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A life cycle perspective on business models in the smart home device industry

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Abstract

The Smart Home Device market is expected to grow to 231.6 billion US Dollars by 2028 worldwide. With this growing number, the number of manufacturers offering devices is also growing. This group lacks information on establishing and maintaining a business model for a competitive advantage. To solve this, companies must loop the process of making their business model clear and evaluate, validate and adjust their model. In other words, they are creating a business model life cycle. To understand how this can be best achieved, this research focuses on the question: What is the life cycle of business models in the smart home device industry?

This question is answered by conducting a multi-case study, in which ten semi-structured interviews are conducted with experts influencing business models. Cross-case patterns are found in the cases, which help validate the literature-based conceptual framework. Besides validation, these patterns are used for a general method guiding the steps in the framework and three in-depth strategies: Fast-Development, Low-Cost, and Thoughtful-Following. The final framework presents a life cycle that can be started for a first business model or a model brought alive after adjustments to the previous business model. Then, companies write out their complete business model canvas. Evaluating is followed to understand the market, and validation is applied to create competitiveness and check success. After validation, adjustments are made to restart the framework. During these five steps, influences can be found in external drivers, the business structure, and business relationships.

This framework highlights creating a continuous business model with new inputs, adding a new method to the literature, and creating a management guideline. Changes in the business model are shown to influence internal and external stakeholders in the framework. At the same time, these parties will influence the framework in a new and competitive Smart Home market.

Keywords

Smart home devices, Business model, Life cycle business framework, Multi-case study, Smart home strategies, Business model evaluation, Business model validation, smart home influence, Business relations

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1 Introduction - Lacking knowledge of business models in growing smart home device market

In 2023, the Smart home device market was good for 134.8 billion US Dollars in revenue worldwide and is expected to grow to 231.6 billion US Dollars by 2028.¹ As the market revenue shows, these devices are entering households at high rates, which nowadays means that 53.5 per cent of the United Kingdom households have at least one Smart Home Device.² This market growth shows a new promising sector but these Smart Home Devices bring extra challenges for the production and usage stages. As these devices communicate and register their environment, extra hardware and software components are required. For the communication itself, the device requires network connectivity during usage and has protocols installed to send data to data platforms, which will analyse and store the data.³ To offer these changes, companies focus on finding bugs and the value customers desire while their working method shifts to short development cycles.⁴

These changes in the product and working method require companies to function differently. Business models change as the company may not sell a device anymore but focus on multi-side platforms with free(mium) services or bait & hooks.⁵ Internal goals are redefined with Smart Home Devices, and the network connection and after-sale support become more critical. Companies must unbundle their business model with this to prevent conflicts in customer relationships, product innovation, and infrastructure goals.⁶ However, the company's focus cannot stay only on the current business model as constant changes in the market, industry, macroeconomics, and preferred trends exist.⁷ These changes require constant evaluation of the current business model and preparing for the future by scenario planning and prototyping new business models.⁸

As smart home devices significantly use digital transformation, technological trends are observed, and companies prepare themselves for the appliances. Business structures change as data becomes a vital aspect of the company. IT has to support R&D with the development of software. Other departments learn to use data, which allows Marketing to understand customers. Human Resources, at the same time, attracts new skill sets and enables employees to support the change.⁹ Besides internal support, external support could be found as suppliers can help develop new products via different levels of dedication when a particular customer preference is achieved.¹⁰

All this information seems to help understand smart home device manufacturers' current and future business models. However, the decent-to-find literature focuses only on the current business models or potential future models. With this, clear drivers of seeing potential in a business model are lacking.¹¹ This lack of information reduces the competitive capabilities of companies in a rising and fast-changing smart home market. To stay competitive, companies could constantly loop in the process of understanding their business model by evaluating, validating, and adjusting it. This loop can be named a life cycle, as an adjusted

¹ See Zavaialova (2023), p.8.

² See *Smart Home - Worldwide* | Statista Market Forecast (n.d.)

³ See Cheruvu et al. (2020), p.31.

⁴ See Porter and Heppelmann (2015), p.13.

⁵ See Osterwalder and Pigneur (2010), pp.78-110.

⁶ See Osterwalder and Pigneur (2010), p.60.

⁷ See Osterwalder and Pigneur (2010), p.201.

⁸ See Osterwalder and Pigneur (2010), pp.165-168,182.

⁹ See Porter and Heppelmann (2015), p.7-14.

¹⁰ See Petersen et al. (2005), p.378; Schiele (2012), p.48.

¹¹ See Chasin et al. (2020), p.129; Sovacool and Furszyfer Del Rio (2020), p.12.

model becomes the new current one, restarting the evaluation, validation and adjustments. Again, a general framework for this process was lacking, and research was required on the following question: What is the life cycle of business models in the smart home device industry?

To help structure the answer, five sub-questions guided the research process:

1. What are the business models used in the industry?
2. How is the business model selection driven?
3. How is the process of creating a future-proof business model outlined?
4. How are smart home devices changing the business structure?
5. What are the characteristics of business relationships in the industry?

At first, finding literature to create a conceptual framework and background information was required to prepare semi-structured interviews. These interviews were conducted with experts from smart home industry businesses, resulting in ten cases. Multi-case patterns were found with the information from these cases. These patterns were then analysed to find support for the conceptual framework, which was given after some adjustments. Besides the validated framework, a general strategy and three more in-depth strategies were found which can be applied to the framework. Together, this framework and strategies gave insight into how smart home device manufacturers could keep their business model competitive by evaluating, validating and adjusting to create an improved or new business model. Simultaneously, this framework allows for the application of different levels of technology, which is also new in the theory. Besides this technology application, this framework allows the start of a business model due to external and internal drivers and due to a continuous loop of business improvements, which seems not to be suggested by the literature, especially in the smart home device industry. The exact details of this framework and the related strategies will be given later in this paper. First, it is important to understand the background and literature of smart home devices, business models, and influencing factors.

2 Smart Home Device’s concept influencing business model, internal digital transformation and business relationships

2.1 From IoT to Smart Home Device categories

The Internet of Things has two specialisations: Consumer IoT and Industry IoT, whereby Consumer IoT includes interconnected devices to improve human awareness of their surrounding environment and to save time and money.¹² Besides this Consumer IoT term, Smart Device is used, defined by Gutierrez et al. (2013) as: “A smart device is an autonomous object which is designed for self-organised embedding into different environments in the course of its life-cycle and which allows for a natural device-to-human interaction. Smart devices can proactively approach the user by using sensing, input, and output capabilities of the environment, making them self-, situational-, and context-aware. The related knowledge and functionality can be shared and distributed among multiple smart devices and emerges over time”.¹³ These smart devices have four levels of complexity to determine their independence. All devices start with monitoring via sensors and external sources to determine the product’s condition, external environment, operation, and usage. With built-in or cloud-enabled software, the next level can control the product functions or personalise the user experience. The third level optimises the product’s performance or allows the creation of predictive diagnostics, service, or repair by applying algorithms to the monitored information. At the highest maturity, the first three levels merge to create an autonomous object which autonomously operates, self-coordinates operations with other systems or products, autonomously enhances/personalises user experience, or self-diagnoses and services.¹⁴ As the application of these smart devices is broad, four categories with corresponding industries or applications come forward to narrow their scopes, as shown in Table 1 with the help of Lueth (2015) white paper.¹⁵ These categories make it possible to focus on the goal of

Table 1: Consumer IoT categories with industry/application according to Lueth (2015)

Category	Industry/Application
Home	Home automation, home improvement, energy efficiency
Lifestyle	Wearable computing, entertainment & music, family, leisure, pets, toys, drones
Health	Fitness, monitoring, measurement, diagnosis
Mobility	Connected cars, eBikes

Smart Home Devices as the application of Home focuses on home automation, home improvement and energy efficiency. Schiefer (2015) defines a Smart Home Device as “A thing, whose main functionality is extended with networking abilities to create a new one. The additional infrastructure for those devices, like a base or control station, falls also in Smart Home.” This definition means that a standard device in a home, such as a refrigerator, can be extended with network abilities, becoming a Smart refrigerator. Schiefer also has fifteen categories, Table 2, to define the Smart Home Device’s goal better.¹⁶ The type of devices show potential as these Smart Home Devices as companies widely produce them. Still, a company requires a strategy to make the offering profitable by applying business models and evaluation methods.

¹² See Sisinni et al. (2018), p.4725.

¹³ See Gutierrez et al. (2013), p.207.

¹⁴ See Porter and Heppelmann (2014), p.8.

¹⁵ See Lueth (2015), p.5.

¹⁶ See Schiefer (2015), p.6.

Table 2: Overview of Smart Home Device categories based on Schiefer (2015)

Category	Description
Controlling Systems (ConS)	Systems that only control the Smart Home.
Security Systems (SecS)	Includes lock systems, surveillance cameras and similar devices.
Safety Systems (SafS)	Devices that detect and avoid threats to life or physical condition.
eHealth Systems (eHS)	Devices for medical inspection, but also medical assistance. In this context, only Smart Home devices are considered.
Measurement and Sensors (MaS)	Water meter, electric meter, and such devices. Discrete sensors and detectors included if they are not part of SafS or SecS.
Heating, Ventilation and Airconditioning (HVAC)	Systems used to regulate room temperature and air ventilation.
Light and Shadow (LaS)	Devices emitting or preventing light.
Kitchen Devices (KD)	Devices meant to be used in a kitchen.
Water Systems (WS)	Tap, bathtub and toilet as well as lawn sprinkler.
Cleaning Systems (CLeS)	Systems to clean up, like washers, dishwashers, and robots for vacuum-cleaning.
e-Pet Systems (ePSy)	Every device around pets or animals.
Entertainment (Ent)	Audio systems, television, gaming consoles, toy robots and more.
Pieces of Furniture (PieF)	Seating and sleeping accommodations like massage-giving mattresses, desks, closets, etc.
Agility Devices (AgiD)	Devices for transporting persons, like cars, bicycles, and bicycle gadgets.
Others (Oths)	Systems which cannot be part of another category in a meaningful way.

2.2 Drivers for creating a (future) business model and how to evaluate

2.2.1 The business model canvas and related patterns as base

An option to understand the business models of Smart Home Device manufacturers is the business model canvas. This widely-known method for creating an overview of what influences the potential income is the Business Model Canvas, Figure 1, of Osterwalder and Pigneur (2010). The canvas covers four business themes to fully understand a business: customers, offer, infrastructure and financial viability. The advantage of this canvas lies in its easy-to-use design and applicability to every type of company.¹⁷ Certain different business models with high synergy are closely related to the canvas of the business models and are named patterns. Osterwalder and Pigneur (2010) highlighted five patterns, whereby three can relate to the smart home device industry. The first pattern describes that companies internally have three fundamentally different types of businesses: customer relationships, product innovation, and infrastructure. These three businesses have their own economic, competitive, and cultural imperatives, meaning they can co-exist but cannot bundle into one entity canvas, as keeping them "unbundled" avoids conflicts or undesirable trade-offs. Thus, unbundling

¹⁷ See Osterwalder and Pigneur (2010), pp.18-44.

8. Key Partnerships Some activities are outsourced and some resources are acquired outside the enterprise.	7. Key Activities ... by performing a number of Key Activities.	2. Value Propositions It seeks to solve customer problems and satisfy customer needs with value propositions.	4. Customer Relationships Customer relationships are established and maintained with each Customer Segment.	1. Customer Segments An organization serves one or several Customer Segments.
	6. Key Resources Key resources are the assets required to offer and deliver 1 till 5...		3. Channels Value propositions are delivered to customers through communication, distribution, and sales Channels.	
9. Cost Structure The business model elements result in the cost structure.		5. Revenue Streams Revenue streams result from value propositions successfully offered to customers.		

Figure 1: Business model canvas with descriptions based on Osterwalder and Pigneur (2010)

requires three separate canvases to avoid conflict.¹⁸

Multi-sided platforms are the second pattern, which brings two or more distinct but interdependent groups of customers together. The company providing the platform creates value with a service but can only create value by serving all groups. Thus, these companies often try to lure one segment of customers to the platform with an inexpensive or free value proposition to attract users on the platform's other side.¹⁹

A specialisation of the multi-sided platform is the pattern "Free", whereby at least one Customer Segment continuously benefits from the free-of-charge offer. In total, there are three options for Free: advertising-based, freemium, and bait & hook. Multi-sided platforms use advertising-based platforms, whereby one side of the platform attracts users via free content, products, or services. At the same time, the other side creates revenue by selling advertising rights. Freemium is mainly web-based, whereby companies offer free basic services to a large user base. Most customers will not pay for the premium service, but the group with the premium service subsidises the free users. The last in the Free model is Bait & hook. This model is the case when the company makes an attractive, inexpensive, or free initial offer to encourage continuing future purchases of related products or services.²⁰

What does not become clear from looking at a business model canvas or patterns is what drove a company to manufacture Smart Home Devices. To better understand this decision, it is essential to understand the general areas where companies can find these drivers. As these drivers could also affect the future, the relation to business model evaluation must become apparent.

¹⁸ See Osterwalder and Pigneur (2010), p.60.

¹⁹ See Osterwalder and Pigneur (2010), pp.78-79.

²⁰ See Osterwalder and Pigneur (2010), pp.90-104.

2.2.2 Four areas for drivers, resistance for change, and evaluating of current method

Keeping track of the environment has become highly important as the economic landscape grows in complexity, uncertainties become more prominent, and market disruptions become more severe. Continuous scanning allows companies to adapt their business model effectively to shifting external forces. For every company, it is possible to divide external forces over four areas, as in Table 4. When considering the business model canvas with these areas, the effect can be related to the building blocks. Market forces focus on the changes in the customer segment and revenue streams. At the same time, Industry forces highlight the changes in key resources, key partnerships, and cost structure. Key trends have the broadest effect on the canvas and affect customer segments, value propositions, customer relationships, key activities, and key partnerships. For macroeconomic forces, the effect relates to value propositions, channels, revenue streams, cost structures, and key resources.²¹ Besides

Table 3: Main areas of external forces with related topics according to Osterwalder and Pigneur (2010)

Market forces	Industry forces	Key trends	Macroeconomic forces
Market issues	Competitors (incumbents)	Technology trends	Global market conditions
Market segment	new entrants (insurgents)	Regulatory trends	Capital markets
Needs and demands	Substitute products and services	Societal and cultural trends	Commodities and other resources
Switching costs	Suppliers and other value chain actors	Socioeconomic trends	Economic infrastructure
Revenue attractiveness			

the current external forces, focusing on future forces is required to keep a competitive advantage. As the future is uncertain, it is necessary to create hypotheses to guide a future-proof business model. These hypotheses focus on the four main areas of external forces resulting in the development of potential business model options as prototypes, stories, or scenarios.²² Prototyping brings the advantage of uncompromised commitment to discover new and better business models. These prototypes aim to create ideas to implement or explore new and perhaps absurd or impossible ideas. These prototyped business models can be at different scales, from a rough sketch of an idea to a field-tested business model canvas. Ultimately, these prototypes provoke new designs for future business models.²³ With these conceptual business models, a story can also be created whereby the goal is to introduce the new model in an engaging, tangible way. The story stays simple but aims to provoke the idea or justify a change. The provoking idea helps challenge the organisational status quo as the current business model may be severely challenged or obsolete. A justification of change will help visualise the firm's idea of how the company's competitive landscape will evolve and how the business will compete via its evolved business model.²⁴ Using scenarios will help to understand the future as well. The goal will not be to predict the future but to imagine possible

²¹ See Osterwalder and Pigneur (2010), pp.200-201.

²² See Osterwalder and Pigneur (2010), p.210.

²³ See Osterwalder and Pigneur (2010), pp.165-168.

²⁴ See Osterwalder and Pigneur (2010), pp.174-175.

futures in concrete detail. These scenarios help encourage innovators to reflect on the most appropriate business model for each of the future environment's options. Applying these scenarios for the future is called Scenario planning and forces reflection on the business model and how a model might have to evolve under certain circumstances.²⁵

As important as having future options is evaluating the current business model. Evaluating helps to understand the company's current health of the market position and helps to apply adaptations when needed. A robust evaluation method here is SWOT (strengths, weaknesses, opportunities, and threats), and it applies to every building block of the business model canvas or the company in general. This method allows an understanding of the internal and external environment to evaluate the current performance and future options for development. The Blue Ocean Strategy could also evaluate the company, whereby the goal is to create new, uncontested market space via value innovation, which means increasing value for customers by creating new benefits and services while at the same time reducing costs by eliminating fewer valuable features or services.²⁶

Technological trends are vital to the success of smart home devices as a unique feature that will create competitiveness. For this, a company must prepare to apply such a new technology by undergoing a digital transformation, which will influence the business model.

