Chapter 2
Smart and Connected Product Business Models

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Abstract A business model describes the value offered by the company. Business models have a significant impact on the success of the business. Smart and connected products, which connect the physical objects by using sensors and communication technology, change the nature of traditional businesses and business models. The value propositions, revenue streams, and technologies offered with these smart and connected products are different from the traditional business models. In this chapter, we define the key features of smart and connected product business models and reveal the successful real life cases with this framework.

2.1 Introduction

The fourth industrial revolution is realized by the combination of numerous physical and digital technologies such as sensors, embedded systems, cloud computing and Internet of Things (IoT). Regardless of the triggering technologies, the main purpose of industrial transformation is to increase the resource efficiency and productivity to increase the competitive power of the companies. The transformation era, which we are living in now, differs from the others in that it not only provides the change in main business processes but also reveals the concepts of smart and connected products by presenting service-driven business models.

According to Osterwalder et al. (2005), the business model is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, delivering this value and relationship capital, and generating profitable and sustainable revenue streams. A successful business model should have four fundamental building

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A. Ustundag and E. Cevikcan, *Industry 4.0: Managing The Digital Transformation*,
Springer Series in Advanced Manufacturing, https://doi.org/10.1007/978-3-319-57870-5_2

blocks (1) the customer value proposition that fulfills an important job; (2) the profit formula that lays out how your company makes money delivering the value proposition; (3) the key resources that value proposition requires; and (4) the key processes needed to deliver it (Innosight 2017). In the harsh competition of today's business world, only the companies developing the right business models can be successful. The companies having innovative business models can transform businesses, create new markets and unlock significant growth.

With the rise of IoT, the growing number of smart and connected products entered into the market, change industry domains and the structure of competition. With service-driven business models, they are reshaping industry boundaries and creating entirely new industries (Porter and Heppelman 2014). Smart, connected product capabilities can be grouped into four categories (PTC 2017):

- Monitor: Sensors and external data sources enable monitoring of the product's condition, operation, and external environment to generate alerts and actionable intelligence.
- Control: Software built into the product enable control and personalization.
- Optimize: Monitoring and controlling capabilities enable optimization algorithms to enhance product performance and perform remote service and repair.
- Automate: Combination of monitoring, controlling and optimization capabilities enhanced with software algorithms and business logic allows the product to perform autonomously.

Smart and connected products having enhanced capabilities allow the radical change in business models. A shift from a product-based to service-centric business models has emerged (Porter and Heppelman 2014). This transformation forces the companies to differentiate their value chain alignment, set new strategic decisions to cope with competition, redefine the organizational structure and change their application success factors.

Value propositions, revenue streams, and technologies are the primary determinants of smart and connected product business models. In this chapter, we propose a business model framework for smart and connected products. In this framework, the main determinants are classified with relevant cases.

The rest of the chapter is organized as follows: Sect. 2.2 briefly explains the nature of business models. In Sect. 2.3, the key business model components of smart and connected products are given. The proposed framework is provided in Sect. 2.4. Conclusions and further suggestions are given in the last section.

2.2 Business Models

Business modeling is a useful tool that makes current processes in the system less costly, more efficient and satisfying profit expectation with excellent progress. Business modeling is determining a company's priority value about customer expectation, developing methods by forming foundations about determined priority

and progress of working on providing continuity to these methods. As many entrepreneur acts could not have satisfied the expectation of current era, they were not able to stay alive. Entrepreneurship is meaningful when it fulfills a necessity. Modeling this need on a particular value provides continuity to a company. Businesses that do not progress with specific methods and systems have limited life, as they cannot take work under control in today's world. According to scientific researches, there are various business models. However, as each company has developed its model on its priority, no particular model is applicable for every company. This project involves information about existing models and progress of applying existing models. A deep research about models shows that they provide holistic approaches to businesses and reveal the research needs in details.

