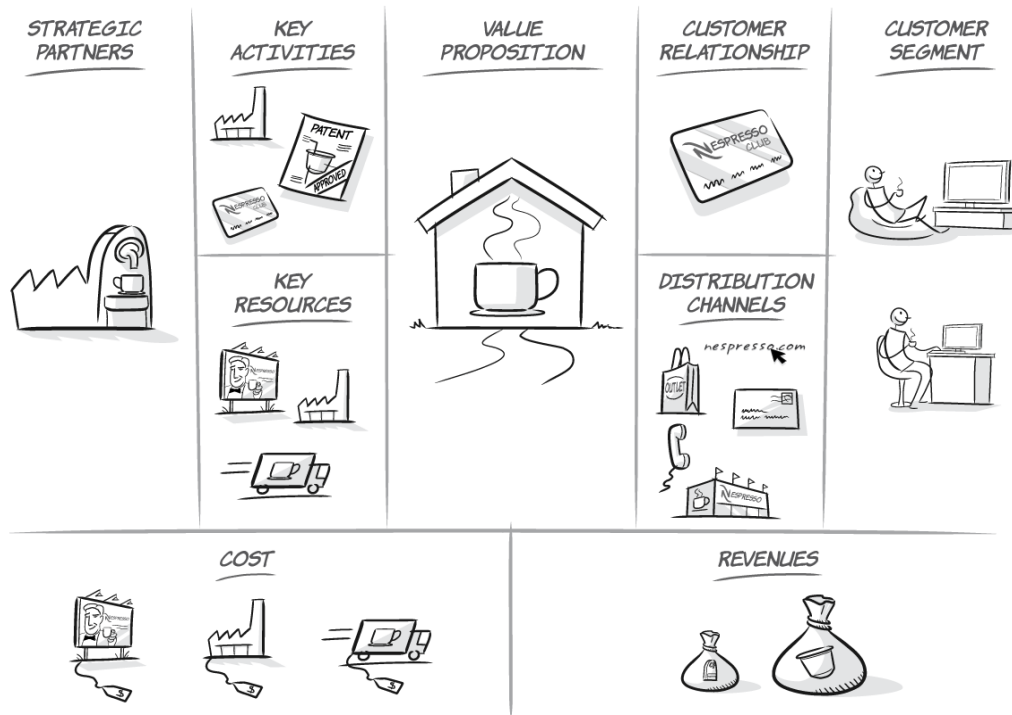


Figure 2: Canvas Model. Source: Business Model Generation (2013).

2.2 Latest technological advancements: Internet of Things

As it was herein stated, technological advancements have been shaping the evolution of the way in which business is conducted. By having greater advancements in the field of ICT there is an increase need for flexibility and adaptability of the business models and how innovations are managed. Among the most recent innovations in the field of ICT is Internet of Things, which initially begun as a possibility to use Radio Frequency Identification (RFID) tags as indicators to identify elements in supply chain management. These RFIDs were connected to Internet databases which contributed to organize and follow up these objects. Given the success of this initiative and the potential for further applications, a new area for research and innovation development was created. Nowadays several other technologies complement RFID in enabling for the existence of interconnected objects, such as QR codes, Bluetooth, UWB, or Zigbee, all of which consist of technology of radiofrequency of radio transmission of information between objects. Moreover, future Internet would be integrated into everyday life events of firms, governments and people’s personal lives, called the Internet of Things (IoT).

IoT became then the ultimate objective to create a dynamic global network infrastructure through which communication could be standardized and interoperable, adding self-configuring capacities to “things”. This would lead to a mixture between physical and virtual elements by using intelligent interfaces which integrate information. The objective is to have “things” which actively participate in business, information and social processes, interacting and communicating between each other and with the environment. This is achieved through data exchange, whether facts each element “knows” or data they “sense” about the environment. Furthermore, IoT allows for elements to react autonomously to physical world events according to a predetermined premise, independently of human intervention.



Figure 3: Internet of things IoT. Source: IoT European Research Cluster.