2.3 Digital transformation and Smart devices influencing the business (model)

2.3.1 Domains and guidance for digital transformation

A company cannot directly apply a digital transformation as the transformation requires a certain maturity. The first step is digitising to make all analogue signals digital. These digital signals make transferring and reading them possible via multiple formats and devices. Digitalisation is the second step and aims to develop new organisational procedures, business models, or commercial offerings by applying the sociotechnical process of leveraging digitised products or systems. These new organisational forms create the maturity to apply digital transformation, as adapting to these forms creates the end goal of a new cost-revenue model. For this adaptation, employees must learn new skill sets to enable the company to remain viable and relevant.²⁷

Acquiring this new cost-revenue model is achieved by fulfilling four strategic imperatives, according to Verhoef et al. (2021). Before a company can create value, it must acquire or develop new digital assets and capabilities. Organisational changes, especially flexibility, are required to adapt to digital change. Digital growth strategies are required, and digital platforms are the most prominent option. It will also be required to apply KPIs to facilitate learning and fine-tune the business model.²⁸ How the maturity of these imperatives influence each other is visualised by the building blocks of Vial (2019), Figure 2. The first building block is using digital technologies, fuelling market disruption. These disruptions trigger a company's strategic response by applying a new digital business and digital transformation strategy. The influence of the strategies goes back to the use of digital technologies, as this usage relies on the strategy. These technologies also enable changes in value creation. With this, organisational barriers and structural changes influence the value creation. Lastly, these changes in value generate positive and negative impacts.²⁹ Nevertheless, starting the digital

²⁵ See Osterwalder and Pigneur (2010), p.182.

²⁶ See Osterwalder and Pigneur (2010), pp.216-228.

²⁷ See Saarikko et al. (2020), pp.828-830; Verhoef et al. (2021), p.892.

²⁸ See Verhoef et al. (2021), pp. 892-895.

²⁹ See Vial (2019), p.122.

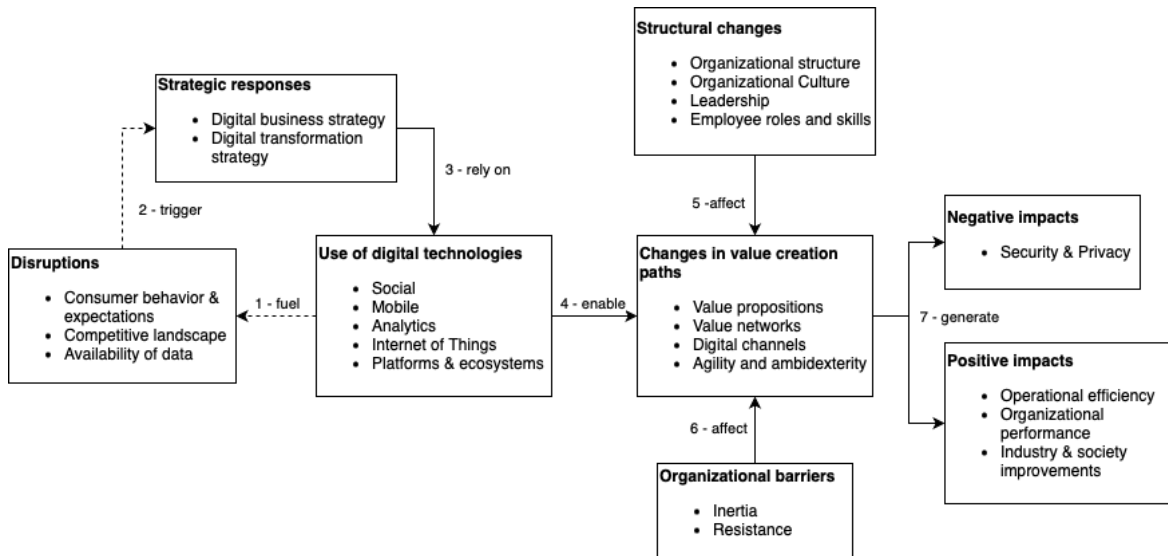


Figure 2: Building blocks of Digital Transformation process by Vial according to Vial (2019)

transformation stays unclear from these building blocks but can be solved by the recommendations of Saarikko et al. (2020). The first recommendation is to 'start small and build on first-hand benefits', whereby the goal is to carefully gather the valuable data that will bring benefits instead of collecting Big Data. 'Team up and create competitive advantage from brand recognition' recommends teaming up as a small company with a recognised brand to establish a foothold or as an established brand with smaller companies to achieve competitive advantage with their technologies or business models. The third recommendation is to 'engage in standardisation efforts' as digital transformation relies on multiple technologies running simultaneously. Standardisation is required to harmonise these technologies to achieve strategic benefits. 'Take responsibility for data ownership and ethics' highlights recognising legal dimensions and considering practical implications for data ownership and management. To what extent can the data be used to compile digital profiles? It is unclear, and potentially destructive effects arise when the data falls into the wrong hands. The last recommendation is to "own the change and ensure organisation-wide commitment", meaning to have an organisational-wide understanding that digital transformation is a tool to achieve the end goal, only possible by creating digital consciousness.³⁰

These building blocks and recommendations give insight into the general application of digital transformation. Nevertheless, the company's management highly influences the success of transformation and innovation through its decisions.

³⁰ See Saarikko et al. (2020), pp.835-838

2.3.2 Management requirements and circularity for digital innovation

As a practical case example for digital innovation, Volvo Cars achieved digital innovation, whereby the following four topics made Volvo Cars' management successful: capability, focus, collaboration, and governance. New capabilities are required to identify novel ideas within existing internal contexts and to engage external parties. A long-term vision will be required whereby the focus on digital innovation aims at the innovation process, not the outcome. From the capability of engaging external parties grows the collaboration for innovation. These external parties stimulate the development of new configurations and possibilities through an ongoing transformative process. Governance must balance the generativity of new products and the bounds to keep products in control. From these topics, innovation capability was the essential management concern as all projects required this by creating, for example, an innovation hub whereby teams leave their team silo and start to innovate together. The innovation focus was also essential to making the project successful over time. Depending on the project, collaboration and governance were required to find a fitting partner or to find the balance between new concepts and mainly data security.³¹

From these four topics, the capability and focus tend to come back in the paper of Khin and Ho (2020) as digital capability and digital orientation due to the digital orientation describing a digital mindset for recognising digital technology as a powerful tool to create new digital solutions which can disrupt the industry. Digital capability means building up skills, talent, knowledge, and experience within the workforce related to managing digital technologies. These two topics are essential as Khin and Ho (2020) show both have a significant positive effect on digital innovation within IT companies, which results in a significant positive effect on (non)-financial performance.³² Del Giudice et al. (2021) also use closely related terms to support the positive effect of digital innovation on smart manufacturing SMEs. Digital orientation is mentioned as organisational ambidexterity but also means exploiting existing knowledge and resources. Digital capability becomes the general organisational adaptability whereby a company learns from developing digital technologies and adapting its structure to market changes to be competitive. With this, ambidexterity influences organisational agility, improving a company's agility to operate in uncertain and complex environments, resulting in agility affecting digital innovation.³³

Looking further into the literature, Hinings et al. (2018) can identify three types of digital innovation. The first type of digital innovation focuses on improving the organisational form by creating a digitally enabled arrangement between practices, structures and values constituting the organisation's core. To make such innovation successful, the organisation must gain legitimacy by presenting arguments about why there is a problem and how they solve it. Digital institutional infrastructures are another type of innovation that tries to set a standard for digital technologies to enable, constrain, and coordinate numerous actors' actions and create the option to interact in ecosystems, fields, or industries. These infrastructures include the Apple product platform with multiple ecosystems or blockchain technology, a peer-to-peer network to store data. The third type of digital innovation is institutional building blocks: digital technologies for running or creating an organisation. These are generally accepted and are ready-made or customisable modules. These building blocks always come with a value-laden design and require varying technological knowledge for application.³⁴

These strategies to transform and innovate Smart Home Devices change the consumer's

³¹ See Svahn et al. (2017), pp. 246-249.

³² See Khin and Ho (2020), pp.189-190.

³³ See Del Giudice et al. (2021), pp.78-79

³⁴ See Hinings et al. (2018), pp.54-55.

household and the company's profit model. Suddenly, new business models arise, and questions about what the company wants to achieve with its devices become a new topic.

2.3.3 Digital transformation and business models with Smart (Home) Devices

A digital transformation starts by offering Smart Devices as competition within industries reshapes and boundaries expand. This industry expansion starts when creating product systems whereby one smart (internet) connected device optimises itself with other related devices. This system allows companies to offer packages of smart connected products to optimise the overall result of the client instead of one actor. Boundaries can even be increased further by combining multiple product systems into a System of Systems whereby one system can use external information to coordinate and optimise itself. A smart home is an example of a system of systems whereby multiple product systems, such as lighting, entertainment, and security, are connected. The effect of these smart connected products will be the rise of industry entry barriers. However, the first-mover advantage will be more vital when companies can easily accumulate and analyse product usage data. The second effect is companies merging, especially in industries where boundaries are expanding. As a result, single-product manufacturers will have more difficulty competing with multiproduct companies that can optimise broader systems. At the same time, new entrants will emerge, as these companies do not have a definition for their legacy products and do not need to protect their incomes. Some of these new smart products will be productless as their solution will be the system to connect smart products.³⁵ Manufacturing these Smart Devices will require strategic decisions whereby Porter and Heppelmann (2014) suggest ten questions to answer:³⁶

1. Which set of smart, connected product capabilities and features should the company pursue?
2. How much functionality should be embedded in the product and how much in the cloud?
3. Should the company pursue an open or closed system?
4. Should the company develop the full set of smart, connected product capabilities and infrastructure internally or outsource to vendors and partners?
5. What data must the company capture, secure, and analyse to maximise the value of its offering?
6. How does the company manage ownership and access rights to its product data?
7. Should the company fully or partially disintermediate distribution channels or service networks?
8. Should the company change its business model?
9. Should the company enter new businesses by monetising its product data through selling it to outside parties?
10. Should the company expand its scope?

Manufacturers must also start an internal software department to make their traditional product smart. With this, learning for the software industry as early adaptors of on-premises

³⁵ See Porter and Heppelmann (2014), pp.13-14.

³⁶ See Porter and Heppelmann (2014), pp.16-22.

and cloud software and remote client support will help Smart Device manufacturers. These lessons can be divided into five categories and integrated partly into the ten questions mentioned. At first, a company requires shorter development cycles to keep track of customer requirements, whereby the company delivers enhancements with course corrections weekly. Second, companies must consider the product-as-a-service business model, making the product an operating expense instead of a capital expense. Focusing on customer success is also required, as customers can easily change vendors; thus, it is an ongoing value critical. The product must be part of a broader system as software is released in a stack of tools nowadays, which enhances the value when integrated. Lastly, analytics will bring a competitive advantage as this allows the right time to connect to a customer or to identify bugs with the highest impact on customers.³⁷

With Smart Home technologies, the business models tend to have the overarching themes of data inferences, advertising, brokerage, services, and assets. Data inferences focus on collecting behavioural data to anticipate and respond to users' needs, and together with an advertisement, these models create revenue from household data and surveillance capitalism or insurance models. As a broker, the business model with smart home is charging transaction costs in the energy sector for demand response, 'prosuming', peer-to-peer and blockchain trading, or for bundling and integrating services. With servicing, there are two options: usage fee or subscription fee. The usage fee focuses on capturing savings and energy service provisions. Subscription fees make use of pay-as-you-go and subscription-based models. Lastly, asset sales focus on selling mobility, EVs, Vehicle-to-grid, Security and safety, convenience and accessibility, health care, and coupling with retrofits.³⁸

These business models for Smart Home Devices will influence customer value and change internal structures. Divisions within the company will change to use the devices' full potential.

2.3.4 Smart (Home) Devices changing company structures and working ethics

With Smart Home Devices, a new era starts for creating new value in the value chain. Porter and Heppelmann (2015) state that smart devices will change the company from product development to after-sale services with changes in organisational structure as well. Table 4 gives an overview of business functions relevant to Smart Home Devices to simplify the overview of these changes. With this, product development changes from mechanical engineering to interdisciplinary system engineering as the product now contains many software and cloud connections. The final assembly overhauls manufacturing as the customer loads and configures software at home during the product's lifetime. Within marketing and sales, staying connected to the device allows the constant improvement of the customer's value. After-sale service improves, as they can monitor and access devices from a distance. The biggest threat from these changes lies within security as the network connection allows hacking, especially as most devices do not have the processing power for modern security hardware and software. Besides hacking, data privacy, in general, is essential, and it requires the company to create data policies. Human resources is required simultaneously to find new expertise within employees, which requires a new working method and cultural norms.³⁹ Besides the change to system engineering, the organisational structure must change to comply better with Smart Home Devices. Within a traditional company, only IT has developed the

³⁷ See Porter and Heppelmann (2015), p.13.

³⁸ See Sovacool and Furszyfer Del Rio (2020), p.12.

³⁹ See Porter and Heppelmann (2015), pp.7-14.

Table 4: Changes in the value chain per business function for Smart Home Devices based on Porter and Heppelmann (2015)

Product development	Low-cost variability, evergreen design, new user interfaces and augmented reality, ongoing quality management, connected service, support for new business model, system interoperability
Manufacturing	Simplified components, reconfigured assembly processes, continuous product operations
Marketing and sales	New ways to segment and customise, new customer relationships, new business models, a focus on systems, not discrete products
After-sale service	One-stop service, remote service, preventive service, new services
Security	
Human resources	New expertise, new cultures, new compensation models

skills to develop and apply software. As Smart Home devices are embedded with software and use related infrastructures, R&D is required to cooperate as R&D generally lacks software and cloud skills. These new devices and the growing amount of data are strategically becoming more critical, requiring a unified data organisation department to utilise this data at best. This team handles all the data analytics and trains employees to use the data. Concerning the IT and R&D cooperation, this must be extended even further to a DEV-OPS team to enhance the continuous product operation and support. This team is responsible for managing and optimising the ongoing performance of connected products by releasing smart and carefully tested batches of fixed and enhanced products. Customer success management is required to manage the customer experience and ensure the customer gets the most value from the product. With smart home devices, this team can use the data to determine customer value, prevent defections, or find customer benefits from additional product capabilities or services. Lastly, a strong collaboration between R&D, IT, and data organisations is required to share responsibility for data security. With this, R&D and Dev-Ops take the lead on reducing vulnerabilities in the physical product, and IT and R&D will simultaneously take responsibility for maintaining and protecting the product cloud and connections to products.⁴⁰

Relations with external parties change as well. As the Smart Home devices require software, the development may be outsourced instead of developed by the IT and R&D development. At the same time, the devices require network capabilities and chips to run the software. For these changes, it is essential to understand the stakeholders related to Smart Home Devices and strategies to maintain a business relationship.

⁴⁰ See Porter and Heppelmann (2015), pp.14-14.

2.4 Stakeholders for smart home devices and strategising business relations

2.4.1 Primary and secondary stakeholders for Smart Home Devices

A stakeholder map for Smart Home Device manufacturers seems unfindable, but this is not true for a Smart Home stakeholder map. Ehrenhard et al. (2014) created an overarching map for Smart Homes whereby with two stakeholder roles: Primary and Secondary. The Primary describes the essential roles for offering Smart Home services, and the Secondary describes who could enhance and enrich the value of the primary roles by adding specific values. Within this stakeholder map, the manufactured smart home devices are called "System integrators" and allow the creation of an overview of smart home device stakeholders. The primary stakeholders are almost identical for Smart Home Devices; only Smart Home service providers must be merged with the Customers as these providers are customers of the Smart Home Device manufacturer. This change in customer and making the Smart Home provider the nodal role results in Table 5.

Table 5: Primary stakeholder roles adapted to Smart Home Devices based on Ehrenhard et al. (2014)

Primary roles	Activity
Smart Home Device manufacturer (nodal role)	Integrates (hardware and software) technology
Customer	Pays for the product or service offered
End User	Using the product or service offered
Hardware provider	Offers hardware
Network provider	Offers connectivity services
Software provider	Offers software (platform)

When looking into the secondary roles of Ehrenhard et al. (2014), some unclearness exists as their paper presents a value network figure which does not include all their founded secondary roles. This difference results in not knowing to what role these not-mentioned secondary roles are connected. Thus, all secondary roles not mentioned in the value network will be kept for the overview of secondary roles connected to the system integrators, resulting in Table 6.⁴¹

The Chinese Smart Home Ecosystem map of Man et al. (2020) also gives an insight into stakeholders, as system integrators have supplies from Original Engineering Manufacturers (OEM) and Device suppliers over eight fields, such as Entertainment and Security. These OEMs and device suppliers get their supply from component providers divided into four groups: sensor, wireless module, chip and material, and screen.⁴²

More potential stakeholders can be found by keeping track of relevant patents to the sector. As patents show where companies invest time, it becomes clear who can be a supplier or a potential competitor. In the case of competitors, comparing the patent data between the firm and the competitor brings the benefit of assessing technology portfolios and technologies' attractiveness, recognising changes in the competitor's strategies, identifying and assessing external sources of knowledge generation, assessing the patent situation, and evaluating essential market partners.⁴³ Keeping track of these patents also helps to map competitors' locations. Mapping the Patent Cooperation Treaty applications of the Internet of Things,

⁴¹ See Ehrenhard et al. (2014), pp.312-313.

⁴² See Man et al. (2020), p.48.