In literature, different studies focus on various values. Some authors have supported the idea of focusing on customer demands, and some supported the idea of focusing on determination of the company. A business model is a comprehensive tool to understand the way of doing the business of the firms and to analyze their performance and competitive strategies through the design of their products or services offered to the market. Business models also help for a full scanning of a firm. With a business model, a person can understand a company's costs to produce, the value they offered to the market and which strategy they follow to communicate with the consumers. The business models are the value propositions that explains how the company meets the customer needs (Kim and Mauborgne 2005). A business model is a system of interdependent activities that enlarge the boundaries of an organization (Amit and Zott 2001). The companies should realize customer expectations and they should build up a new business model structure based on the value created.

Weisbord (1976) defines purpose, structure, relationship, reward, leadership, helpful mechanisms as the key components of a business model. According to Amit and Zott (2001), the blue ocean strategies and business models can be classified as across alternative industries, strategic groups and chain of buyers, complementary offerings, emotional and functional appeal. The value proposition, value creation, delivery, and value capture are considered as the key components of a business model. In the value proposition, the company decides which product/service they offer to their consumers and which customer segment they have. The last thing to do in the first part is choosing the way of communicating with the customers. The company analyzes what they have for these customer segments and how they implement their business regarding their resources, channels, partners and technology. After all these processes, in the last part, the company should introduce its cost structure and determine its revenue streams to defray this spending.

Osterwalder and Pigneur (2010) synthesize the business models in the literature and develop a comprehensive template for business models. In this model, there are five key components of a business structure, infrastructure, offering, customers, finances, and resources. The beginning of building the model should be with Customer Segments part. Before analyzing their strategy and activities, companies should define which customer segments, they target. They should make a segmentation of the customers according to their importance and then choose the best

target group for the following steps. The next step should be valued proposition. Each firm should focus on value, which affects the customers to improve a new business strategy. This value should be determined according to the understanding of the client expectations. After detecting the value proposition, the company should decide which channels they use to provide these benefits for the customers. The next step will be customer relationships. In this part, the company should define their way of communicating with their customer. The company should decide, whether it be a face-to-face meeting or via calling and so on. After evaluating the customer parts, the company should define the revenue streams, which shows the things, or activities, which will make money. The next stage should be detecting the key partners. During this business, the company can need to do same partnerships with other companies or some foundations. Companies should define these partners. After these parts, the critical part called key activities should be fill in. Next step is setting action plans to reach this customer segment with supplying particular value via detected channels to gain the aimed revenue stream. After a well-designed action plan, the company should control its key resources if it is enough for the short and long-term plans or not. The last stage is determining cost structure, which is the total spending of this model.

Successful smart and connected product business models differentiate from the traditional business models regarding the value propositions, revenue streams, and the technologies.

2.3 Key Business Model Components of Smart and Connected Products

Business models are the management tools that facilitate creating, enlarging and retaining business value. In the recent years, there is a significant interest in smart and connected business models, especially IoT business models, since they enhance competitive advantage (Wirtz et al. 2016). There are many challenges of these business models. For instance, connecting different devices and developing standards or maintaining information security are some of the challenges of smart and connected business models (Hognelid and Kalling 2015). Business models are the tools that help to overcome these difficulties. In this section, the key components of smart and connected business models are examined.

Guo et al. (2017) evaluate the impact of the business models of an IoT on the business value. They classified business models as novelty-centered, efficiency-centered, lock-in centered and complementary. Novelty centered IoT business models focus on creating new markets, new services or innovations. Efficiency focused IoT business models try to increase the efficiency of transactions. The objective of these models is to fasten, simplify, eliminate errors and improve the transparency of a transaction. Lock-in centered IoT business models try to enlarge transaction volume and increase customer loyalty by various ways such as

customizing, improving safety and reliability. Complementary based IoT business models provide additional goods/services that are more valuable together. Bujari et al. (2017) reveal the capabilities and limitations IoT technologies. IoT business models along with some factors such as security and privacy are considered as the factors that affect IoT usage. Weinberger et al. (2016) claim that IoT enhances industries and supply chains by shortening optimization cycles, testing processes and increasing the quality, flexibility, and efficiency. The IoT business models are classified into six groups namely, remote usage and condition monitoring, object self-service, digital add-on, digital lock-in, product as a point of sales and physical freemium.

