國立臺灣大學管理學院企業管理碩士專班

碩士論文

Global MBA

Collage of Management

National Taiwan University

Master Thesis

家庭陪伴型機器人發展：

以華碩機器人 Zenbo 個案研究為例

Home Companion Robot Development:

A Case Study of ASUS Zenbo

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Bernice Chang-Yung Chen

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Abstract

For many years, people have told stories about robots. These machines can help us live better lives. The first movie robot was shown in a film made in 1924. They act like friends and can do many tasks. Robots are now a part of real life. ASUS Zenbo was created and positioned to be the home companion robot in 2016. After so many years of waiting, people's dream about owning a robot has finally came true. It successfully generated buzz around the world when Zenbo launched in 2016 Computex. However, the heat was tended to decline after three years.

The purpose of this thesis is to identify the significant factors, and accordingly put forward the suggestions. The case study of Zenbo conducted a market survey to discover user experience of using Zenbo. It also covers Zenbo business models, competitor analysis and the Porter's Five Forces model of the industry. At the end of this study, we will base on the findings to give suggestion for Zenbo's future development in the industry.

Keywords: ASUS, ASUS Zenbo, Zenbo, Robot, Zenbo Business Model, Zenbo Reposition

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1. INTORDCUTION

1.1 Objective of the Research

For decades, humans have dreamed of owning such a companion: one that is smart, dear to our hearts, and always at our disposal. After two years of researching and developing, ASUS Chairman Jonney Shih introduced Zenbo's features and shared his vision of enabling robotic computing for every household in 2016. However, after three years of hard work, Zenbo did not continue generating buzz in the home robot market as what ASUS expected. In this thesis, we are going to study the circumstances that home robot in a household, and the user experiences in using the robot – Zenbo. Then, we will provide the recommendations of how and what can ASUS Zenbo be improved and repositioned in the robot market. This study expects to achieve the following research goals:

A. Explore the robot market attractions and opportunities
B. Understand the design of Zenbo based on the market attractions and opportunities
C. Find out the Zenbo business model
D. Conduct market survey to analyze the current user experiences
E. Provide of future business strategy and new market opportunitieties

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1.2 Research Methodology

The research framework of this thesis begins with understanding the robot market opportunities the product design background, confirm the research purpose and motivation, and next will move the direction of research through market survey analysis and company confidential data.

First, we will explore the robot market attractions and opportunities. Then, we will find out ASUS designed the Zenbo based on the market opportunities. Next, we analyze the market research to find out the circumstances that home robot in a household, and the user experiences toward of using the robot – Zenbo. Then, we will analyze direct and indirect competitors to find out ASUS's position and opportunities in the market. Most importantly, we will provide the recommendations of how and what can ASUS Zenbo be improved and repositioned in the robot market.

1.3 Market Attractions and Opportunities

Taiwan government has invested more and more resources in robot industry. Also, because the low newborn rate, parents tend to invest more resources on their next generation. Another opportunity is the elderly market, the research finds out that being a senior and aging is now about living better, not just longer (SRA Research Group, 2014), ASUS think to develop a robot that can assist seniors in their daily

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life, and provide a better living quality. Asus took above as a good business opportunity for Zenbo during the product development stage.

1.3.1 Industry Factor

The household robots' market is expected to grow from USD 3.3 billion in 2019 to USD 9.1 billion by 2024; it is expected to grow at a CAGR of 22.4% during the forecast period. Technological advancements are enabling household robots to become more practical and usable day by day. This is driving the consumer demand and acceptance of such products. Rising consumer demand for autonomous robotic technology, along with minimization of human intervention, is another factor driving the market. APAC is expected to witness the largest share of the household robots' market during 2019–2024. Growth of household robots in the APAC region is strongly correlated with consumer demand the region. Increase in investment toward household robots (Markets and Markets, 2019)