⁴³ See Ernst (2003), p.241.

Table 6: Secondary stakeholder roles adapted to Smart Home Devices based on Ehrenhard et al. (2014)

Secondary roles	Activity
App provider	Offers specific apps
App store provider	Offers app store functionality
Bank	Offers financial services
Certification provider	Offers certification services
Consultant	Offers consultancy services
Government	Determines regulation and privacy aspects
Helpdesk provider	Offers support
R&D provider	Research & Development
Retailer	Sells hardware
Software Developer	Develops software
Technology standard provider	Offers technology standards
Video connection provider	Offers video connectivity

for example, creates an overview of patent claims per country and who claimed the patent. The applications from 2000 to 2012 show that the USA ranked first with 37 per cent of the applications, followed by China and Japan.⁴⁴

Developing new devices can achieve a competitive advantage with the primary stakeholders and potential new patent suppliers. Therefore, a company must understand what a supplier can offer and how to strategise this offer during new product development.

2.4.2 Factors, strategies, and capabilities for NPD with suppliers

Integrating the supplier is not required during the New Product Development (NPD) process. However, when a company can align its needs with the supplier’s capabilities or integrate its strategies with the supplier, the buyer’s NPD cycle time, quality, and cost results will have a positive effect. For this effect, a company must perform on supplier selection, supplier relationships for development and adaptation, and internal customer capabilities.⁴⁵

As given as an action for Supplier Selection, it is vital to determine the level of supplier involvement. For this involvement, the spectrum of supplier integration gives four options: None, White-, Gray- and Black Box. With these boxes, the responsibility grows from no integration to a supplier advising on the buyer’s design in the White Box. Even more responsibility for the supplier results in the Grey Box of joint development between both parties. The highest supplier responsibility is in the Black Box, whereby the supplier designs a product driven by the buyer’s performance specifications.⁴⁶ More in-depth information regarding integrations is also an option, resulting in the Different modes of development by Schilling (2023), Table 7.⁴⁷

Before such an integration strategy can be determined, the buying firm needs to know which supplier technology knowledge will help it innovate. This understanding starts with the ability to scan for breakthroughs in technologies used within or outside the firm’s industry sector. After scanning and coding these new potential technologies, the company must translate this

⁴⁴ See Ardito et al. (2018), pp.320-322.

⁴⁵ See Johnsen (2009), p.195; Ragatz et al. (2002), pp. 395-396.

⁴⁶ See Petersen et al. (2005), p.378.

⁴⁷ See Schilling (2023), p.186.

Table 7: Modes of development according to Schilling (2023)

	Speed	Cost	Control	Potential for leveraging existing competencies	Potential for developing new competencies	Potential for accessing other firms' competencies
Solo Internal Development	Low	High	High	Yes	Yes	No
Strategic Alliances	Varies	Varies	Low	Yes	Yes	Sometimes
Joint Ventures	Low	Shared	Shared	Yes	Yes	Yes
Licensing In	High	Medium	Low	Sometimes	Sometimes	Sometimes
Licensing Out	High	Low	Medium	Yes	No	Sometimes
Outsourcing	Medium/High	Medium	Medium	Sometimes	No	Yes
Collective Research Organizations	Low	Varies	Varies	Yes	Yes	Yes

knowledge into organisational processes. Understanding whether these technologies will add value to the company can be achieved by technical capabilities such as R&D, investment programs and organisational systems. When these technical capabilities are strong, they positively influence the NPD, allowing the firm to understand which technologies their products embed and help them see the potential technologies available in the market. This market insight helps with a stronger position when searching for knowledge exchange as the company understands whether a supplier possesses sufficient knowledge. This supplier knowledge exchange will then positively influence the NPD, as the supplier helps to set more realistic technology goals and provides information on trade-offs within the product and process design.⁴⁸ To further understand the effect of long-term supplier relationships, the next chapter will highlight the benefits and drawbacks.

2.4.3 Achieving long-term relationships with benefits and drawbacks

When the cooperation with a supplier becomes long-term, positive effects affect the connected information technology, information sharing between the parties, and the overall performance of the buyer.⁴⁹ The buyer's firm can expect more positive effects as delivery schedules improve, procurement costs lower, product costs lower, supplies become more reliable, and purchasing productivity improves. The supplier experiences the benefits of reliability in reorders, improved marketing productivity, better knowledge of customer needs and more optimal capacity planning.⁵⁰ Focusing on long-term relationships results in less conflict and more satisfaction between the parties.⁵¹ Adverse effects, such as the negative effect of Corporate Social Responsibility (CSR) on financial performance, are also reduced by having a long-term orientation with a supplier.⁵²

⁴⁸ See Cousins et al. (2011), pp.933-934,938.

⁴⁹ See Prajogo and Olhager (2012), p.517.

⁵⁰ See Han et al. (1993), p.335.

⁵¹ See Griffith et al. (2006), p.93.

⁵² See Wang and Bansal (2012), p.1146.

To achieve this long-term relationship, both the buyer and supplier develop an orientation that cooperation is vital and that maximum effort is applied to maintain the relationship. Procedural achieves this long-term orientation- and Distributive Justice. With this, Procedural Justice stands for the perception of a firm that the development and admiration of the relationship policies are fair and equitable. Disruptive Justice describes the firm’s perception of the equitable distribution of the relationship resources relative to their input.⁵³

However, trust between the parties can also negatively affect the buyer. When a buyer starts to trust a supplier, more cases start of the buyer monitoring less, the buyer overcommits to the relationship, and the buyer starts to accept supplier ideas and information without questions. This trust will create drawbacks, resulting in less efficiency, especially when the buyer has a high supplier dependency. This drawback is partly dependent on the market stability as a volatile market results in high trust and a minor downside in efficiency compared to a stable market.⁵⁴

When applying the Preferred Customer Matrix strategy, a company could prevent these trust issues and receive a performance increase. This matrix uses the competitive drive of the supplier and the preferred customer status. With this, the following strategies roll out: Quacksalver, Black Knight, Squire, and King, Figure 3. The Quacksalver strategy prescribes find-

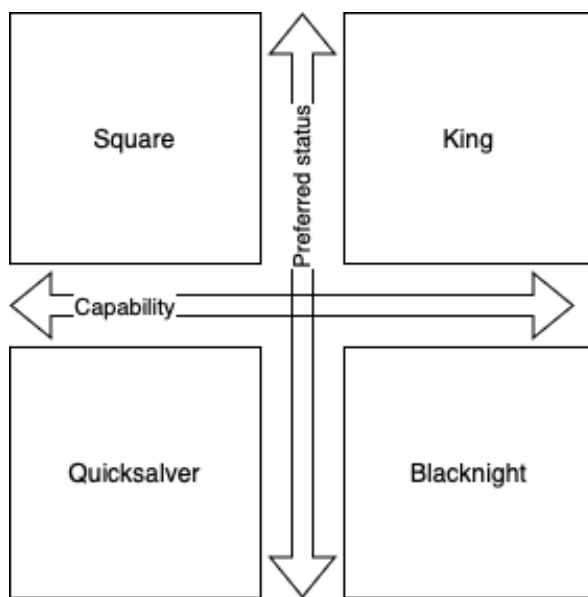


Figure 3: Preferred Customer Matrix based on Schiele (2012)

ing another supplier as the supplier does not see his customer as essential and, at the same time, is not the best in his field. A Black Knight strategy notes that it is crucial to keep this supplier as they threaten the buying firm and may sell better quality materials to competitors. At the same time, a company can attempt to improve the relationship to receive the preferred customer status; otherwise, finding a second-tier supplier who gives the preferred customer status and guarantees to develop capabilities is more useful. This second-tier plan describes the Squire strategy, whereby investments improve capabilities. The King strategy is the supplier loyal to the buyer, giving them the preferred customer status and offering them the most competitive materials.⁵⁵

With the literature related to the concept of Smart Home devices, business models, digital

⁵³ See Griffith et al. (2006), pp.91-93.

⁵⁴ See Villena et al. (2016), pp.776-777.

⁵⁵ See Schiele (2012), pp.48-49.

transformation, and business relations gathered the information can be bundled into a framework. This conceptual framework will aim to describe the life-cycle of the business model of smart home device manufacturers.

2.5 Conceptual framework: Smart Home Device business model life cycle

As introduced, the business model must constantly be evaluated, validated, and adjusted to stay competitive.⁵⁶ With this, keeping track of the external drivers is vital to evaluating the current business model for success.⁵⁷ This evaluation may suggest model changes that require validation to understand whether the change will be successful. The business model can be adjusted when positively validated, creating an improved business model. Validation may also result in a new detached business model as validation has shown that there is potential but not as the newer version of the current business model.⁵⁸

These adjustments to the current business model may influence the internal business structure as new departments are required or current departments must fulfil different tasks. With this, companies may need to learn new skill sets or working cultures to their employees.⁵⁹

These business structures are crucial when validating, highlighting whether the company is ready to adjust to a newer business model. Adjusting the business model will influence business relationships and business-to-business partners, and stakeholders may have to deliver new products or services, or new partners are required as no partner can offer the required service.⁶⁰ At the same time, these relationships influence the evaluation, and the relationship's age and quality may influence the performance.⁶¹

Drivers and partners may also create opportunities for new business model concepts via new product development.⁶² Validation of these new concepts is required and may become the new business model, restarting the loop of evaluating, validating, and adjusting. In the end, this constant loop results in a life cycle of the business model and is the concept framework of this paper given in Figure 4.

As this framework uses founded literature, validating whether businesses follow it becomes essential. Information regarding companies' working methods had to be gathered for this validation. These companies were interviewed semi-structured, whereby the data allowed a multi-case study.

⁵⁶ See Osterwalder and Pigneur (2010), p.201.

⁵⁷ See Osterwalder and Pigneur (2010), pp.210-228.

⁵⁸ See Sovacool and Furszyfer Del Rio (2020), p.12.

⁵⁹ See Ehrenhard et al. (2014), pp.312-313; Porter and Heppelmann (2015), pp.7-18.

⁶⁰ See Ehrenhard et al. (2014), p.312.

⁶¹ See Han et al. (1993), p.335; Schiele (2020), pp.124-125.

⁶² See Johnsen (2009), p.195; Ragatz et al. (2002), p.396.

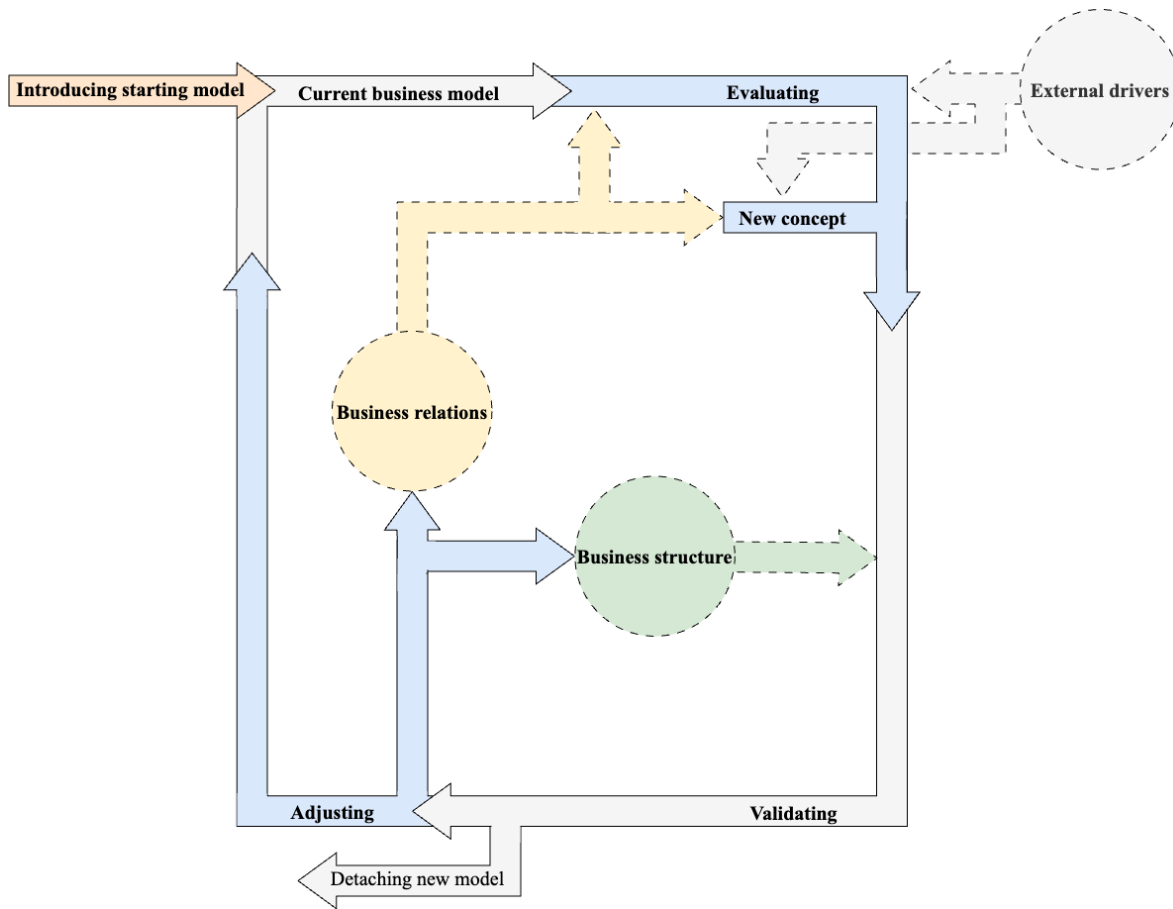


Figure 4: Conceptual framework: Smart Home Device business model life cycle

3 Methodology: multi-case study with ten semi-structured interviews over seven topics

3.1 Multiple case study design: one-to-one semi-structured interviews to expand current knowledge and validate framework

Having the conceptual framework was the first step in understanding the life cycle business model of smart home device manufacturers. As the theory lacks insights into the market, information must be gathered from experts in the field. For such research, the theory-building method of Eisenhardt (1989) can be applied whereby information is won from case studies and specifically can be used when literature is lacking. With this method, a focus is given to juxtaposing as attempts are made to reconsider evidence across cases and between cases and literature, increasing the potential to be creative in reframing new theoretical visions. Eisenhardt prescribes eight steps to apply to achieve this juxtaposition: Getting started, Selecting Cases, Crafting Instruments and Protocols, Entering the Field, Analysing Data, Sharpening Hypotheses, Enfolding literature, and Reaching Closure.

With this, the first four steps focus on creating a base ground to deliver good data. At first, it is to define the research question and apply possibly a priori constructs, which are, for this research, the question "What is the life cycle of business models in the smart home device industry?" and bundling the existing literature in a conceptual framework. With this, the conceptual framework will be used to hypothesise how the market works. Selecting cases was the second step, whereby the population must be specified to constrain extraneous variation and shape external validity, and the selected cases should contribute to the new theory. For this research, the population was bound to smart home manufacturing parties, which had to sell smart home devices at the moment of contact. Within this company, the case had to be explained by an internal expert who influences decisions during the production of smart home devices, which also affects the business model. This research used qualitative and quantitative data to craft instruments and protocols. The cases had to describe specific characteristics to create quantitative data, allowing comparison, and the rest was qualitative to reach a vast amount of information. Given the time, it was impossible to create multiple data collection methods, and as the research had to be performed by one person, various investigators were also impossible. Entering the field became possible with this information in mind, where overlap should exist during data collection to improve analysis. Also, the data collection method had to be flexible and opportunistic. To achieve this, semi-structured interviews were applied as this allowed overlap in questions to improve analysis, and this type of permitted interview to deepen an exciting topic, creating flexibility.

The other four steps focused on analysing and processing the analysis, whereby the first step was to create a with-in-case analysis, followed by cross-case pattern searching. This step was followed as it allowed us to gain familiarity with the data and to find evidence through multiple lenses. After having the analysis, the hypothesis had to be sharpened. Thus, adjustments were made to the conceptual framework to fit the cases better. The cases contained more information than the framework, expanding the theory further with business strategies. Enforcing the literature with the findings and the new framework is the next step in comparing it with existing research for conflicts and similarities. This can be found in the discussion, and the research was closed after searching for multiple cases via two large exhibits to reach closure.⁶³

The exact application method used in preparation and analysis is not described but is in the

⁶³ See Eisenhardt (1989), pp.536-545.

following chapters, starting with the precise instruments and protocols to collect the data.

3.2 Data collection: seven topics guiding the interview on business strategies and influencers

As knowledge already existed in general for companies but not for smart home device companies, the information gathering aimed to expand the current knowledge to the specific Smart Homes industry. As described by the crafting instruments and protocols and entering the field step of Eisenhardt (1989), it was important to find a method which allowed the gathering of quantitative and qualitative information and had to be flexible and opportunistic during data gathering. This was best achieved by performing semi-structured interviews with experts.⁶⁴ Semi-structured interviews allowed interviewees to explain their answers and generate extra knowledge and conversations about previously not considered topics during the interview preparation, creating flexibility with an opportunistic topic. This flexibility was helpful in this research as it allowed a better understanding of the decision-making process in the company's business model when the knowledge passed the general questions. At the same time, semi-structured interviews guided the results as all interviewees started with the same question, resulting in being more able to compare company strategies. Having prepared questions allowed to ask quantitative questions as well, which would later increase the speed of comparison. As manufacturers of Smart Home Devices settled themselves worldwide, the interviews had to be online. Therefore, video calls were the best option as they removed the geographical boundaries and enhanced the number of possible participating companies.