Dijkman et al. (2015) adopted business canvas model to the IoT business models. In this study, key partners in IoT models are hardware producers, software developers, and other suppliers, data integration, launching customers, distributors, logistics and service partners. The main activities are customer development, product development, implementation/service, marketing/sales, platform development, software development, partner management, logistics. Key resources are physical resources, intellectual property, employee capabilities, financial resources, software, and relations. Value propositions are newness, performance, customization, getting the job done, design, brand/status, price, cost reduction, risk mitigation, accessibility, convenience/usability, comfort, and the possibility for updates. Customer relationship components are personal assistance, dedicated assistance, self-service, automated service, communities, and co-creation. Channels are sales-force, web sales, own stores, partner stores, and wholesaler. Customer segments are mass market, niche market, segmented, diversified and multi-sided platforms. Cost structures are product development cost, IT cost, personnel cost, hardware/production cost, logistics cost, marketing, and sales cost. Asset sale, usage, rental, subscription, licensing, installation and advertising fees are the main revenue streams.

2.4 Proposed Framework

The smart and connected business models can be classified based on value propositions, revenue stream, and the offered architecture and technologies. Value proposition categorizes the values created with business models. Revenue stream shows how the business model creates income and the used technologies can be explained under three layers, namely, the physical layer, connectivity layer, and digital layer. Combinations of these futures create benefits for the customers.

2.4.1 Value Proposition

The smart and connected product technologies significantly transform the core business models. They not only provide cost reductions but also create new revenue

streams. These business models offer four primary values. In this chapter, the value propositions of smart and connected product businesses are classified based on Guo et al.'s (2017) classification as follows:

- Novelty

Novelty refers to the new market, new services and innovation. IoT applications enable firms creating new markets, new services, and innovations. Not only the IoT solutions that enable creating new business models but also the IoT Platforms themselves can be considered as novel business models.

Watson IoT Platform enables manufacturers to develop personalized adaptive robots. Similarly, Libelium provides an IoT Platform that allows connecting various devices located at different locations and gather data from these devices. Cities, agriculture systems or water resources can be managed by using Libelium platform. Microsoft IoT Platform provides a range of solutions to connect, analyze and optimize the usage of industrial equipment and devices in the factories. This platform can significantly enhance the workplace safety.

AT&T Connected car turns the vehicle into a Wi-Fi hotspot. Keeps the car connected to a network even during the trip. Users can do video streaming, web browsing, and Internet radio via Car's network.

- Efficiency

The smart and connected product business models that bring efficiency make the transaction faster, simple, transparent and eliminate errors. The primary goal of smart and connected product applications can be increasing the efficiency of transactions. The efficiency can be improved by making the transaction faster, simple or increasing its dependability and transparency. Increasing efficiency usually the first step of implementing embedded systems. Therefore, efficiency is the most common benefit sought in IoT businesses.

For instance, IoT embedded vibration sensors developed by Intel can track the vibration in bridges and provide reliable data for maintenance planning which may increase the reliability of constructions. Nest Thermostat developed by Nest Labs tracks user behaviors and decreases heating and cooling costs by adjusting the desired room temperature before the owner arrives at home. It also connects with the energy companies and enables these companies to optimize their production levels based on the consumption information.

- Lock-in

Smart and connected product applications allow firms to enlarge transaction volume for existing customers and increase customer loyalty. They can provide affiliate programs or virtual communities. These applications can enhance customization, repeat usage, customer retention, reliability, and transaction safety.

Amazon Dash Button is a Wi-Fi connected device that reorders product with the press of a button (https://www.amazon.com/Dash-Buttons). These dash buttons are paired with pre-selected products. Pushing the button is enough for a reorder. This smart and connected product enables repeat usage of the pre-selected items.