Applications of IoT with respect to the business environment involve several areas of the firm, some already established, while others are yet to be determined. Figure 1 shows the main areas in which IoT will be developed. According to Atzori et al. (2010), the areas can be divided depending on whether it is directly applicable or close to current living habitudes and others which are futuristic (not currently available as technologies and societies are not prepared for their deployment). The authors determine the domains in which it can be implemented are: transportation and logistics; healthcare; smart environment (home, office, plant); and personal-social domain. Within transportation, IoT reinforces and contributes to higher efficiency in logistics, environment monitoring, besides incorporating the possibility for augmented maps, assisted driving and mobile ticketing. Regarding healthcare, Atzori et al. (2010) identify tracking, identification, authentication, data collection and sensing as the main areas where IoT would impact.

With respect to smart environments, the authors evaluate IoT's influence will be on industrial plants, smart facilities (gym, museum, etc.) and creating comfortable homes and offices. On personal-social domain, social networking, historical queries, losses and thefts are the areas with higher impact; while the futuristic elements regard an enhanced game room, a city information model (smart cities), and a robot taxi. The real applications, together with the futuristic ones, are only a small part of the true extension of IoT, considering the possibilities derived from using embedded sensors and actuators in the environment. Considering the IoT currently available to our society is a limited portion of the true IoT world, there will be a real revolution when a vast range of devices can provide access and resources through the Internet (Serbanati et al., 2011).

3 Robert Bosch GmbH

Robert Bosch GmbH, is a multinational company based in Stuttgart (Germany) which operates in the automotive industry as well as the household appliances and industrial technology sector (machinery). It was founded by Robert Bosch in 1886, who started working as engineer for companies such as Siemens and Thomas Edison. After his first steps as technician working for others he decided to run his own business. At the age of 25, Mr. Bosch opened a workshop for precision Mechanics and Electrical Engineering in 1896 in Stuttgart (Germany), during the same year in which Karl Benz patented the first working automobile. Bosch's first activities were mainly related to the automobile industry, where he helped to solve some specific problems of the first combustion engines.

Due to the entrepreneurial nature of its founder, the company continued to sell different inventions like high-voltage spark plugs, headlights and windscreen wipers, all elements related to automobile components as it was the firm's main field of specialization at the time. By the beginning of the twentieth century, Bosch had a factory in Stuttgart, offices in many countries (Including United States, United Kingdom and South Africa) and was the most important company of electricity for automobiles. After the world economic crisis of the late 1920s Robert Bosch showed the founder's visionary way to run business: Diversification. The great depression affected Bosch (as many other companies) yet through the firm's innovations and constant adaptation to market changes, the company successfully overcame the crisis. Since the automotive sector had been significantly impacted by the economic downturn, the firm shifted its economic activities to new sectors and industries, while bringing creating new elements related to the car-making industry. By having innovation as the cornerstone of its business strategy and diversifying into new markets and economic activities, the firm successfully continued to grow.

Bosch's first approach was related-diversification, that is entering industries in which either the production process or the final product has similar technological basis as the company's existing product range. In doing so, the firm created synergies between new developments and existing ones in terms of supply chain management, while profiting from the expertise and know-how of its employees. One of the most noteworthy innovations Bosch created based on related diversification was the first refrigerator, introduced to the market in 1922. Additionally, Bosch believed it could benefit from collaborating with other agents in the market. Also related to the household appliances market, Bosch established its first alliance with other corporations in order to develop the necessary technology for the recently born TV industry. Established as a joint venture, Fernseh AG, was an alliance between Bosch, Baird (Television Development), Zeiss Ikon (Camera Manufacturer), and Loewe (Television and radio Manufacturer), which supplied the first electronic recording for the Berlin Olympics games in 1936.