The advantage of online interviews was the option to record the interview, which would later help improve the transcription process.⁶⁵ Besides the transcription process, not having to write down the exact words of the interviewee allowed one to focus on writing down in-depth follow-up questions. With this, there was one exception: an interview took place via phone, whereby recording was impossible. For this interview, the interviewee had to confirm the notes.

The privacy of participating companies was important during the research. As their answers would allow the company to be traced back, information regarding the company, interviewee, devices, and external relations was pseudonymized after the interviews. After rounding up the research, all recordings were also deleted to secure their integrity. The interviewee had to consent to recording and transcribing the interview via software to prevent misunderstandings. Before every interview started, the purpose and confidentiality of the interview were re-explained to ensure the interviewee knew what they participated in. Permission was asked for recording and using software for transcription as well.⁶⁶

During these interviews, the questions followed the main questions and sub-questions, found in Appendix A. Every interview first focused on informal questions regarding the interviewee and company background to loosen up the conversation.⁶⁷ This first topic also asked how many Smart Home Devices the company offered and in which category they fit according to them. The second topic focused on the decision to produce Smart Home Devices, how the company saw itself when entering the market, how it is today, and what changed during this period. The business model was topic three, where the company described its business model around smart home devices and whether the company had applied multiple business models within the company. With this business model, the sub-questions specifically fo-

⁶⁴ See Kallio et al. (2016), p.2961.

⁶⁵ See Hove and Anda (2005), p.9.

⁶⁶ See Hove and Anda (2005), p.5.

⁶⁷ See Hove and Anda (2005), p.7.

cused on describing parts of the business model canvas. Topic four opened the conversation about drivers for the business model, how the current model is evaluated, how preparations for the future are made, and how changes are applied to the model. To further understand the effect of smart home devices, questions focused on how the introduction changed the internal business in topic five. Topic six attempted to clarify who the stakeholders for the smart home devices are and what role these stakeholders have. The business-to-business stakeholders were the topic in part seven to understand whether long-term relationships are the company's goal and how these relationships affect the business, whereby innovation cooperation was also questioned.

With everything prepared to conduct interviews, it became important to understand who would be participating. Thus, the following section is about how the companies were founded and how they were asked to participate. This section will also briefly describe the cases and their quantitative characteristics.

3.3 Sampling: ten companies in four categories found via connections and expositions

To find experts who are influencing the smart home business model, a first attempt was searching "Smart Home Device" online. This search term resulted in buying recommendations and web shops offering Smart Home Devices. Nevertheless, this search method gave some companies but mainly devices of these companies. This result made the creation of a company database harder and resulted in looking into the tech exposition called the Consumer Electronic Show (CES). As the CES focused on consumer appliances and has a "Smart Home and Appliances" category, a well-given company could be found as the floorplan for 2024 highlighted 955 Smart Home-related companies.⁶⁸ Besides this CES list, the smart home exhibitors of the exhibition IFA 2023 gave 47 company names.⁶⁹ Lastly, SmartWitgoed offered an overview of 93 brands as this website showed brands based on home appliances.⁷⁰ These searches resulted in more than 1000 company names saved in an overview document; however, these were not all unique names, and not all were manufacturing smart home devices.

First, it was required to remove duplicates, and the second step was to understand whether a company offered Smart Home Devices. Finding their products was solved by visiting the websites of these companies. Removal of the overview document happened when a company did not sell a smart home device, did not seem to have an official website, did not have an English website, or was part of a company group whereby planned contact was switched to the overarching company. With this clean-up of names, the more than 1000 company names resulted in an overview document with 166 unique companies. There could have been more companies, but initially, the decision was to contact experts directly via LinkedIn. This method required that a company be active on LinkedIn and that employees connect themselves to that account. In a later stage, this requirement was removed, as new attempts focused on contacting companies via mail to increase the chance of response.

While looking into the companies' websites, extra information was stored in the overview document. To be able to find the websites later, the URL was saved. A small description of which devices they offered was added as well. At the same time, via the LinkedIn pages of the companies, the number of employees was saved as an indication of the company's size. Every time of making contact, a new time stamp and description of the contact were added

⁶⁸ See *CES floorplan 2024* (2024)

⁶⁹ See *IFA-Berlin exhibitors smart home 2023* (2023)

⁷⁰ See *Brands smart home appliances SmartWitgoed* (n.d.)

as well. This contact information helped track the time passed between contact and what the next step of communication had to be. When the contact was made via LinkedIn, the name and function would also be saved to prevent a second time contacting the person.

During this process, contacting a person via LinkedIn required several steps. LinkedIn did not allow large messages when making first contact, so it was necessary to send a compact message to create interest. When the person accepted the connection or replied, sending a follow-up message with more information became possible. After these messages, the contact switched to e-mail, which allowed a better option to send documents and invites for the video calls. In the case of contacting companies via e-mail, the first message contained all information immediately. Besides online contact, personal connections were used to contact companies. For these personally connected companies, the e-mail methodology gave the companies the required information. All documents used to create this sampling group can be found in Appendix B

These 166 companies resulted in 10 willingly participating in the research given in Table 8, anonymised via a Greek letter. Besides answers to the questions, the extra characteristics of the companies mentioned previously are given. The companies received an industry category in the table to compare the companies better in the upcoming chapters.

Table 8: Overview of case categories and interview detail

Company	Industry category given	Age category given	Size category given	Interview time
Alpha	Home Appliances (HA)	5-10 years	Large	42 minutes
Beta	Home Appliances (HA)	>=10 years	Large	49 minutes
Gamma	Indoor Climate (IC)	<=5 years	Small	70 minutes
Delta	Lightning (LI)	>=10 years	Small	57 minutes
Epsilon	Home Appliances (HA)	<=5 years	Large	41 minutes
Zeta	Home Appliances (HA)	>=10 years	Large	32 minutes
Eta	EV charging (EV)	<=5 years	Medium	33 minutes
Theta	Indoor Climate (IC)	>=10 years	Micro	45 minutes
Jota	Indoor Climate (LI)	5-10 years	Large	54 minutes
Kappa	Lighting (LI)	>=10 years	Large	40 minutes

The time a company offers Smart Home Devices was collected during most cases during the interview. This collection was not the case for companies Delta and Kappa, resulting in looking up the age of offering Smart Home Devices online. Based on this age, the "Age

category given" categorised them as less or equal to five years active, five to ten years active, and ten or more than ten years active. This division was based on personal opinion to create equal sizes between the groups.

The number of employees was added to the table via LinkedIn. They were categorised based on the European Union's division: micro, small, medium, or large. With this categorisation, the yearly turnover is not considered, as this information was not gathered.⁷¹

3.4 Data analyses: Creating multi-case patterns to prepare for analysis

As the interviews contained the how and why answers to the research questions, finding a fitting analysis method to highlight these explanations was important. As suggested by Yin (2015), using an Explanation Building will help, as this allows the development of an idea of an applied method. In this study, the conceptual framework is such an idea for a method. Besides this development, measuring precise factors influencing the strategy during the interviews is difficult. With this, the Explanation Building describes the conceptual framework in a narrative form whereby the support of decisions made by multiple cases gives magnitude. The cases could also lack magnitude, requiring changing the conceptual framework in the analyses. A threat with this method is to drift away from the original research questions when analysing the data.⁷²

This drift was solved by applying semi-structured interviews with questions related to the framework. To further prevent a drift, the interviews received a coding, which also required transcribing the audio files. As this process took a long time to perform manually, the transcription function of Word 365 was applied.⁷³ After this transcription, all documents were read to increase the clearance of sentences. Translation was required, as some interviews took place in Dutch, so Word 365 was used. The transcriptions were added to Atlas Ti to enhance the case insights further by providing options for codes, folders and code groups. To further strengthen the overview for the description of every company, the conceptual framework was filled in per case. These frameworks resulted in the overviews in Appendix ??.

As these overviews and codes contained the primary information and relations regarding the cases, the overviews were narratively written down into multi-case patterns, as suggested by Yin (2015). These patterns were applied to prevent again the hard focus on a specific strategy instead of the general findings. A comparison in strategy was still required; thus, after the patterns, analysis was applied. The patterns were more thoughtfully examined during this analysis to find general methods to validate the conceptual framework. With this, an option was a lack of support for the framework, resulting in the removal of parts. Information was added as a new influence or step when the cases described something not conceptualised. The cases also presented strategies beyond a general Smart Home Device business model. Thus, these strategies were written out and validated with literature on market entrance strategies.

With Eisenhardt's method, the complete methodology is given, and data can be presented. As the method suggests, the cases will first be presented as with-in cases, followed by cross-case patterns.

⁷¹ See Commission (n.d.)

⁷² Yin (2015), pp.106-108

⁷³ See "Transcribe your recordings - Microsoft Support" (n.d.)

4 Results: case descriptions and overall observations following framework

4.1 Description of ten business models

4.1.1 Alpha: five to ten years smart home within home appliances as large company

The journey of producing smart home devices started for Alpha due to competition and seeing an opportunity; "...because we actually saw the development with major competitors of ours, that they were already working on that, and we had to work on that as well. So yes, we saw the future in the connected products, we didn't know exactly what, let's say, the benefit would be for the user." This meant their entrance to the market was out of a follower principle five to ten years ago. Nowadays, the competition is still ahead, but they closed the gap to become more mainstream based on the quote, "They are still a bit further along than we are. Anyway, the difference is not as big as it was then."

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.2 Beta: more or equal to ten years smart home within home appliances as large company

A pioneering feeling combined with someone in management with a technology background and seeing opportunities in smart homes resulted in company Beta entering the smart market ten or more years ago. "So we were the first home appliance manufacturer to bring smart appliances to market." the interviewee described them offering smart home devices in the home appliances industry for the first time. However, in the current market, offering a smart device has become a part of the early majority as almost every product offered has become Smart. This also resulted in Beta becoming a mainstream company when looking at their smart home devices.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.3 Gamma: five or fewer years smart home within indoor climate as small company

five or fewer years ago, Gamma started offering devices that can influence the indoor climate in the home. At first, these devices were non-brand devices directly sourced, which resulted in "... setting up a very good distribution network on an international level and thus a lot of countries within a few years that can supply those products". However, one of the entrepreneurs was passionate about smart homes and saw potential in offering these devices in their industry. With the development of own-brand devices, smart home devices were provided soon after starting. During these years, the company is still a scale-up whereby they focus on sub-premium devices, which have a high focus on design and are specialised for their purpose for a more accessible price.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.4 Delta: ten or more years smart home within lighting as small company

The smart home proposition for Delta started with the founders wanting to establish their own proposition with smart lighting by creating a new company. Their value proposition is to follow a competitor. Hereby, Delta's devices are qualitatively equal devices that are cheaper in price, making it a sub-premium brand. These devices are sold via retail partners in the online and offline markets. Delta attempts to grow the direct sales, but "The direct model is very difficult, also because the moment you get bigger in retail, if you press too hard through your direct channel, you get channel conflicts as we call it. Then the retailer is also going to say, hello, we're confronting those customers, we're putting a lot of effort into that and then you're going to do the upsell directly."

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.5 Epsilon: five or fewer years smart home within home appliances as large company

Epsilon started applying a smart home proposition five or fewer years ago because it could then monitor and remote-control products. This reason has also been extended recently to gathering data for better consumer insights; "But for the future, the real reason behind all these smart appliances and smart home and things is really about getting data about people inside the home. How are they using our products as well as how they the customer journey looks like inside homes." Gathering information is possible as Epsilon offers its platform services and content for consumers.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.6 Zeta: more than ten years smart home within household appliances as large company

Zeta already presented the first smart home propositions more than ten years ago. Besides wanting to stay close to the consumer, this drive for innovation was the reason to offer smart home devices. Nowadays, the company has become mainstream as there are more and more providers, making Smart Home a broad community. This also brought competitors who developed their features faster.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.7 Eta: five or fewer years smart home within EV charging as small company

The start of smart home devices started with a customer knocking on the door of Eta for an EV charger. This request was given to the overarching company and resulted in the creation of Eta two years ago. Within these years, Eta is still small compared to the top market players but shows competitiveness by offering devices with the same high quality but for an average price.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.8 Theta: more than 10 years smart home within heating control as micro company

Saving energy was the goal when the first owners of Theta started the company. A few years later, another company began offering a product first in the market, whereby Theta also saw the potential to create such a product with their knowledge; "There is nothing wrong with their product, but we thought it could be nicer and we put our product on the market." This made them a combination of a fast follower and pioneer, as they were the second in the market. Nowadays, Theta is one of the top three players.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.9 Jota: five till ten years smart home within indoor climate as large company

Jota wanted to pioneer with their smart heating controller as fast-growing markets drove them. However, their start was unsuccessful as there was a low interest; "There was no one on the market back then, and apps were new. Unknown at first. Unknown makes unloved. A lot of interest but hardly any purchase." Therefore, Jota finds competition required to create a market. Nowadays, it is different, as many installers know them.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.1.10 Kappa: more than 10 years smart home within lightning as large company

The combination of being able to perform a technology push with a technology that was mature enough and a market that was ready for the technology was why the marketing team of Kappa started initiating smart lighting, this resulted in Kappa's pioneering role.

[Due to privacy agreements, further information is only given when agreed to share the complete research.]

4.2 Using conceptual framework as guide for finding cross-case patterns

4.2.1 Pioneering or following, different outcomes today

For multiple reasons, companies started offering smart home devices. When looking into their market position when entering the market, some cases had a strong drive for pioneering. (Beta, Zeta, Theta, Jota, Kappa) The result of being a pioneer differs in the current market. The position can be maintained, resulting in becoming a market leader in the industry. (Theta, Kappa) Both market leading parties seem to have used technology maturity and push as motivation when they started; as Theta mentioned, "... there we thought it was time with our knowledge about smart plugs and motion sensors, and temperature sensors we had already made in the meantime, that there was a competitor there.", and Kappa mentioned, "Ultimately it is from marketing that always starts from a combination of technology push, technology is mature, and there are needs that you can offer with lighting." On the other hand, maintaining the pioneering position can be difficult, resulting in becoming mainstream as competition becomes further in the newest features. (Beta, Zeta) With pioneering, it is essential to remember that the market is not mature when the company aims to produce high volumes to reduce costs, as the market will not have a high demand for these products. (Jota) A different reason to enter the market is the competition having entered the market already, resulting in a follower principle. (Alpha) Another option is offering a new proposition as knowledge is within the company or knowledge is gathered by the entrepreneurs during pre-

vious jobs. (Delta, Theta) With existing companies, a customer can be the trigger for this new proposition. (Eta) With this, a follow-up strategy for the current market can be to offer lower-priced products. (Delta, Eta, Jota) This results in having a follower role in the market, as competition first has to show features' success (Delta, Jota), or the strategy becomes as competitive but maintains lower pricing. (Gamma, Eta)

With a driver to start, the next step is to write out the business model whereby smart home devices bring unique topics to the canvas.

4.2.2 Services, monitoring and extended features as main characteristics of smart home business model

4.2.2.1 Selling assets, and (feature) services (in the future)

The most significant common factor between all companies is their device sales revenue model. Depending on the company, accessories, such as sensors (Epsilon, Kappa) or filters (Alpha, Beta, Epsilon, Zeta) are also sold. An option with this is also to be an OEM, but methods differ. (Eta, Theta) An option is to customize the product and add the customer's brand, such as a white label. (Eta) The other option is always to offer the product with the company's brand name and actively add new features that the customer desires. (Theta)

With smart features, new revenue streams started whereby certain features extended themselves with paid subscriptions. For example, within household appliances, a company offers detergents via a subscription model for an auto-dosing feature. This subscription partly creates an up-sell opportunity and keeps the consumer close to the company for the relationship. (Alpha, Zeta) Conversely, this method is not fully supported within the industry, as Beta mentioned: "If you're in the supermarket yourself and you think, I need dishwasher tablets, you take them with you. So it was very difficult, and also the suppliers of those products of those consumables where there were also not too keen on it." The subscription reasoning of Kappa supports this: "It's about willingness to pay, your consideration of what our consumers want. It's not about us what we want, but of course, there is interest." This quote highlights that consumers must be willing to provide a service. Within the OEM case, a company may create a unique service for the customer's end-users, whereby the future option exists to make them available customer-wide. (Theta) There is an upcoming service within the cases as well.