Sentrian (Platform) is a remote patient monitoring platform analyzes bio-sensor data and sends patient-specific alerts to clinicians and learn from their feedbacks.

- Complementary

Complementary based IoT business models provide additional goods/services that are more valuable together. Cross selling and effective bundling are available with these business models.

Amazon Dash Replenishment Service enables automatic reordering for products such as laundry detergent for washing machines or ink cartridges for printers. These embedded replenishment services give automatic orders before the last load. It uses the Amazon's customer service systems such as payment systems and authentication.

Similarly, Moov is a fitness wearable with an artificial intelligent based personal coach.

2.4.2 IoT Value Creation Layers and Technologies

The IoT is a widely used term for a set of technologies, systems, and design principles associated with the emerging wave of Internet-connected things that are based on the physical environment (Holler et al. 2014). An IoT architecture consists of three main layers which can be called as physical, connectivity and digital layers (Andre 2015). In this section, Streetline Smart Parking Soluiton will be used as an example to explain how the value creation layers are formed. Streetline is a smart parking company using IoT technologies which help to solve parking issues by delivering smart data and advanced analytics to its customers (Streetline 2017).

- Physical Layer

At the physical layer, sensors and micro-controllers work together to provide one of the most important aspects of the Internet of Things (IoT): Detecting changes in an object or the environment, allowing for capture of relevant data for real-time or post-processing. Sensors are used for detection of physical changes including temperature, light, pressure, sound, and motion. They are also used for detection of the logical relationship of one object to another(s) and the environment including the presence/absence of an electronically traceable entity, location or activity (Research and Markets Report 2016). Actuators are other critical devices at the physical layer which are used to effect a change in the environment such as the temperature controller of an air conditioner.

As an example in Streetline Smart Parking Solution at the physical layer, ultra-low power sensors detect the status of parking spaces and communicate through a wireless mesh network. The mesh network is built using a series of unobtrusive and easily installed repeaters, placed on locations like streetlights and telephone poles, to form a canopy above the targeted area. Meter Monitors can be installed in legacy single-space meters to detect payment and wirelessly integrate the meter into the network (Streetline and IBM White Paper).

- Connectivity Layer

The connectivity layer is responsible for connecting to other smart things, network devices, and servers. Its features are also used for transmitting and processing sensor data (Sethi and Sarangi 2017). IoT devices connect and communicate using various technical communication models and technologies such as IP networks, 3G/4G, Bluetooth, Z-Wave, WiFi ZigBee, RFID or NFC (Internet Society IoT Report 2015).

- The device-to-device communication model represents two or more devices that directly connect and communicate between one another, rather than through an intermediary application server.
- In a device-to-cloud communication model, the IoT device connects directly to an Internet cloud service like an application service provider to exchange data and control message traffic.
- In the device-to-gateway model, or more typically, the device-to-application-layer gateway (ALG) model, the IoT device connects through an ALG service as a conduit to reach a cloud service.
- The back-end data-sharing model refers to a communication architecture that enables users to export and analyze smart object data from a cloud service in combination with data from other sources.

In Streetline Smart Parking Solution, the sensors are tied into municipality Wi-Fi networks using a device-to-gateway model at the connectivity layer.

- Digital Layer

Digital layer stores, analyzes and processes huge amounts of data that comes from the connectivity layer. It can manage and provide a diverse set of services to the lower layers. It employs many technologies such as databases, cloud computing, and big data processing modules. It is also responsible for delivering application specific services to the user. It defines various applications in which the IoT can be deployed, for example, smart homes, smart cities, and smart health (Sethi and Sarangi 2017).

In Streetline Smart Parking Solution, at the digital layer, machine-learning techniques are deployed to merge multiple data sources into an integrated data set for real-time parking guidance. The data analytics capabilities are used to improve accuracy and provide a comprehensive city-wide view of parking utilization. A suite of mobile and web applications enables each key stakeholder in the parking ecosystem.