Throughout the years, Bosch has increased the number of collaborations with academia and other firms, as well as government and research institutions, as seen in Figure 2. Amid academia and research institutions, Bosch nowadays collaborates with the Massachusetts Institute of Technology (USA), Stanford University(USA), Universität Stuttgart (Germany), CalTech(USA), Tongji University (China), Indian Institute of Science (India) and many other world-recognized institutions. With regards to alliances with other companies, the firm collaborates with Bosch, Volkswagen, The Linde Group,

among others. Additionally, Bosch participates in 'Invent', an independent association in which German-based automotive-related companies collaborate to create intelligent and user-friendly traffic technology. Other members of this initiative include Audi AG, BMW Group, Daimler Chrysler AG, IBM Deutschland GmbH, and Siemens AG. It is also noteworthy that Bosch collaborates with the German Government as well as the European Commission, by participating in the 7th Framework Programme to develop electronic technologies to improve the European industry's competitiveness.

During its more than 120 years, Bosch has achieved break-through innovations in each of the large industries where it operates. In 2011, Bosch registered 853 patents in the European Patent Office, which it has placed the firm as the number one in the ranking patenting companies in Europe. Although not all the patents go on to become products, this shows the high relevance the company allocates to research and innovation production. Nowadays, Bosch has more than 34.000 researcher and developers in its workforce distributed in many regions on a global scale, creating a large knowledge-network.

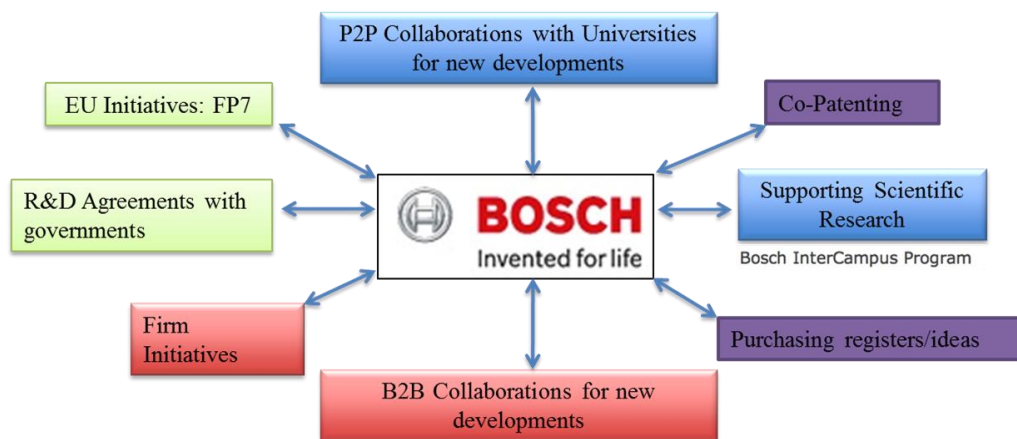


Figure 4: Robert Bosch's Collaboration Map per areas. Source: Mattera (2013).

One of the most recent and influential technological elements recently introduced in the market is ICT, as it was previously described in section 2. Considering Bosch is a highly technological company and currently a pioneer in the implementation of new elements or incorporating them to their product-development, it was one of the first firms to interiorize IoT. Within the elements that allow the creation of an interconnected network of elements, RFID was one of the first technologies implemented, mostly in transportation personnel access, toll roads and industrial as well as business applications. Bosch constituted one of the first companies in Europe to incorporate RFID to its products and to participate in the European Committee for Standardization (CEN) to regulate standards for electronic tolling.

Bosch created Bosch Tool Corporation, a division that offers power tools for professionals or workplaces. Through this division, the firm learned its customers needed a different system to track their tools, better than the bar-code system, given that bar-code labels could be removed or damaged. Due to Bosch's accurate customer relationship management, the firm began to offer in 2005 products with RFID, together with an RFID reader and software, thanks to which clients were able to track products within their facilities. Even though the final price of products increased, the value added was significantly greater and highly valued by customers, as they evidenced a significant reduction of theft in their workplace. Based on the success of this initiative, a year later 2006 Bosch introduced the RFID-based kanban cards, which was a system used to control the supply chain in its car-component manufacturing plant located in Eisehach, Germany. This implementation increased the speed of the production process and enabled higher accuracy in managing customers' orders. In addition, all the data collected via RFID enter into the Bosch enterprise resource planning system automatically, which was used to report and implement more improvements. Just a year later, the project was fully operational and by applying RFID technology, the firm has been saving over a million euros per year.