A smart home device requires an application and a platform, requiring to consider the associated costs. Currently, companies offer the application for free, resulting in this being part of the cost structure. (Beta, Zeta, Theta, Jota, Kappa) A company places certain features behind a paid subscription to reduce costs, which, according to them, are justifiable to customers. (Kappa) Other companies are considering applying for paid services but have not added them. (Zeta, Theta, Jota) This decision is mainly due to the rising costs of saving data as data grows and cloud suppliers demand higher payment. (Theta, Jota) Even with these costs, some companies suggest that certain features could always be free of use: "I think you should be able to continue to do the basic functionality ... for free, despite the fact that it costs us money. But you can seduce the customer by offering additional services, and you will see that happen with us." (Theta) Another option to solve the costs is to create multiple use cases for the application by adding, for example, e-commerce. (Beta) For a few players, an option is not to use data, but this mostly brings the drawback of not knowing the customer journey. (Delta) Reducing the costs for data is possible by, for example, only registering device information. (Theta) Even with the costs, the advantages of smart home devices remain essential.

4.2.2.2 Smart to monitor customer journey, and create loyalty

With their platforms, companies monitor the usage of their products to understand the customer journey in terms of device usage and maintenance moments. (Alpha, Beta, Gamma, Epsilon, Zeta) The data helps to identify consumers in general, as retail partners are not keen on giving this information. (Beta) Tracking consumers is possible as the companies require users to register to use all features. (Beta, Gamma, Zeta)

With this data, companies try to improve the usage of their products by giving tips and tricks (Gamma, Epsilon); "We give more insight into how that works so that he can also use his products more effectively ... So really try to add something on the knowledge side as well, not just in terms of operation." (Gamma) This data helps to make contact with consumers more personal (Beta, Gamma, Zeta) as more personal contact helps create more brand loyalty. (Beta, Zeta) In specific industries, such as household appliances, this is necessary as loyalty is, on average, low: "In our business, that has everything to do with loyalty, so brand quality within the kitchen industry is very difficult." (Beta) Besides the customer journey and loyalty, smart connectivity brings advantages to the features.

4.2.2.3 Smart to extent features and upgrade during usage

With smart technology, devices can constantly update to optimise or add new features. (Beta, Gamma, Epsilon, Zeta, Kappa) With this, companies actively collaborate with parties in multiple industries to enhance the user cases. (Alpha, Beta, Zeta, Theta, Kappa) The most mentioned integration is with dynamic energy tariffs- and solar panel providers (Alpha, Beta, Theta) to help customers reduce energy costs, as noted by Theta: "Belgium does not have the netting arrangement for a long time ... it is very important that the moment you have solar panels and then you supply them back, you want to keep that energy in your home." These energy-related integrations seem related to the companies that offer or control high-energy devices, such as dishwashers and heat pumps. (Alpha, Beta, Theta) Most companies mentioned having an in-house platform or application development to offer such features. (Alpha, Beta, Epsilon, Zeta, Eta, Theta, Jota, Kappa) With this, some markets have different brands in the ecosystem, bringing an advantage when the platform supports multiple brands; "We know that about 60% of all kitchens that were sold in the Netherlands actually contain multiple brands. So we don't really believe in the idea that every manufacturer is going to get its own app on the customer's phone. We believe more in that mix brand household." (Beta) Outsourcing platform development may be an option when expertise is lacking. Large platform providers may offer this solution, but it brings the drawback of not having data insights, and the request to develop new features will only be accepted when the company does not have a significant market share, according to the supplier. A solution for this may be switching to a more minor party like a start-up. (Gamma)

The development speed of new features varies between companies. Some attempt to create the latest features with high development costs (Epsilon, Eta, Theta, Kappa), while others copy features when they have become successful. (Delta, Jota) Some markets require these feature investments as the market is highly competitive on the newest features and does not have these results in less volume. (Eta, Theta) On the other hand, waiting on the competition's success has advantages as well, as the larger competitor first invests high amounts in marketing, making a feature successful, and it will require less development costs as the feature characteristics are known. (Delta, Jota)

Yet, not every product category seems to have the addition of smart features as clear (Epsilon), as primary usability is still in the physical product itself (Beta), or the smart features

are a glorified remote control. (Gamma) This unclearness in using smart features is a market factor that companies must deal with, whereby other factors are influencers as well.

4.2.3 Factors influencing evaluation and validating changes

4.2.3.1 Influencing factors: unclear connectivity desire, tech push, legislation, external parties, and big-tech

During the interviews, the cases revealed that smart home devices can be found from entry-level products to luxury (Alpha, Beta, Zeta, Jota) while at the same time, the customer does not seem to demand smart home devices, as Epsilon mentioned: "It really is not a huge consumer value or user benefit, but the market is moving towards smart appliances so that consumers will check if this refrigerator is connected to Wi-Fi or that without knowing what they can do with it." (Beta, Epsilon) This difference is also shown in the moment of the maturity curve, as the companies are unclear about the stage. There is the belief that the majority curve has left the early innovator stage and reached the early majority stage (Beta), which Delta partly supports: "So at the moment, the market for smart home in Northern Europe is still more or less towards that early majority, but in Southern Europe, it is still clearly Innovator and early majority area." At the same time, the market is slowly getting ready to buy more smart home devices, which may indicate a change to the early majority. (Alpha, Epsilon, Theta) Some noticed that their sales are still mainly to early adaptors and innovators, indicating a market for early adaptors. (Beta, Epsilon) As mentioned, companies offer smart devices in every price range, but the consumer sometimes does not know how to use this smart ability. Besides this, multiple companies noticed that all their competition offers smart devices, which may indicate the market is pushing the technology. (Alpha, Beta, Epsilon, Zeta, Eta, Jota, Kappa)

An influence on the technology and the companies also comes from governments, which influence the market via legislation and subsidies. Subsidies may affect the penetration of particular industries, such as Electric Vehicles and related charging. (Eta) With legislation, the European Union, for example, is creating a new law regarding data security, as mentioned by Jota: "In these so-called RED Directives, security requirements are significantly increased." (Gamma, Jota) This legislation may also differ per country, influencing the companies on, for example, energy transition (Theta), resulting in the previously mentioned energy-related features. Governments indirectly influence companies during world events such as war and epidemics. (Gamma) For example, the war between Ukraine and Russia influences the oil industry, resulting in the market demanding more electric heat devices. (Gamma) Other parties also affect the industry, mainly with investments. However, the number of investments in smart homes is decreasing (Beta, Delta); Delta supports this as they noticed that long-term investments have become harder: "... all in all, you need investors who really dare to invest in that term, which is increasingly difficult at the moment. Money is expensive, and the venture capital is much less now."

Besides investment issues, the smart home industry sometimes struggles as there is no standard communication language. Multiple options exist, such as Wi-Fi (Alpha, Gamma, Epsilon, Eta) and Zigbee. (Delta, Kappa) With Wi-Fi and Zigbee, there seems to be a reasoning behind the number of devices you want to control at once, as Delta explained: "So the moment you want to turn off all the lights in your house at once, you get too much communication to one point at the same time. Then the malfunctions arise, and then it may be that 5 or 6 lamps in a system, of, let's say, 25 lamps, do not respond well, and that is for lighting that is, of course, a problem. You don't have that as much, or you don't have

that with a Zigbee-based system or what creates a mesh network." This protocol decision is important whereby parties utilising Zigbee offer, for example, lighting that requires the simultaneous control of multiple devices. Companies using Wi-Fi are offering large devices that solely do their tasks. Besides that, Wi-Fi is a high-energy protocol better utilised with devices permanently connected to the energy grid. (Delta) The different protocols require more cooperation when developing something with an external party; as Alpha mentioned, "You have to coordinate on that as long as there is not yet one standard language with which to communicate." Companies may solve this problem in the coming years, as large platform players, Amazon, Apple, Google, and Meta, are attempting to enter the smart home market. To enhance the speed with which they can join, they cooperated and created a new protocol, Matter. (Delta, Epsilon, Jota, Kappa) Companies will support this protocol (Kappa), but other companies see it as a possible threat: "It's a silent war between the hardware manufacturers and these big tech platform providers like Google, Amazon and Apple. These big techs would obviously want to come in, provide their high-tech operating systems and services and user interfaces to capture the value of the market and then obviously they will be pushed back from electronic manufacturers who will try to capture the value because these are the natural and existing owners of this market. So, it'll be interesting to see how this would play out ... some players try to get together for common benefit, but it's very, very difficult for these entities to work because there is conflict of interest from every participant." (Epsilon) These external factors influence the cases and require evaluation for their effect on the business model.

4.2.3.2 Evaluation via data, feedback, competition, and sales to understand trends

As mentioned, as part of the business model, the companies use smart features to track the customer journey. With this data, the companies can evaluate how consumers use their products and when maintenance is applied to improve their products. (Alpha, Gamma, Epsilon, Zeta) Besides this digital method, consumers are also asked for feedback after purchase or service enhance the product, as Gamma mentioned: "So what has actually come in on all channels around such a product and we do indeed use that to see if we can do further developments on it. For example, are there dissatisfies that we can change". (Alpha, Gamma, Delta, Epsilon, Zeta, Jota) Customer feedback is also used to understand new desires via, for example, a focus group. (Beta, Epsilon, Eta, Theta, Kappa)

Competition is taken into account as well when evaluating. (Epsilon, Eta, Theta, Jota) With this, the features offered and their unique selling points are examined (Jota), and why a tender is won or lost is evaluated. (Eta) This tracking of competition is required in some industries, such as EV charging, as "... development in the market is quite fast, so if you lag behind the competition, you quickly see that you are going to lose volumes." (Eta) Tracking competition is also related to the lower-cost strategy, as copying successful features results in higher volume and lower marketing costs. (Delta, Eta)

Related to competition is the evaluation of sales number (Gamma), turnover (Zeta, Theta) and pricing of devices (Eta), as these numbers give insight into how successful devices are in the market; "Why is one product very successful and you sell a lot of it and the other product where you expect it suddenly a lot less, just the why behind it, you really have to find out sometimes, and sometimes it's just really about features." (Gamma) In the end, all these evaluation methods have one goal: understanding and keeping in line with the current trends in the market (Eta, Kappa) and preparing to validate the change.

4.2.3.3 Making changes based on balance, opportunism, feedback, and copying competition to add value

A part of validation is to develop new features with the information received from the evaluations regarding new features and devices or product improvement. (Gamma) During this development, the companies balance technological feasibility via high-ranking functionalities and technical complexity to determine quick wins and long-term focuses. This balance also comes down to investment and returns, a cost-benefit or trade-off, in other words. (Alpha, Beta, Gamma) For this balance, prioritising based on what the company can reach within an update and what is seen as necessary by the company and consumers is also possible. (Zeta) When deciding to improve a device, companies attempt to improve their new product in quality or pricing, called quality engineering. (Delta, Eta) Sometimes, it will be required to redevelop a device as a part may not be deliverable anymore, or a supplier may offer a better or newer version of a part. (Theta) This development may also be opportunistic, whereby the goal is to develop something for success in the future (Epsilon, Theta, Kappa), explained by Epsilon as: "So as soon as we plan something and develop something, we push it out to the market. And if it gets well received, then we will make more investments. And if it's not well received, we pull it back from our app or service platform." This opportunity may result in entering a new market, such as Kappa entering the security industry, as there was a potential to use their existing products in a new proposition.

To validate whether this new or improved device will become successful. Some determine success by estimating market size to determine costs and turnover (Delta, Eta, Theta, Jota), whereby the reason for this market could be the suggestion of a business relationship. (Delta, Eta) This balance between costs and turnover is essential for the low-cost strategy, as a high volume will be required to keep costs low. (Jota) Even with a large market size, it may still be necessary to determine if the feature will add value to the company's proposition; "Does it add value for us by developing that feature, or would it be better to put our resources into other features or other aspects and that's that strategic discussion that we actually have all the time." (Eta)

Customers are asked to give their opinion about new test cases (Beta) or use a beta version to understand success further. (Alpha, Kappa) Sales partners and customers directly from a business relationship also give feedback on detailed designs. (Gamma, Theta) The price is also considered by bench-marking it to understand the price in the market compared to the value it gives. (Delta, Jota) The last strategy for validation is to await the competition's success, as mentioned in the evaluation method. When the market shows a feature or device is successful, this gives a green light for the lower-cost strategy to create a cheaper alternative or develop the feature. (Delta, Jota)

Ultimately, the new development seems to focus on adding value to the company (Eta, Kappa) or the end-user (Alpha) via a structured method. (Gamma, Delta, Kappa) Data can play an essential role in this method, but it is sometimes unclear how companies can use it. (Alpha) This unclearness is related to an internal transition a company must fulfil before fully utilising its smart devices.

4.2.4 New requirements and team setups for Smart Home Devices

4.2.4.1 Smart home requires new capabilities, reorganisation, and focusing on constant development

With smart home devices, an orientation switch was required for some companies as they were hardware-focused and now are required to focus more on software, as described by Beta: "But the moment you give someone who normally talks about types of steel or what functionalities or energy labels and choices make to keep the energy label low, for example, suddenly also the responsibility to come up with digital features. That is a different branch of sport..." (Beta, Epsilon, Zeta) This change resulted in companies acquiring new knowledge via competencies for digital features during development, installation, and after-service. (Alpha, Beta, Zeta, Jota) For development, for example, competencies are required regarding protocols and security, whereby data privacy may be a struggle. (Theta, Jota) Also, new costs, such as cloud system costs, must be considered. (Jota) For Zeta, this process was complicated at the beginning "because it was quite difficult in the knowledge area. Not everyone within the organisation felt equally comfortable with the subject, for example, smart home, and talking to a customer about it, for example." However, it resulted in examples of how knowledge can become common via training, academy, and information provision. (Zeta) Sometimes, it is still unclear for a company what data may bring an advantage, resulting in limited faith. (Alpha, Gamma) To optimise the company for smart home usage, reorganisations, restructuring and sometimes new governance models may be required.

Teams had to become closer to create better products, and companies started to organise teams around product groups or functionalities. (Alpha, Beta, Epsilon, Zeta, Kappa) With this, international companies optimise their development of new smart home features by applying centralisation, whereby teams dedicated to smart homes help other teams focus on a product group. (Epsilon, Zeta, Jota, Kappa) With this, the perfect organisation has not been found yet, as Beta mentioned: "...we have not yet found the golden code to do that in the best way." Other companies also describe this as they constantly reorganise to find optimisation, with, for example, their market needs and growth. (Beta, Kappa) Yet, significant changes did not occur when the company's first products were smart home devices. (Delta, Theta)

Just as changing from product, the company's size influences certain decisions. Smaller companies cope with limited resources (Gamma, Delta, Eta), such as limited marketing options (Delta, Eta) or sales department growth. (Eta) For large companies, difficulties come forward in getting the support of the complete company in new strategies (Beta) or, as described, bringing smart home knowledge to every department. (Beta, Epsilon, Zeta) Ultimately, one of the most significant strategy changes with smart home devices is not focusing on a product launch anymore but on the constant development of bringing more and better features. (Beta) Specific teams are required within the companies to support this continuous development.

4.2.4.2 New teams, and existing teams requiring new knowledge

New teams have started to exist as smart home devices require new capabilities. The digital department (Alpha, Epsilon) is such a team and includes the software development (Zeta, Jota) and app development team. (Epsilon, Zeta, Jota) With this, the digital department was seen as a centralised team and communicated with R&D, giving the idea that software development is more dedicated to the software and becomes a sub-team of the digital department which makes decisions for new features. These tasks make the digital department necessary as they constantly deliver new features. (Alpha)

The product development team (Alpha, Gamma, Theta, Kappa) is related to the digital department, which nowadays must also focus on smart features. The product development team roadmaps and executes the complete development. (Kappa) They communicate with after-service and sales to find the required features (Gamma, Kappa) and cooperate with partners to integrate more features. (Theta, Kappa) Yet, as a middleman, they seem to be seen as a secondary stakeholder. (Alpha) This position may be because R&D is part of the development teams. (Kappa) As R&D researches the newest hardware and software options, they are essential for the future. (Alpha, Eta) Investments and FTEs are high for R&D when the company is highly focused on offering the newest features (Eta, Kappa), making them more meaningful as primary stakeholders. (Alpha)

Other departments, such as the customer and service departments, have also noticed changes due to the smart home. Customer support must help customers with smart home-related questions, as Zeta states, "So all of a sudden someone calls with the question of "I can't get my washing machine connected." (Zeta, Jota) The service departments must install devices and fix issues when they visit the customer (Alpha, Zeta, Jota), requiring them to know smart home devices. Smart home features can help the service department in their work as the data can tell when maintenance has occurred, or service can be given from a distance when supported. (Zeta) As these teams help to improve the customer experience, they add value to the devices, making them secondary stakeholders. (Alpha, Jota) The service department can also be a primary stakeholder as they ensure the customer can still use their product.

Other teams are also seen as primary: marketing (Zeta) and sales. (Zeta) The company, in general, is a primary stakeholder as well, as it determines general KPIs which every department must follow. (Kappa) General employees are seen as primary, as they must perform all tasks. (Eta) With these and other teams mentioned in the cases, an overview can be given in Figure 5. This overview provides insights into the team relationship and shows who the primary and secondary stakeholders are. As these stakeholders are internal, the external stakeholders and their influence must also be described.