Table 2.1 shows the characteristics some smart and connected business model cases. Both businesses to business (B2B) and business to customers (B2C) business models are considered in this table.

Table 2.1 Characteristics some smart and connected business model cases

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
IBM/Streetline	B2C	Efficiency	Streetline fastens finding parking spots by giving directions to the open parking slots	Parking payment can be done via mobile app, it has a monthly subscription model, parking enterprises can publish their parking slots	Sensors with light sensitivity installed in the parking slots	The sensors are tied into municipality Wi-Fi networks. Data obtained from sensors are transferred to cloud platform	Data are analyzed at cloud analytic platform, and customers use consumer-facing streetline parker app
Nestlab	B2C	Efficiency	Nest thermostat developed by Nest Labs tracks user behaviors and decreases heating and cooling costs by adjusting the desired room temperature before the owner arrives at home. It also connects with the energy companies and enables these companies to optimize their production levels based on the consumption information	Nest sells its smart home consumer products, namely its thermostat, which is more expensive than a traditional thermostat. It sells the energy consumption data that it is able to aggregate across its devices	It has a split-spectrum smoke sensor that detects carbon monoxide, a microphone that enables complete self-monitoring and other sensors that detect temperature, humidity, occupancy and ambient light	The sensors are tied into Wi-Fi networks	Nest app enables remote usage of products
Amazon's dash button	B2C	Lock-in	Amazon's dash button is a Wi-Fi connected device that reorders	Dash buttons are sold at low prices	Sensors and Wi-Fi connection are	The sensors are tied into Wi-Fi networks	Dash button is managed with a mobile app

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
			product with the press of a button. These dash buttons are paired with pre-selected products		embedded in the dash buttons		
Amazon's dash replenishment	B2B/B2C	Complementary	Amazon dash replenishment service enables automatic reordering for products such as laundry detergent for washing machines	Companies can use amazon's authentication and payment systems, customer service, and fulfillment network for automatic reordering	It works with any sensor or tracking mechanism, but it can tracks customer usage directly	The device is connected to the internet through companies cloud or directly	Dash replenishment service uses Login with Amazon (LWA), Amazon Simple Notification Service, and RESTful API endpoints to allow the device or cloud to integrate
AT&T/Connected car	B2C	Novelty	Turns vehicle into a Wi-Fi hotspot. Keeps the car connected to a network even during the trip. Users can do video streaming, web browsing, and internet radio via car's network	No initial payment required. Monthly payment with a 2-year contract. Payment changes with the content of the internet package	A plug-in, which is attached to the car, provides Wi-Fi connection to the people in the car	Plug-in is connected to AT&T's 4G LTE network.	People in the car can connect to the internet from their smart devices via Wi-Fi network in their car. Also, they can locate their can in the parking lot, send directions to their car and remote start through the mobile app
Shipwise	B2B	Efficiency	Shipwise provides a web platform for small and medium enterprises who want	Shipwise makes contract based arrangements small	All the equipping vehicles, warehouses, goods, cargo carriers and other devices in	The sensors are tied into Wi-Fi networks	Shipwise's online dashboard provides shippers end-to-end

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
			to book and manage global freight shipments. Shipwise's online dashboard enables tracking global shipments and provides analyzing tools to reduce errors	and medium enterprises	the supply chain have embedded smart sensors		management of shipments
Placemeter	B2B	Efficiency	Placemeter turns video into meaningful data. It provides solutions for smart cities, out-of-home advertising, and retailers	Monthly subscription model with a 1-year contract, which includes a cellular data plan, full feature access, software updates and 24/7 technical assistance	The platform collects videos through Arlo cameras or existing security cameras	Security cameras are connected to closed or hidden Wi-Fi networks and to the cloud server	From Placemeter's dashboard, users can access all the information about the movement in that specific location
Belkin/WeMo	B2C	Efficiency	A Smart plug that is controllable from smartphones. Power on/off situation can be arranged according to a predetermined schedule. Also, tracks energy consumption of the related electronic device. It decreases the energy consumption of that plug	One time payment model. Customers have to pay a certain price for the purchase phase. No additional payment during the usage	WeMo is plugged into an electrical outlet, and it controls power outage according to the signals coming from the Wi-Fi network	WeMo is tied into Wi-Fi networks. Which then connects to a cloud server	Via the cloud server, users can control their electronic products which are connected to WeMo from the mobile app