Bosch continued to advance in the implementation of IoT, not only within its facilities in the supply chain and other activities, but also in collaboration with other firms to expand the use of RFID and related technologies. Along these lines, one of the most relevant implementations was in 2008 with the exhibition of Tutankhamun, the Golden King and the Great Pharaohs. This exposition begun in the Ethnological Museum (Vienna, Austria) and even though RFID had already been used to protect valuable art pieces, Bosch Security Systems integrated the use of RFID with video images from a CCTV (closed circuit television) system. Through this initiative, Bosch provided cameras with the proper software to translate the data from the cameras to the security system, which allowed the museum’s staff members to receive live and accurate information. In addition, the system could be easily relocated, which constituted a determinant feature in the initiative’s success as the exhibition was itinerant, being displayed in many different museums and institutions around the world.

After 2009, Bosch evaluated extending the implementation of IoT to all of its business sectors and industries in which it operates. Taking into account IoT is the next level in the development of the Web Technology; the firm consolidated its efforts in becoming the global leader in IoT innovative solutions. Bosch has been investing in the development of IoT-related products and processes, both on a supply chain and on an overall corporate level, creating the elements with which things and people will be communicating in the near future. In this way, Bosch has focused on three lines of development: technology, applications and an integrative business model. In order to achieve this, the firm recently created a new division: Bosch Software Innovations, which is currently commercializing head units in vehicles, sensors in buildings with connection with the internet, while offering software platforms and other technological elements. The new division attributes four dimensions to IoT and related services: business innovation, market, competences and technology.

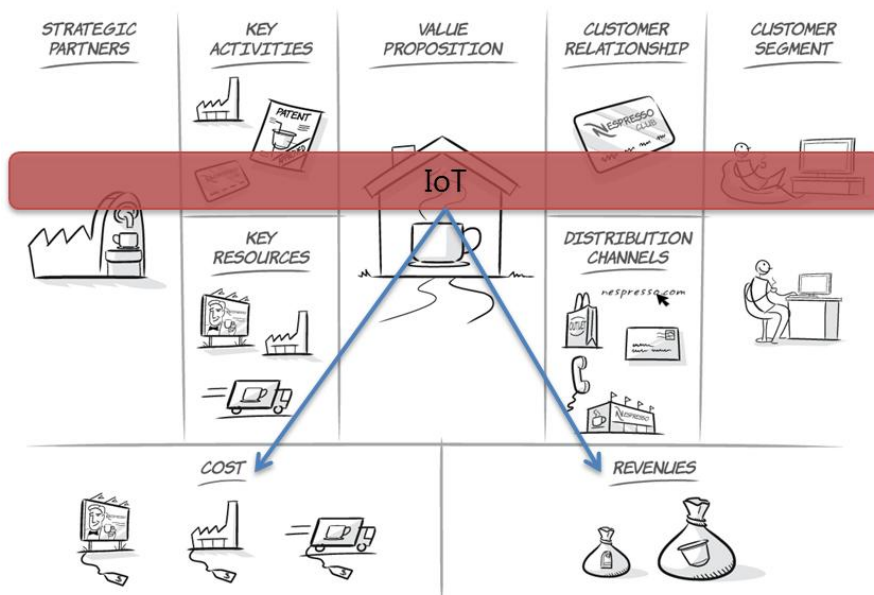


Figure 4: Canvas Business Model adapted to Robert Bosch GmbH. Source: Own elaboration based on Business Model Generation (2013).