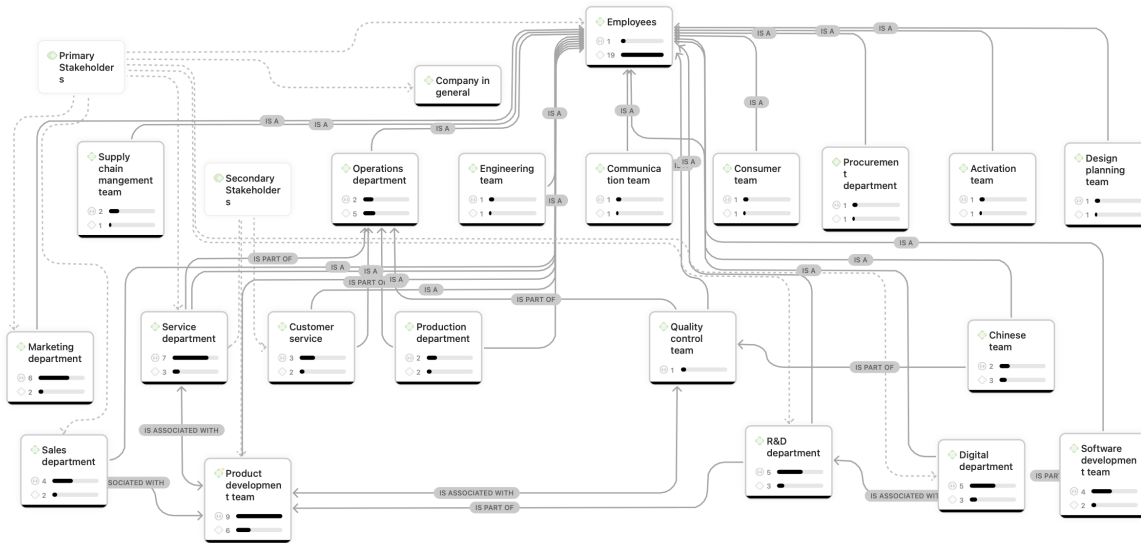


Figure 5: Internal stakeholders

4.2.5 Long-term cooperation for benefits and innovation

4.2.5.1 Long-term focus for benefits, but with criteria

With external partners, the cases strongly focus on long-term relations (Beta, Gamma, Epsilon, Kappa); some have described this as their culture. (Gamma, Epsilon) With these relations, the goal is to find new potential to add value for the consumer. (Alpha, Beta, Epsilon, Kappa) More accessible connections to potential consumers are also meaningful, as the partner may have better connections to a new market (Beta, Zeta, Eta), or the long-term relationship makes it easier to sell new devices. (Jota) Partners can help in building a solid foundation for the devices as well by offering their expertise (Gamma, Epsilon); as Epsilon mentioned: " Sometimes we partner with big companies that provide underlying fundamental technologies like chipsets or operating systems or AI like AI capabilities or these software stats that get into our platform or our product."

Such partnerships are not instantly started but have specific criteria beforehand and generally must have a long-term focus. (Kappa) Criteria for whether a partnership will work depends on the case but could rely on what their name brings as a benefit, what their use case brings as a benefit, or what their market brings as a benefit. (Beta) The demand can be that the most minor party will develop the case. (Beta) Cooperation can also offer information regarding the market, such as local legislation. (Theta) More insight into data (Gamma) and having more control over new features may also be a reason. (Gamma, Epsilon) Sometimes, the company itself is not ready yet to make the full potential of the partner. When this occurs, and the partner will be helpful in the future, it is essential to keep them engaged. (Beta)

It will not be uncommon for a partner to demand something back, such as a commission or lead fee per sold item, or if the partner wants their brand in the marketing. (Beta) It may also be that the company intends to cooperate more together and have monthly or quarterly meetings to fulfil its needs. (Epsilon) Investing this time in them may be costly. Still, depending on the intensity, it will help create more value and strengthen the relationship. (Epsilon, Kappa) The relationship can also open up the API for connection to the platform so that a partner can add value, which is especially useful for market penetration. (Kappa) The last mentioned option would be a demand for brand awareness via marketing of the company; "So people also expect a certain effort from us as a brand name that we are going to nom-

inate about a collaboration." (Beta) These demands may sometimes be challenging, just as other demands may be, resulting in stopping a partnership. (Beta) A reason to stop cooperation might also be a partner unwilling to fulfil needs such as new features or insights into information. (Gamma) Another case would be a large factory as a supplier who believes the company is too small to put effort into development. (Gamma) Still, often, parties need each other for their expertise. (Jota)

4.2.5.2 Partnership dependency in general and during innovation

When cooperation occurs, it will be required to write down its contents via a traditional contract (Gamma), but a company can also decide to apply multiple partnership levels. (Alpha, Zeta, Kappa) These partnerships could also include investments to ensure the cooperation results in the required development. (Gamma, Epsilon) When this desired development is not fast enough, it may be possible to buy the partner, which happens with start-ups. (Epsilon) When such an extra feature is essential, the partnerships become a dependency. This dependency can be an issue sometimes, resulting in a strategy to ensure such partnerships will not be highly dependent on each other. (Beta) It may also mean the partner will not have exclusive rights, meaning the company can cooperate with a competitor. (Zeta) Depending on the cooperation's size, the relationship can be maintained via the headquarters for international or national benefit as it would better fit that market. (Zeta)

For dependency, the partner could also be the dependent party, which is often the case when the company is the supplier. (Eta, Theta) When a company develops specific features for a client, a lock-in situation starts to exist, which makes it hard for the client to switch suppliers. (Eta, Theta) In such cases, the company must stay competitive for the client, as underperforming could still result in the customer leaving (Theta), especially in a highly competitive market. (Eta) As this competitiveness is maintained, the advantage may be created of the client becoming an essential stakeholder in giving ideas for new features (Eta) and the development together. (Theta) Such lock-in may happen more often in the future, as the data costs now result in bankruptcy for some players, making their smart devices unusable. When the company has a reputable name, customers tend to stick for stability. (Theta)

4.2.5.3 Insight in the importance of external parties

Just as internally, companies have external stakeholders. Highlighted by the companies, the customer and the related consumer are seen as primarily buying the product and influencing demanded features. (Epsilon, Zeta, Eta, Kappa) With this, the associated channels to reach these consumers are also critical (Epsilon, Kappa), whereby retailers or salespeople are essential as they tell the story, install devices and offer services to consumers. (Zeta, Jota) In the market, companies consider their competitors as secondary stakeholders as they influence features on the market. (Eta) Government agencies significantly affect the demand for specific industries by setting legislation and offering subsidies. (Eta) Like governments, investors are also primary stakeholders, as they provide money but expect a return on their investments. (Jota) Suppliers are also primary, as they make it possible to develop products (Eta) and show information regarding the footprint. (Kappa) Besides suppliers, integration partners add value by extending features which make them stakeholders (Alpha, Beta, Theta, Kappa), making them primary as well. (Theta, Kappa) Other parties are also mentioned, resulting in the overall overview as given in Figure 6.

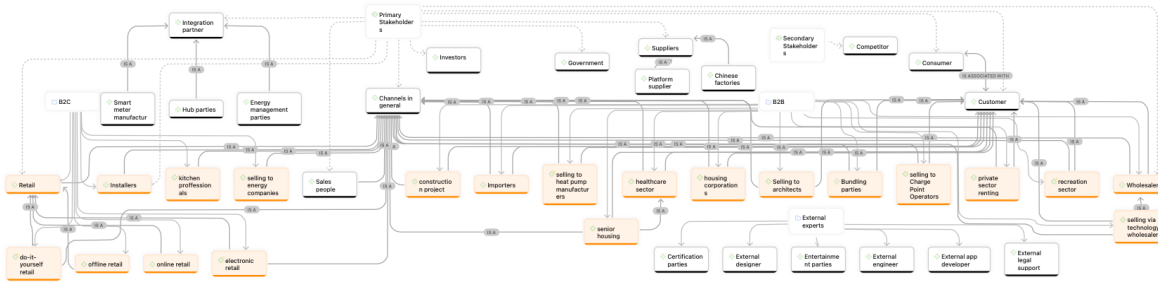


Figure 6: External stakeholders

All patterns are highlighted with the guidance of the conceptual framework and support for the framework. However, a lack of support or new information is also found, requiring the adjustment of the conceptual framework, as Eisenhardt's Sharpening the Hypotheses step describes. To describe this lack and support of the framework, the following section will walk through the changes to the model.

5 Analysis: validating framework with cases, and validating strategies with literature

5.1 Changes in framework after validation with cases

5.1.1 Starting first or extra business model life cycle with drivers and focus points

With the information given by the cases, an improved framework is created and presented in Figure 7. This framework presents a complete overview of improved workflow and three more deepening strategies to apply. First, an explanation of the general workflow will be given whereby the focus lies on explaining the general methods to apply and how the flow of the framework is applied. With this, the multi-case pattern effects will be presented. Later, the three deepening strategies are explained and described in how they affect the framework and whether these strategies can be validated via literature.

The first step for parties willing to offer a smart home device business model is creating a new one, described as a "New business model". Compared to the concept, entrance can be new (A) or a result of validating. (B) This change in the framework is related to the case descriptions, which state that change suggestions from business relations come during "Validating" but are applied during "Adjusting". (Delta, Eta, Theta, Jota) With this, leaving the life cycle during validation is removed as existing companies apply their additional business model, meaning a new life cycle is required. These companies also have different motivations for creating a smart home device business model.

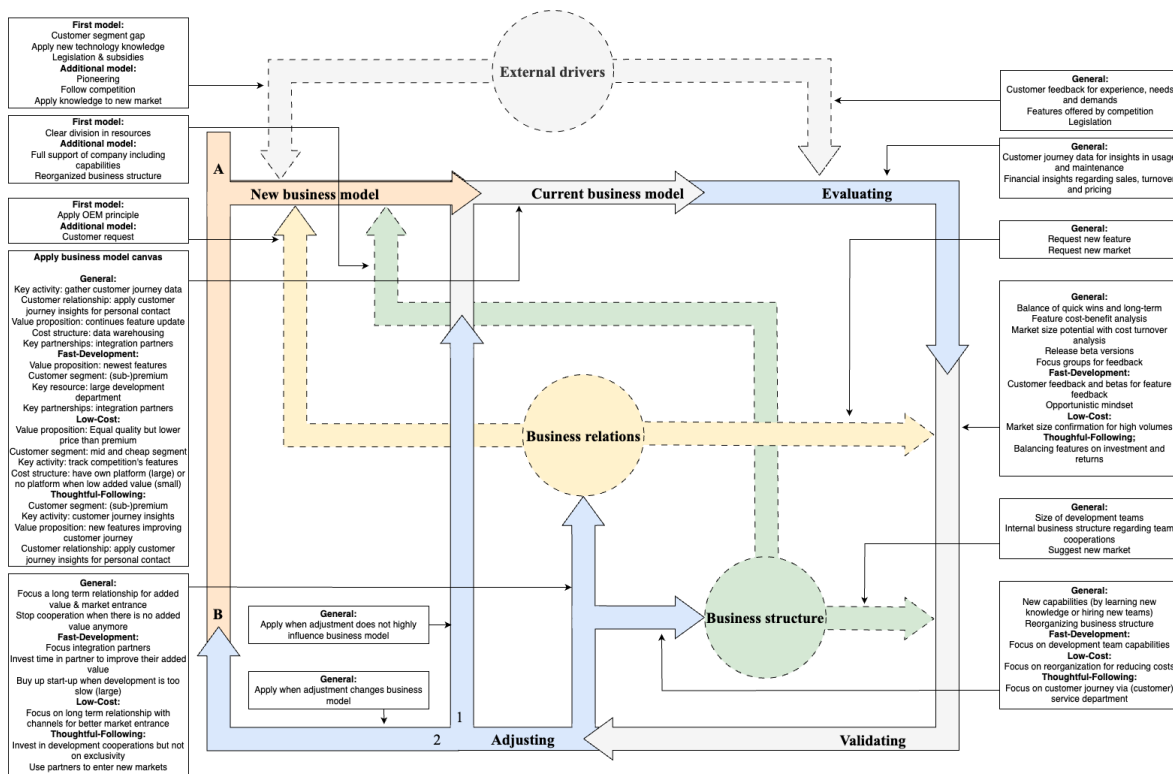


Figure 7: Smart Home Device business model life cycle framework

Newly starting parties (A) may have noticed a gap in the customer segment (Gamma), or their knowledge gathered over the years can be applied to their new business concept. (Delta) Existing parties (B) may have noticed that their knowledge can also be applied in a new market (Delta, Theta), but their reason may also be to pioneer via the newest features (Beta, Zeta,

Theta, Jota, Kappa), follow competition not to lack behind (Alpha), or a customer requesting such device. (Eta) Due to these motivations, the reasoning must be added to the framework; as a result, "External drivers" are now influencing the new model step. However, due to changes These new and small existing parties must remember that dividing resources will be difficult due to their size, and they must decide between, for example, R&D and marketing. (Delta, Eta) They can partly resolve such issues by taking advantage of governmental regulation and subsidies (Eta, Theta) or create larger volumes by becoming OEMs as well. (Eta, Theta) Larger existing companies must prepare the complete company for smart home devices as not only the development parties must create them, but departments such as (customer) service must be able to help customers with new problems. (Beta, Epsilon, Zeta) These companies must also change their business structure to optimize development (Alpha, Beta, Epsilon, Zeta, Kappa), including a centralized digital department for overall guidance. (Epsilon, Zeta, Jota, Kappa)

When it is clear what this new business model will be, the next step will be to complete the details of the current model.

5.1.2 Apply business model canvas with 5 general topics for current business model

The following step is the "Current business model," whereby the business model must be defined. During the interviews, this research used the Business Model Canvas of Osterwalder and Pigneur (2010) to create detailed insights; thus, it is suggested to apply this as well for the framework. When filling in this framework, particular focuses are essential for the smart home device industry. To start, a key activity must be gathering customer journey data, which gives insights into the feature usage and maintenance. (Alpha, Beta, Gamma, Epsilon, Zeta) This data can then be used to improve customer relationships as more personal contact can be created. (Beta, Gamma, Zeta) The value proposition must focus on continuously offering new features via updates as the connectivity allows new added value during usage. (Beta, Gamma, Epsilon, Zeta, Kappa) Integration partners are required as key partnerships to improve these new features further. (Alpha, Beta, Zeta, Theta, Kappa) Lastly, the data warehousing must be known as cost structure as the data brings maintenance and storage costs. (Beta, Zeta, Theta, Jota, Kappa) These five points are general for smart homes; depending on focus, more has to be filled in. After completing the canvas, the next step of the framework can be applied: evaluation.

5.1.3 Evaluating business model with external drivers and internal information

During the "Evaluating", the companies experienced external drivers as described in the concept framework. Business relations no longer affect the evaluation as no support was found, meaning that the start of a new concept in "Evaluating" is removed from the framework. Focusing on the external drivers, the cases showed that companies must use customer feedback for the perceived experience (Alpha, Gamma, Delta, Epsilon, Zeta, Jota), and needs and demands must also be considered by them. (Beta, Epsilon, Eta, Theta, Kappa) Features of competition are also important (Epsilon, Eta, Theta, Jota), as are governmental legislations. (Eta, Theta, Jota)

In addition to these external drivers, internal business information is evaluated. Companies must analyse Customer journey data for trends (Alpha, Gamma, Epsilon, Zeta) and financial insights regarding sales, turnover, and pricing. (Gamma, Zeta, Eta, Theta) After these evaluations, the framework can continue making changes and validating them.

5.1.4 Validating changes based on evaluation, business structure and relationships

The "Validating" step has changed compared to the conceptual framework. A new model will not be detachable from this step, and new is that business relations will influence this step. During "Validating", companies use the evaluation information to focus on balancing quick wins and long-term benefits, whereby a cost-benefit analysis is also required. (Alpha, Beta, Gamma) A part of this cost-benefit analysis is to analyse the cost-turnover of the market size potential. (Delta, Eta, Theta, Jota) When the related device or feature is almost ready, it is vital to understand whether it will be successful by gathering feedback from customers (Beta, Delta, Jota) or releasing a beta version when it is a feature. (Alpha, Kappa)

With this validation, the internal business structure influences the step due to the size of the development teams (Eta, Kappa), the cooperation between teams (Alpha, Beta, Epsilon, Zeta, Kappa), and their suggestions for new markets. (Beta, Gamma, Kappa) Business relations also influence the validation by requesting new features (Theta, Kappa) or suggesting new markets. (Beta, Zeta, Eta) When companies finish the validation, the next step is to adjust the business model and related influencers.

5.1.5 Adjust or create new model, and adapt business structure and relationships

"Adjusting" still influences the business relations and structure as suggested in the conceptual framework. However, a change has come in the continuation of the life cycle. As indicated in the concept, the step would continue in the "Current business model"; now, a split takes place depending on the change in the business model. When adjustments do not highly influence the business model, creating a new business model will not be required. Thus, a company must follow path "1" in the framework whereby an example to follow is offering energy usage-related features. When a more extensive change is required, a "New business model" may be necessary to prevent conflict in the proposition. This extensive change results in path "2" in the framework, where an example is entering new markets for creating ecosystems or adding subscription models whereby certain features are behind a paywall.