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
Philips/Hue	B2C	Efficiency	A light bulb that can be turned off and on remotely from a mobile device. It also can change the color of the light	One-time payment model. Customers have to pay a certain price for the purchase phase. No additional payment during the usage	The small internal device provides communication with the network	Through WiFi network reception of bytes are transmitted to Hue. It has three communication channels: router, Ethernet, and ZigBee	With Philips Hue's mobile app, users send commands to the light bulb
August/Smart lock	B2C	Efficiency	A smart lock that unlocks when the owner of the house came home with his smartphone and locks when the owner leaves. Access right can be granted to others via application in the smartphone	One time payment model. Customers have to pay a certain price for the purchase phase. No additional payment during the usage	Command signals through Wi-Fi or Bluetooth are received by the receptors	August smart lock is tied into Wi-Fi networks through august connect. Which then connects to a cloud server	Via mobile application, which is connected to the lock through Wi-Fi network, users can control august smart lock
DHL/IoT tracking and monitoring	B2B	Efficiency	Implementation of IoT applications to the logistics regarding providing tracking and monitoring situation of packages or the vehicles, at the same time giving information about the	Decreases the cost of monitoring	Location and utilization of machines or vehicles are determined through signals coming from the sensors	The sensors are tied into Wi-Fi networks. Data obtained from sensors are transferred to cloud platform	Data are analyzed at cloud analytic platform, and customers reach information via mobile DHL's mobile app

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
			maintenance status. It decreases the costs related to logistics				
Farmobile	B2C	Efficiency	Provides farmers to collect machine and agricultural data. From the mobile app digital information can be tracked. Efficiency can be increased by sharing the agricultural data with the agronomists and insurance agents	The yearly subscription model, which includes a cellular data plan, full feature access, unlimited user accounts, unlimited data storage, software updates and 24/7 technical assistance	With small devices (sensors) called PUCs, machinery information is collected	The sensors are tied into Wi-Fi networks. Data obtained from sensors are transferred to cloud platform second by second	Data are analyzed at cloud analytic platform, and customers use consumer-facing farmobile app
Condeco sense	B2B	Efficiency	Workplace occupancy sensor that gathers real-time data from workplaces. Gathered data shows typically the utilization rate of the desk or workplace areas like meeting rooms	One time payment model. Customers have to pay a certain price for each unit of products. No additional payment during the usage	Wireless sensors collect real-time data about workplace occupancy. Each sensor monitors movement and heat in that particular workplace	The sensors are tied into Wi-Fi networks. Data obtained from sensors are transferred to cloud platform	The collected raw data is then analyzed and transformed into insights to help companies manage the office are more effectively from the smart devices
Daqri/Smart helmet	B2B	Effectiveness	Increases the capabilities in the workplace via data visualization, thermal vision, guided work	One time payment model which include: Daqri helmet, Compute pack with Daqri VOS installed, Developer Tools,	High-speed wide angle camera tracking and collecting the visual information around. RGB camera, stereo infrared cameras, and	The cameras are connected to Intel Core processor	The processor provides high-performance multimedia and Augmented Reality applications. Data visualization, thermal