Bosch Software Innovations conducts research in order to link the diverse agents participating in the market which are or could be partners in creating new products or services, constituting the first dimension. With respect to market, the second division, Bosch distinguished the diverse industries in which it operates, assessing new market segments and related products or services. Meanwhile, the third division analyses the competitors in each market and intends to collaborate with other firms to generate synergies and create new solutions. Considering Bosch has wide experience in the markets in which it operates, the last dimension intends to create a technology allows systems to be integrated in single software, thus creating pioneer maps, network webs and business models.

In accordance with the Canvas Model, although Bosch considers the same strategic areas, namely infrastructure, offering, customers/ customer relationship and finance, the firm currently is basing its

Business Model in the implementation of IoT in each of these areas, which integrates them while affecting the firm's finances, as seen in Figure 4. However, in this case IoT would be viewed as element which enables and increases the efficiency of each area in the model, namely strategic partners, key activities and resources, value proposition, customer relationship, customer segment and distribution channels; in addition to costs and revenues. Bosch has been incorporating IoT into every aspect of their business, from supply chain management to relationships with employees and other stakeholders. Consequently, the firm bases its value proposition in offering products and services incorporating IoT and at the same time IoT represents a fundamental element in their infrastructure; their key activities and resources; to communicate and collaborate with its strategic partners; segmenting and managing their relations with customers.

IoT contributes to build a solid competitive advantage for Bosch, which is sustainable in time and allows the firm to reduce costs and increase their margin. Furthermore, the German corporation

In doing so, interoperable, scalable and open technology shall allow for new systems, things and services to be integrated. The company has invested more than ten million Euros, and together with other companies, it seeks to fulfill suitable ventures. Strategic plans go beyond cars, and household appliances, focusing on mobility (emobility), energy markets, home (smart homes), buildings, and intelligent cities.

and finance (cost structure and revenue streams). This contribution, depicted as the "Canvas model" (Figure 1) summarizes the fundamentals of a business to be successful and on which elements it is basing its value proposition.

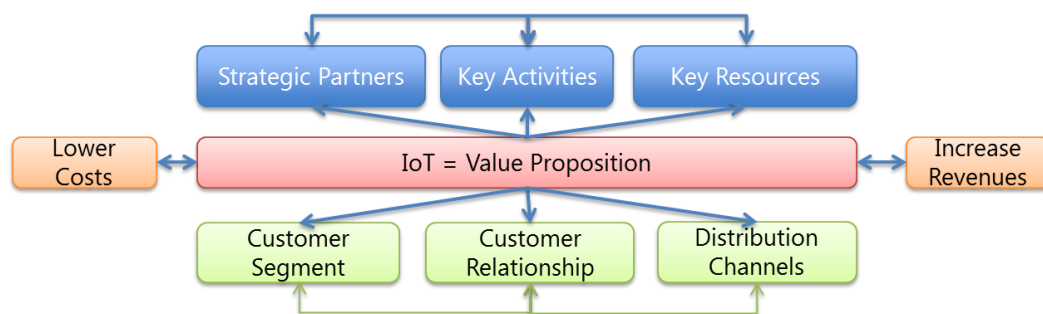


Figure 5:
Robert
Bosch's
Business Model. Source: Own Elaboration.

4 Conclusion

From the beginning, innovation has been the pillar in Bosch's strategic design and business model. Due to his founder personality, the history of Bosch has been extraordinary linked with innovation. These facts have made Bosch a leader in Development and Research. Starting with the corporate slogan "invented for life", stands for a technological leadership, the benefit of their products and services and the quality of the work. The slogan has a dual significance. First, it means the core knowledge (quality, reliability and innovation) of the brand; second, the technology helps to improve the quality of life, (contribution to people, society and environmental sustainability).

Nowadays, Bosch is one of the world's most diversified companies. The Bosch Group comprises Robert Bosch GmbH (The parent company) and 350 subsidiaries. The main elements of the company's strategy are still the same three pillars: A powerful international presence, focused diversification and a high level of innovation. This contribution, depicted as the "Canvas model" (Figure 1) summarizes the fundamentals of a business to be successful and on which elements it is basing its value proposition.

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