For such changes, companies may need new capabilities (Alpha, Beta, Zeta, Jota), which require a reorganisation for better cooperation and team focus. (Alpha, Beta, Epsilon, Zeta, Kappa) With this, companies must focus on their digital-related product development and service departments for smart home devices. (Alpha, Beta, Zeta, Jota) Externally, it is best to maintain long-term business relations (Beta, Gamma, Epsilon, Kappa), as partners help add value for the customer (Alpha, Beta, Epsilon, Kappa) and have connections to new markets. (Beta, Zeta, Eta) Still, sometimes, it will be required to stop cooperation if this does not fit the new proposition anymore. (Beta, Gamma)

After these adjustments, the framework restarts itself. Depending on the route, companies will start their new business model or continue with their improved current one. Companies can better prepare themselves to apply the framework with the added methods and focus of the business model canvas. However, this is not the only method, as the cases have shown three specific strategies further sharpening the hypotheses of the framework.

5.2 Three more deepening strategies: Fast-Development, Low-Cost, Thoughtful-Following

5.2.1 Fast-Development: best in market for competition or premium status

The multi-case patterns have shown that three strategies can be found to improve the business model further. These strategies will be described first and later placed beside the literature focusing on the application of technology. As already shown, the strategies can be found in Figure 7 by their title: First-Development, Low-Cost, and Thoughtful-Following.

The first strategy concerns having the newest features within the devices due to a drive for opportunity and is called Fast-Development. These companies apply many resources to develop new features by investing in R&D (Eta, Kappa), cooperating with start-ups (Epsilon), and working on integration with external parties. (Theta, Kappa) This focus creates importance in the business model for key partners and developers as key resources. The drive behind this differs; for one, it is due to a highly competitive market (Eta), while the other focuses on a premium product. (Theta, Kappa) Due to this difference in the drive, the companies are not solely premium brands (Theta, Kappa) but also contain price fighters with the quality of premium devices at the mid-segment price. (Eta)

Evaluating the competition (Epsilon, Eta, Theta) is crucial for these companies as they must follow these new features related to their industry. During development, receiving customer feedback via focus groups (Kappa) and betas (Kappa) is required to validate whether the new features will have a chance for success. With this, some companies develop an opportunistic view whereby they attempt to create features that will be useful in the future. (Epsilon, Theta, Kappa) This type of development means they sometimes develop features with no demand, hoping to receive positive feedback, which will result in further investments. (Epsilon) The feedback may also be negative, resulting in a pullback of the feature. (Epsilon) These companies applying this strategy are the first to use a subscription or extra payment for specific features, as their customers understand that new or particular features may bring extra costs. (Theta, Kappa)

Looking at the sizes of the companies, the minor parties within this strategy track legislation and government subsidies (Eta, Theta), while the larger companies do not discuss this. This dependency seems related to their industry but may be associated with the liquid assets, as larger parties generally have more available. As a result, the small companies note that their success in fast development partly depends on these governmental benefits. (Theta) Minor parties also apply an OEM principle, wherein lock-in situations are sometimes created, resulting in a stable customer in a competitive market. (Eta, Theta) These small parties focus on a long-term relationship, just like the larger parties, whereby integration partners are essential. (Epsilon, Kappa) However, larger companies state that the partner must add value to their proposition. (Epsilon, Kappa) In general, this means that larger companies have multiple levels of partnerships, whereby depending on the level of cooperation, the company helps the partner solve issues. (Epsilon) When larger companies cooperate with start-ups, buy-up is sometimes applied when development is not fast enough. (Epsilon) This buy-up option may also be related to the larger availability of liquid assets.

Instead of this fast strategy, other parties seem to wait for a successful feature before adoption.

5.2.2 Low-Cost: wait for success and maybe no platform

Waiting for success is applied by the cases focussing on a Low-Cost strategy whereby the main value proposition is equal quality but at a lower price. (Delta, Jota) Under this strategy, the decision is not to develop new features as this incurs high development and marketing costs with unknown success. (Delta) A better fit for them is to await the success of competitors' features. (Delta, Jota) For this method, it is mainly required to constantly evaluate which features the competition releases (Delta, Jota) and whether the customers demand them (Jota) before a feature is developed for their devices. As this tracking is a prominent part of the strategy, it is also a key activity in the business model. When there seems to be a demand, it becomes essential for the company to validate whether the market size will be big enough, as large volumes are required to reduce costs. (Delta, Jota)

An important decision to make as a Low-Cost company is whether to create a personal platform. The platform will bring the advantage of insights into the customer journey, but the costs may be a pitfall for the Low-Cost strategy. (Delta) When deciding not to create a personal platform, it may be possible to piggyback on a competitor's platform when they use Zigbee, as Zigbee is an open-source protocol. (Delta) This decision creates the opportunity for no costs on the platform and a clear focus on a customer segment. (Delta) On the other hand, the drawback is not having insights into the customer journey and being dependent on the competitor. (Delta)

Focusing on external relationships is essential for this strategy. Suppliers must be kept close; they may suggest new parts to improve the current devices' price and quality. (Delta) Channels, such as wholesalers, are also essential to stay close, as they make selling new devices more effortless (Jota) and will give feedback about the devices. (Delta) It may be interesting for the Low-Cost strategy to focus more on direct sales to consumers, as this will reduce costs (Delta, Jota) as, for example, e-tail is demanding more margins and using more claims. (Jota) On the other hand, a danger is that the channels will notice the direct sales and highlight the channel conflict (Delta), possibly damaging this vital relationship with channels.

Looking at the cases, the reason to start is mainly to offer a proposition whereby a market is essential to create volume. (Jota) A specific industry is not required, but the company's size may influence a decision for the platform. With a larger company, the number of sold devices may be higher, which makes it easier to divide the costs of the platform in the pricing. Still, these companies need to find a solution to the rising data warehousing costs.

As last, the third strategy can be found and will apply a middle-way to this Low-Cost strategy and the Fast-Development.

5.2.3 Thoughtful following: understand added value of new features for users

This middle-way strategy is called Thoughtful-Following, and these companies follow the Fast-Developing companies relatively fast, but they are more thoughtful about the added value of the new smart features. Some of these companies attempted to take on the pioneering role with smart home devices but could not maintain their development speed. (Beta, Zeta) This lack in speed is partly due to these companies focusing on the high quality of their offered devices. (Beta, Zeta) Others noticed too late that the shift was happening (Alpha) or decided at a recent moment to enter the market as a new company. (Gamma) Like the Fast-Developing companies, these companies exist as premium (Alpha, Beta, Zeta) and sub-premium brands (Gamma) that see an advantage in the smart feature for continuous feature development. (Beta, Gamma, Zeta) Besides that, they see an advantage in smart as the customer journey becomes apparent (Alpha, Beta, Gamma, Zeta), making it possible to

understand maintenance moments (Alpha, Gamma, Zeta) and create more personal contact with consumers. (Beta, Gamma, Zeta) Due to this, the companies mainly find changes in their key activity as they actively work on understanding the created data and apply this to their customer relationship. This customer relationship is significant for some of these companies as they are active in an industry with low customer loyalty due to the long life cycle of their devices. (Beta, Zeta)

When evaluating, the customer journey is essential for the company, as this data gives insights into whether features are used and how users maintain their devices. Often, this is combined with customer feedback to understand opinions. (Alpha, Gamma, Zeta) The sales numbers and turnover are also evaluated, giving insights into whether their product is in demand. (Gamma, Zeta) These companies are also the most aware of the market competition, as they highlight that smart devices can be found at entry-level to premium devices. (Alpha, Beta, Zeta) When validating, these companies focus on balancing their investments and returns. (Alpha, Beta, Gamma)

As this strategy requires following new feature developments, these companies highlight product development teams as stakeholders (Alpha, Gamma), but they see their service departments as essential for helping customers. (Alpha, Zeta) These service departments are mainly mentioned by the low loyalty-related industries, which indicates that these companies use the service departments to convince customers as well.

Externally, this strategy uses long-term relationships for market options. (Beta, Zeta) Like the Fast-Developing companies, multiple levels of partnerships are applied to determine the depth of cooperation. (Alpha, Zeta) During the cooperation, these companies are not highly dependent on these partners, which may also mean that exclusive rights are not given. (Beta, Zeta) Integration partners are important again as they extend the features. (Alpha, Beta)

These three strategies can be added to the framework but will first require support from other literature to sharpen the hypotheses.

5.2.4 Overview of strategy per case and support for found strategies

With the three strategies known, a small overview is given in Table 9 to highlight which case applies which strategy. As shown in Figure 7, the three strategies can be applied simultaneously with the general method. However, as with the conceptual framework, support is required to make it applicable. Schilling (2023) also described three options for technology

Table 9: Strategies within business model life cycle framework

Strategy	Definition	Cases
Fast-Development	Develop new features fast	Epsilon, Eta, Theta, Kappa
Low-Cost	Await success of feature before applying	Delta, Jota
Thoughtful-Following	Develop new features with added value	Alpha, Beta, Gamma, Zeta

application: first movers, early followers and late entrants. First movers are described as those who sell their first new products or service categories, meaning to be pioneers. As the Fast-Developers offer services and are the first to attempt to sell features with a subscription, support is given to this existing strategy, especially as the cases described have an opportunistic view. The second option of the literature is early followers, those who are early to the market but not the first. This research correlates with the Thoughtful-Following strategy as these companies are not the first but follow fast due to the added value after thought. The Low-Cost strategy seems to fit the late entrants as they enter when products penetrate

the mass market, allowing more optimisation within their business. However, the Low-Cost may also be between early followers and late entrants as they are not the first to offer a product or service, but they follow relatively fast when competitors have shown success.⁷⁴ The strategies align more with the explanation of Gartner's Hype Curve of Linden and Fenn (2003) as aggressive and moderately aggressive players come forward. The aggressive ones, Fast-Development in this research, are relatively comfortable in applying smart home technology, and the features with which they can create a strategic advantage are adopted early. This support is shown in the volatile markets of fast Development as the newest features are applied to stay competitive, and an opportunistic view is applied whereby a feature may become successful. Thoughtful-Following and Low-Cost are more moderately aggressive players as they investigate the technology's advantages and apply them as this contributes to their key business objectives. This support is shown in the Thoughtful-Following as they add smart home features to extend their added value. The Low-Cost strategy fits as customers demand these more features; thus, it must be applied to maintain their objectives.⁷⁵ As these three strategies are supported in the literature, their application to the framework is possible, and the framework widens the insights for literature and the industry. Yet, this does not fully enfold the literature, and more support and contradictions can be found when looking at the framework and founded patterns.

6 Discussion: Framework as answer with new insights, strategies, and future recommendations

6.1 Framework as answer on research question, and giving more insights in smart home market

6.1.1 Framework as life cycle answer for research question

This paper aims to answer the question: What is the life cycle of business models in the smart home device industry? To understand this life cycle, research was required to understand the current business models in the market, the model selection drivers, the process of creating future-proof models, the influences of smart home devices on the business structure, and the characteristics of business relationships. As the cases have shown, there are general and three specific strategies describing the business models. External drivers, internal stakeholders or business relationships triggered the drive for cases to start the first or extra business model. The cases stay competitive with their evaluation and validation methods. With this, external drivers influence the evaluation of the business model. Business relations and business structure influence the validation process. When adjusting the business model to new features and devices, the companies sometimes require new capabilities and restructuring of the business structure. The cases focus on long-term business relationships. However, companies sometimes stop their partnership as their partner no longer offers added value. After this, the steps restart and focus on the current or new business model, creating a loop, a life cycle. When placing this life cycle in a figure, Figure 7 answers the research question as a clear overview of how smart home device manufacturers' business model life cycle works. This framework provides theoretical contributions by having new insights into the smart home device market and the continuous application of a business model.

⁷⁴ See Schilling (2023), p.100.

⁷⁵ See Linden and Fenn (2003), pp.8-11.

6.1.2 Companies push smart into market, creating new revenue method and stakeholder view

As described in the literature background, Vial (2019) created building blocks for a digital transformation within a company. This model helps to understand how a company could handle a transformation when applying a new digital technology, and the cases' disruptions, changes in the value creation paths, structural changes, and organisational barriers show overlap. Yet, this model suggests restarting the model as digital technology can be the only fuel for disruption and a change in the business model. A change in the value creation, an internal push, or a request for a business relationship cannot be the trigger for adjusting the business model, which is not the issue with the presented framework of this research.⁷⁶ When looking further into the business model, the cases made it clear that the companies collect user data from their devices to understand the customer journey. These current data gathering methods align with Osterwalder and Pigneur (2010) describing a multi-sided platform principle of "free" usage. As mentioned, the companies focus on services due to costs, creating the Freemium principle. Yet it is unclear whether the goal will be to have every consumer subscribed or if the goal will be for premium paying consumers to compensate for the free users. This decision is even more complicated because the consumer has already paid for the device.⁷⁷ The cases and Del Rio et al. (2020) also overlap in the revenue methods: 'bundle and integrate multiple services', 'Subscription models and digital platforms', and 'security and safety'. Different from Del Rio et al. (2020) mentioning companies using one method, the cases show that they use asset sales, sometimes combined with extra methods simultaneously, such as the subscription model or security.⁷⁸

When focusing on the external drivers with Osterwalder and Pigneur (2010), the companies seem to be placing themselves in an impulsive competition drive with no demand. All price segments offer smart home devices, while cases mention that consumers do not see the direct benefit. This lack in demand means that some companies saw potential in a new technology whereby competitors and new entrants felt the drive to follow, creating a technology trend. As a result of the impulsive follow, nowadays, cases have mentioned that some parties are seen going bankrupt as they did not consider the effect of data warehousing costs. These costs trigger a new trend whereby substitution occurs to create services for certain features to compensate.⁷⁹ Gartner's Hype Curve seems to describe the market better as the market seems to be climbing the slope of enlightenment. More and more providers can be found, which means the curve is no longer on the slide. The companies see that investments are harder, but most can provide the devices themselves as only one described investors as stakeholders. Described with the climb is that there are technologically aggressive and moderately aggressive parties active in the market; these strategies are applied in the cases. Besides the type of players, the aggressive strategy fits the smart home market as it is described that the companies fully apply the technology when they feel confident, which they do as they continuously create new smart home features.⁸⁰

As seen within the cases, multiple factors are considered to evaluate and validate the current devices and market. What is lacking, however, is the mentioning of concrete methods to assess the complete business model, such as SWOT or Blue Ocean analyses as described

⁷⁶ See Vial (2019), p.122.

⁷⁷ See Osterwalder and Pigneur (2010), pp.90-104

⁷⁸ See Del Rio et al. (2020), pp.5-12.

⁷⁹ See Osterwalder and Pigneur (2010), p.201.

⁸⁰ See Linden and Fenn (2003), p.8.

by Osterwalder and Pigneur (2010).⁸¹ Osterwalder and Pigneur (2010) also describes the principle of untangling the business model to prevent conflict between relationships, production innovation, and infrastructure goals. This principle was not found within the cases as they seem tangled as services will be introduced to compensate for data costs, focusing on an infrastructure problem. This decision will influence the relationship model as not every feature can be used anymore, resulting in fewer insights into the customer journey.⁸²

During validation, known methods seem to come back. From Osterwalder and Pigneur (2010), design stages are applied whereby feedback is asked.⁸³ Compared to Cavalcante et al. (2011), overlap seems to exist when focusing on the key challenges of extending and revising a business model. The validation of new markets shows that the companies try to control their risks, a key challenge during extension. Focusing on revision, the companies have shown a willingness to take a risk on the uncertainty of smart homes, but it is lacking how they prevented the lack of knowledge and resistance. Some described that the push came from the boards or marketing, but no information was given relating to support from the rest of the company. In other cases, support was lacking as the company did not prepare everyone with the correct skills and mindset.⁸⁴

On the other hand, when comparing the changes within the larger cases when applying smart home, it supports Svahn et al. (2017) as departments are reorganised to cooperate, breaking the silo.⁸⁵ A digital mindset is also applied by the cases, focusing on constant development, supporting Del Giudice et al. (2021), Khin and Ho (2020) and Porter and Heppelmann (2015).⁸⁶

With the companies fully offering their smart home device proposition, their stakeholders can also be compared to the adapted stakeholder overview of Ehrenhard et al. (2014) as given in Chapter 2.4.1. As described and seen in the cases, the smart home device manufacturer, customers, and end users are primary stakeholders. Providers are mentioned but not described per specialisation in these cases, making a general supplier a primary stakeholder. Internally, the cases do not just mention the company but mention specific teams which are seen as primary stakeholders: Digital, Marketing, R&D, Sales, and Service departments. Different from Ehrenhard et al. (2014), governments and retailers are not seen as secondary but as primary. To enhance retailers further, the channels, in general, are seen as primary as well. New as primary are integration partners, which do not offer software for the device but a connection to their external features. Certification providers, consultants, and external experts are mentioned when looking into the secondary stakeholders but have not received a primary or secondary role in the cases. When looking again at the internal teams mentioned, service, product, and customer service departments were considered secondary. This helpdesk provider mentions supports the secondary stakeholder position.⁸⁷ Not noticed by Ehrenhard et al. (2014) is competitors being a secondary stakeholder as described by the cases. This position confirms Ernst (2003) partly, as the companies did not mention keeping track of competitors' patents but see the competitor in general as a secondary stakeholder.⁸⁸ Focusing on cases with long-term relationships comes forward from adding more value to

⁸¹ See Osterwalder and Pigneur (2010), pp.216-228.