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
			instruction, and remote expert function	Updates, and device management for enterprises	infrared light projector. Also, has a thermal camera		vision, and work instructions are provided to the user in the workplace
Spire	B2C	Efficiency	Tracks users breath and activity, and warns in the stress situations to calm down the user. Even the user do not feel tense, Spire can detect it and warn the user to get calm via sending notifications to users smart phone	One time payment model. Customers have to pay a certain price for the purchase phase. No additional payment during the usage	Spire's custom force sensors detect the reflection of breathing to torso and diaphragm. Then analyzes the breath periods to understand the user's mood	Spire uses a very popular and low power wireless protocol called Bluetooth to send and receive data to and from your phone	Analyzed data at Spire's processor is sent to Spire's mobile app, which user can track its breath data
Semios	B2B	Efficiency	Semios provides farmers to manage and protect their orchard. Frost, leaf wetness, soil moisture and pest pressure can be controlled and viewed real-time	The yearly subscription model, which includes a cellular data plan, full feature access, unlimited user accounts, unlimited data storage, software updates and 24/7 technical assistance	Semios sensors in the orchard collect all the data about the field like pests, weather conditions and irrigation	The sensors are directly connected with semios platform through cell providers	Through the Semios app, users can get notifications, reach actionable intelligence and see the records
SkyBitz/Tank monitoring	B2B	Efficiency	Provides remote monitoring and analytics for storing liquids and compressed gases like	The monthly subscription model, which includes monitor, sensor and the cable	Through the sensors inside of the tanks, tank monitoring collects information of	The sensors are tied into Wi-Fi networks. Data obtained from sensors are	Data are analyzed at Skybitz Tank Monitoring Portal which users can reach 24/7 and see all the

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Table 2.1 (continued)

Company/Product name	Business	Value proposition	Value proposition	Revenue stream	Physical layer	Connectivity layer	Digital layer
			petroleum, chemicals or water. Optimizes operation efficiency with wireless monitoring		tank level, pressure level, and location	transferred to cloud platform	information about their tank
Enevo	B2B	Efficiency	Enevo helps municipalities or enterprises to simply their waste and providing an effective solution for waste management	The service is provided with 1–10 years of contract with a subscription fee	Enevo, waste management analytics, uses advanced ultrasonic sonar technology to detect fill levels of waste bins	The sensors are tied into Wi-Fi networks. Data obtained from sensors are transferred to cloud platform	At Enevo platform users can manage their waste and reach to all information about it
Wellintel	B2B	Efficiency	It is a groundwater information system for homeowners, farmers, and scientists. It helps to track groundwater level and sends alerts in the necessary situations	One-time paying model, which includes a cellular data plan, full feature access, unlimited user accounts, unlimited data storage, software updates and 24/7 technical assistance	Sensors that are placed in the well collects all information required about the well	The sensors are tied into Wi-Fi networks. Data obtained from sensors are transferred to cloud platform	Data are analyzed at WellIntel platform which users can reach 24/7 and see all the information about their tank
Garagio	B2C	Efficiency	It provides users to control their garage door from anywhere, anytime	One-time paying model, which includes a cellular data plan, full feature access, unlimited user accounts, unlimited data storage, software updates and 24/7 technical assistance	The black box that is inserted into garage communicates with the garage door and transfers the data to Wi-Fi network	The black box is tied into home Wi-Fi networks. Data obtained from the black box are transferred to cloud platform	The web and app-based Garagio dashboard enable users to view garagedoors activity, share access and control the garagedoor

2.5 Conclusion and Further Suggestions

This chapter presents research that leads to a framework for smart and connected product business model. Using an enhanced literature review, we define the main determinants of a business model and specific types these main determinants. Subsequently, we classified the smart and connected product cases based on the main determinants.

In the literature, few studies that focus on smart and connected product business models. This chapter fulfills this need by defining the key features, value propositions, revenue streams, and technologies. This chapter can guide future smart and connected business models.

Although our study yields new and insightful results for smart and connected product business models, a more comprehensive approach can be applied to see the different applications in various markets. A qualitative study can be implemented to show the correlations among the key determinants.

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http://www.springer.com/978-3-319-57869-9

Industry 4.0: Managing The Digital Transformation

Ustundag, A.; Cevikcan, E.

2018, XVIII, 286 p. 30 illus., 23 illus. in color., Hardcover
ISBN: 978-3-319-57869-9