⁸² See Osterwalder and Pigneur (2010), p.60

⁸³ See Osterwalder and Pigneur (2010), pp.165-168.

⁸⁴ See Cavalcante et al. (n.d.), pp.1331-1334.

⁸⁵ See Svahn et al. (2017), pp.246-249.

⁸⁶ See Del Giudice et al. (2021), pp.78-79; Khin and Ho (2020), pp.189-190; Porter and Heppelmann (2015), p.13.

⁸⁷ See Ehrenhard et al. (2014), p. 312.

⁸⁸ See Ernst (2003), p.241

the proposition. No case directly mentions that this relationship is to reduce costs or development time; only one mentioned that sometimes start-ups are bought to reduce development time. This lack of support is contradicted as it is seen as an advantage of long-term relationships by Johnsen (2009), and Ragatz et al. (2002).⁸⁹ Some information is given about development with partners. One party applies that the smallest party develops, which would be the Black Box principle of Petersen et al. (2005) as the smallest party develops according to the performance specifications of the biggest party. The other cooperation is more like a Grey Box principle as both parties have to invest time in the development, creating a joint development. The white box comes back as a selling opportunity for one case, as they sell white labels unrelated to the case's relationship with their supplier.⁹⁰ In some cases described in their cooperations, the Preferred Customer Matrix of Schiele (2020) can be found when looking into suppliers. One case described that they used a large platform developer who did not have the attention to create new features as the case was too small. Thus, the case had a quacksalver issue and was changed to a start-up, creating a square. Another case applies the Blacknight strategy as they know partners have knowledge and could be kept even when no required developments exist currently.⁹¹ The case switching from a large provider to a start-up also shows the Procedural Justice of Griffith et al. (2006) as the case saw the cooperation not as fair and equitable. Another case supports this justice: they, as large party, stop cooperation when small partners ask too much about brand promotion.⁹² With these overlaps and contradictions, this paper helps academics better understand the smart home industry and gives them new research options. In addition to these affairs, the production industry can use this paper to its advantage.

6.2 Managerial contribution: apply framework, focus on strategy support, and be aware of data costs

Smart home device manufacturers can continuously improve their business model with the proposed framework to stay competitive and benchmark their methods to the methods of the cases participated in this research. By applying the business model canvas of Osterwalder and Pigneur (2010), companies will know their uniqueness and the focus of their strategy. To help companies who start with smart home devices, the framework offers a general working method whereby three specific strategies can further help them: Fast-Development, Low-Cost, and Thoughtful-Following. These strategies will suggest evaluation and validation methods to improve further the strategy besides the standard procedure for the smart home industry. With the business model, it is essential to consider the effect of business relations and the internal business structure on the business model. Business relations can help in the development of new features and the entry of new markets, where a long-term relationship is crucial. The internal business structure will determine how efficiently departments can cooperate and how they will achieve the development of new features. To come to this point internally, new capabilities and reorganisations will be required when the company adds smart home devices as a new business model. With this, the company must have smart home knowledge to prevent resistance and less customer support.

Besides the framework and benchmarking, companies have other areas to improve. Within the cases, no information was found that companies check whether their entire company is ready for smart home devices beforehand. This missing information means that companies

⁸⁹ See Johnsen (2009), p.195; Ragatz et al. (2002), pp.395-396.

⁹⁰ See Petersen et al. (2005), p. 378.

⁹¹ Schiele (2020), pp.48-49.

⁹² See Griffith et al. (2006), pp.91-93.

cannot measure their employee readiness. Besides this measurement, most companies did not mention having a structured method to analyse their overall strategy. Due to this lack of overall strategy validation, most companies do not have separate business models to prevent the entanglement of business decisions. A suggestion would be to do this more as this would help the company to untangle its business model, resulting in a better understanding of the effects of, for example, collecting large amounts of data.

As this data increases costs, companies must focus on a solution. A solution could be to anonymise the data more based on device ID, resulting in fewer consumer profiles. This method could be especially helpful as data protection legislation is growing. Another option is to create a compensation method, such as subscriptions. However, the effect of these subscriptions is unknown as the first companies are applying this method. A danger with this may be consumers' perception that they already bought an asset, which now requires extra costs for full usage.

6.3 Limitations in size, interview set up, and market age

While interviewing the cases, some points came forward for improvement in the future. At first, with ten companies, some insight could be created into the smart home market, but this number is still low. With this, the companies all seemed to focus on mid- and luxury devices, meaning there were no entry-level cases. These types of companies must be understood as they improve market insights. The data gathering method could be changed to written interviews or a questionnaire to reach these companies. This reduces the time barrier, as no moment is required to plan to gather data. Besides, the entry-level devices seem to be from Chinese parties, which communicated that their level of English would not be sufficient for a live semi-structured interview but would be for a mail interview.

After the data gathering, it came forward that not every case gave as much information as desired, resulting in limited insights into untangling the business model, the validation, and the exact methods of cooperation. This lack of information came from only speaking to one expert within a company instead of speaking to multiple experts. To solve this, future research can focus on speaking to multiple representatives, ideally from multiple departments, to enhance the scope of the information.

Another limitation of this paper is the newness of the devices focused on. As the market is still developing, research papers are low. This makes it more difficult to find papers focused on the sector, and it was required to compare more general applicable information. Also, the number of companies using the subscription method is still low, as most companies are considering or just starting to apply it. Time will be required for the market to age to solve these issues.

6.4 Future research in framework step speed and termination, revenue and industry influencers

As speaking of the future, this paper gave insight into the current business models of smart home device manufacturers and the corresponding market. With the suggested framework, companies can standardize their business model development to help them to stay competitive. However, it will be required to validate whether the framework can be useful for (starting) companies. The framework also suggests three strategies, but it is unclear whether more strategies exist and what sub-strategies may be. With this, it is unclear how long every stage should take. To understand this, further research will be required to guide companies further. Also, indications could be created to determine when to terminate a business model,

as this could retain a company's competitiveness.

Focussing on market events, the cases showed an increased interest in services, but this is not fully developed yet. To help these companies, more research will be required on the effect of servitisation to highlight opportunities and threats to the business model. The effect of a growing ecosystem must be researched as the business models do not seem untangled at the moment, resulting in a bigger tangle when a company must support multiple devices that cooperate but all have their own achievements.

Externally, governmental agencies influence the smart home device market. As shown, energy-related legislation and subsidies are affecting the EV market and high-energy devices, and more legislation is coming for data. To what extent these influences will make or break a company will be interesting as smart home features are becoming mainstream. With this, the effect of smart home devices influencing energy usage could also be future research, as energy transition is a current topic, and the future of energy can influence energy demand. As last, the effect of big data platforms must be tracked as they attempt to enter the market. These platforms already brought Matter to offer the market a standard protocol, but it is not fully supported yet. Therefore, the growth of this protocol should be studied, and other potentials should be tracked as well to understand the best opportunity for worldwide communication.

6.5 Concluding remarks: A life cycle framework with new insights and strategies

This research aimed to understand the life cycle of business models in the smart home device industry. The ten cases that came forward show that the business model canvas must consider the customer journey data, data warehousing cost, and integration partners. With this, they sell assets, but interest is growing for subscriptions as a revenue stream. Companies can apply this general method and extent strategy by using one of the following strategies: Fast-Development, Low-Cost, and Thoughtful-Following.

Entering the smart home market has different drives, which differ per age and size with corresponding challenges. When applying a smart home device model, the companies evaluate their customer journey data and apply financial insights. With this, the external drive of customer feedback, needs and demands, features of competitors, and legislations and subsidies are considered. This evaluation is used for their validation, whereby a balance between quick wins and long-term wins is applied, together with a cost-benefit analysis. Customers are reached to receive feedback on designs. New market potentials are analysed, whereby a business relation may ask for new features or markets. The internal business structure will determine development speed based on cooperation and development team size. After validation, a company may require reorganisation and new capabilities, and business relationships may be influenced as new added value is necessary. A relationship must be long-term as this brings more benefits, but cooperation must stop when there is no added value.

Ultimately, these findings result in the presented Smart Home Business Model Life Cycle framework, which brings new insights into the literature as the market is competition-driven, subscriptions are becoming a new revenue, and the stakeholders are perceived differently. For managers, this research has shown how the smart home market can be entered and how to stay competitive via the framework. This research also allows a benchmark, but most important is their future focus on whether to accept Matter, better understand their overall strategy, and how to cope with the rising data costs.

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A Questions for semi-structured interview

Introduction: Introduction of interview moderator

Briefing: **Is it possible to record the interview?**

Purpose of research

Purpose of interview

Explain the interview procedure

Anonymous answers

Question: **Do you have any questions before starting the interview?**

Topic 1: Gathering information about the interviewee and the company. As well as identifying the Smart Home Devices via Schiefer (2015).

Question 1. **Would you be so kind as to introduce yourself and your responsibilities within the company?**

- a. Time Period
- b. Responsibilities
- c. Personal background

Question 2. **Can you introduce the company?**

Question 3. **How many different Smart Home Devices are you offering, and how would you categorize them?**[PJ(JSMB2)] (Examples: control systems, entertainment, Light, and Shadow)

Topic 2: Understanding the drive to produce smart home devices and when they entered the market. Thus first mover, early follower or late entrant (Schilling (2008)).

Question 4. **When and why has the company decided to start producing Smart Home Devices?**

- a. What was the main goal to achieve with smart home devices?

Question 5. **How would you describe the company's position in the smart home market over time?**

- a. at entering
- b. today's
- c. changes

Topic 3: Current business model and related building blocks. Identifying business models for smart home technologies Sovacool and Furszyfer Del Rio (2020). Also, identifying product, service or software company (Saarikko et al. (2020)) and the type of transformation given by company type (Tekic and Koroteev (2019)).

Question 6. **To what extent has your company created a platform with your products and services, or have you joined one?**

Question 7. **To what extent does the company use one or multiple business models?**

- a. **Why only one business model?**
- b. **Why multiple business models?**
 - i. **What do the models have in common?**

Question 8. **Can you define the business model of your core smart home device?**

- a. What is your value proposition?
- b. What is your customer segment?
- c. What are your channels?
- d. How do you handle customer relationships?
- e. What are your revenue streams?
- f. What are your key resources?
- g. What are key activities?
- h. What are your key partnerships?
- i. What is your cost structure?

Topic 4: What drives the business model, and how is the business model evaluated and prepared for the future?

Question 9. **What are the drivers for your business model?**

- a. How do Smart Home devices drive your model?

Question 10. **How do you evaluate your model?**

- a. Do you make use of SWOT or The Blue Ocean Strategy
- b. To what extent do you use other methods then evaluating to prepare your business model for the future?
 - i. Stories or scenario planning?

Question 11. **How do you validate new concepts or changes to your business model?**

- a. Prototyping?

Topic 5: Digital transformation and business strategy related to smart home devices. Identifying which questions are used to identify digital transformation Porter and Heppelmann (2014).

Question 12. **How did the introduction of smart home devices affect your internal business?**

- a. What is the role of IT?
- b. Do departments now cooperate more?
- c. Did you create new departments, such as DevOps?
- d. Are departments getting new or more responsibilities?
- e. Did employees require new skills?

Question 13. What do you expect about the influence of smart home devices on your future internal business?

Topic 6: Insights in the stakeholders. Are their primary and secondary roles, as given by Ehrenhard et al. (2014) and are the stakeholders equal? Alternatively, do they categorize as Sensor, Wireless-module, Chip and Material and screen as given by Man et al. (2020). To what extent is a competitor a stakeholder, as given by Ardito et al. (2018)

Question 14. Who are the stakeholders of in the business model of your smart home devices?

- a. Customers, end users, hardware-, software-, network suppliers?
- b. Do you categorize them? Primary and secondary or per specialization?

Question 15. What is the role of your stakeholders in your business model?

- a. How have previous changes in your business model affected your stakeholders?

Topic 7: Understanding the relationship management and long-term vision. Is it attempted to achieve preferred customer status? (Vos et al. (2016)) Are there goals for a long-term relationship and why, and are there drawbacks to a long-term relationship? Han et al. (1993). Understanding to what extent innovation takes place with suppliers. To what extent is a supplier cooperating, and how are they determined/convinced? Petersen et al. (2005) and Pulles et al. (2014). Which development model is chosen by companies as given by Schilling (2008)

Question 16. To what extent are you strategizing long-term relationships?

Question 17. What are the effects of these long-term relationships?

Question 18. How have these long-term relationships affected your business model?

Question 19. To what extent have relationships been involved in innovations and R&D?

- a. How do you select partners for innovation?
- b. How do you convince partners to cooperate?
- c. What kind of contracts do you have with partners for R&D?

Closing the interview

Question 20. Do you have any questions or further comments within the scope of the interview?

Debrief: recap

Anonymous answers

Purpose of research

B Messages to companies

B.1 Messages for LinkedIn contact

B.1.1 Connection message

Dear [Recipient's Name],

I'm Ernst-Jan, for my thesis, I'm researching the smart home industry business model life cycle and relationships. Your insights would greatly contribute to understanding the market. Eager to share details; your participation is invaluable!

Best, Ernst-Jan Peters

B.1.2 Follow-up message for LinkedIn

Thank you for accepting my connection request.

I reached out to you because my thesis is based on the life cycle of business models and relationship networks within the smart home industry. Your insights could give me some perspective on the current strategies within the industry. Together with the insights of other strategic experts, I aim to find overarching themes and strategies as this can help [company name] benchmark to the current standards.

I'd love to schedule an interview to delve deeper into your experiences and thoughts on these aspects of the industry. The interview should take around one hour, and I'm more than willing to adjust to your schedule. To provide a quick overview, I have attached a one-pager with the key information about the interview and the exact focus areas of my research. Would you be able and interested to participate?

Ernst-Jan

B.2 Message via mail or servicedesk

Dear [company],

I hope you are doing well. My name is Ernst-Jan, and I am pursuing my master's degree at the University of Twente. As part of my research, I am investigating the smart home industry and would like to know [company]'s vision!

My thesis focuses on the life cycle of business models and relationship networks within the smart home industry. These factors play a crucial role in shaping a company's success. Your insights could provide valuable perspectives on the current strategies employed within the industry. By collaborating with companies and their strategic departments, I aim to identify overarching themes and practical strategies to help [company] benchmark against industry standards.

I would appreciate you connecting me with an employee who has expertise in the strategies of the smart home industry. During this approximately one-hour interview, I would love to delve deeper into their experiences and thoughts regarding these critical aspects of the industry. I am flexible and willing to accommodate their schedule. For your convenience, I have attached a concise one-pager outlining the interview details and the specific focus areas of my research. Please don't worry- any information shared during the interview will be anonymised in the results.

Thank you very much for considering my request. Your insights and those of your knowledgeable team members could significantly contribute to [company]’s success and strategic positioning in the dynamic smart home industry.

Looking forward to hearing from you soon.

Best regards,
 Ernst-Jan Peters
 University of Twente

B.3 One-pager

UNIVERSITY OF TWENTE

Exploring the life cycle of business models and business relationships in the Smart Home Device industry

- European Smart Home Devices worth **28.6 billion US Dollars** revenue in 2022 with **growth potential of 50.3 billion** in 2027
- Smart Home Devices are **more complex** due to required hardware, software and frequency of updates
- Businesses must **change to optimise** the usability of smart home devices
 - **New business models** are required to stay **competitive** and react to **technological changes**
 - **Business structures** must change to fully use smart home devices by **changing teams and having new skills**
 - **Business relations** change as **open-source** software is used, and **suppliers create advantages** with the newest technology



Research Question	Method	Who is involved
What is the life cycle of business models and business relationships in the smart home device industry? <ul style="list-style-type: none"> ➤ Current business models ➤ Drivers behind business models ➤ Developing future-proof business models ➤ Internal business structure ➤ External business relationships 	<ul style="list-style-type: none"> ➤ Using multi-case study ➤ Semi-structured interviews with strategy managers ➤ Anonymising during transcription ➤ Coding for trends 	<ul style="list-style-type: none"> ➤ Ernst-Jan Peters, student Master Business Administration – Purchasing & Supply Management ➤ Dr. V.F. Delke, primary supervisor ➤ Dr.ir. R. Siemelink, secondary supervisor 

Benefits of participating	Contact information
<ul style="list-style-type: none"> ➤ Critical reflection via the interview on the current performance of your company ➤ Benchmarking with the final research to understand current market standards ➤ Guideline to evolve your business model via the final framework 	Mailadres: e.j.peters@student.utwente.nl