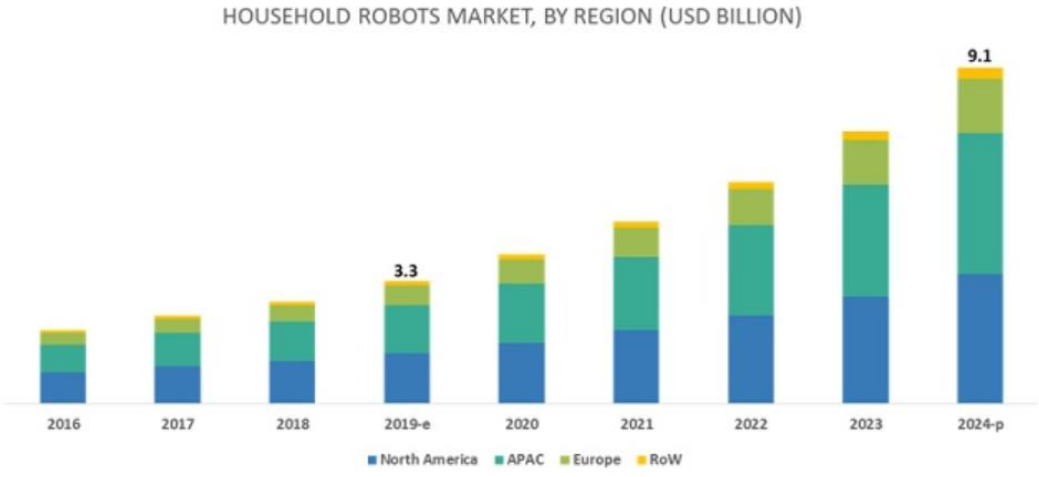

Figure 1.3 Household Robots Market, by region (USD Billion)

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1.3.2 Children Education

WHO (World Health Organization, 2018) has found out the new born rate is generally declining over the years, especially in the developed countries. With fewer children, parents can take better care in ways that facilitate their development. Parents with few children are more likely to be able to pay for their schooling, medical care, and leisure activities. Also, parents in developed countries are more likely to have better income and more willing to put more resources on children's education.

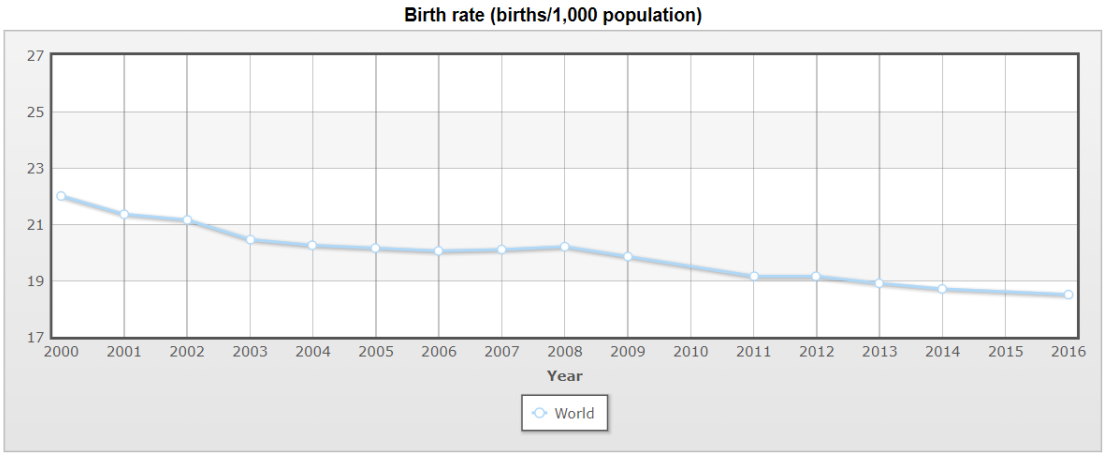

Figure 1.3.2: World's Birth Rate

1.3.3 Elderly Care

The elder care robotics has been around for years. It has become increasingly more apparent as the gap between the number of available caregivers and the world's aging population continues to widen. This population problem is already very real in countries like Japan, where

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there will be an estimated shortage of 1 million caregivers by 2025. The U.S. is facing a similar dilemma — as the percentage of people aged 65 or older is expected to rise to roughly 26% by 2050 (Pew Research Center, 2015). Researchers all around the world are proactively striving to help solve this problem and are independently working to create autonomous robots that are capable of performing similar, if not the exact same, tasks as caregivers.

2. ASUS ZNEBO INTRODUCTION

2.1 Vision

For decades, humans have dreamed of owning such a companion. One that is smart, dear to our hearts, and always at our disposal. ASUS Zenbo's ambition is to enable robotic computing for every household.

2.2 Product Position

When ASUS started to design Zenbo, they have studied and divided robots into 4 factors: Daily life engagement, multiple function/diver purpose, individual function/ single purse, independent work alone.

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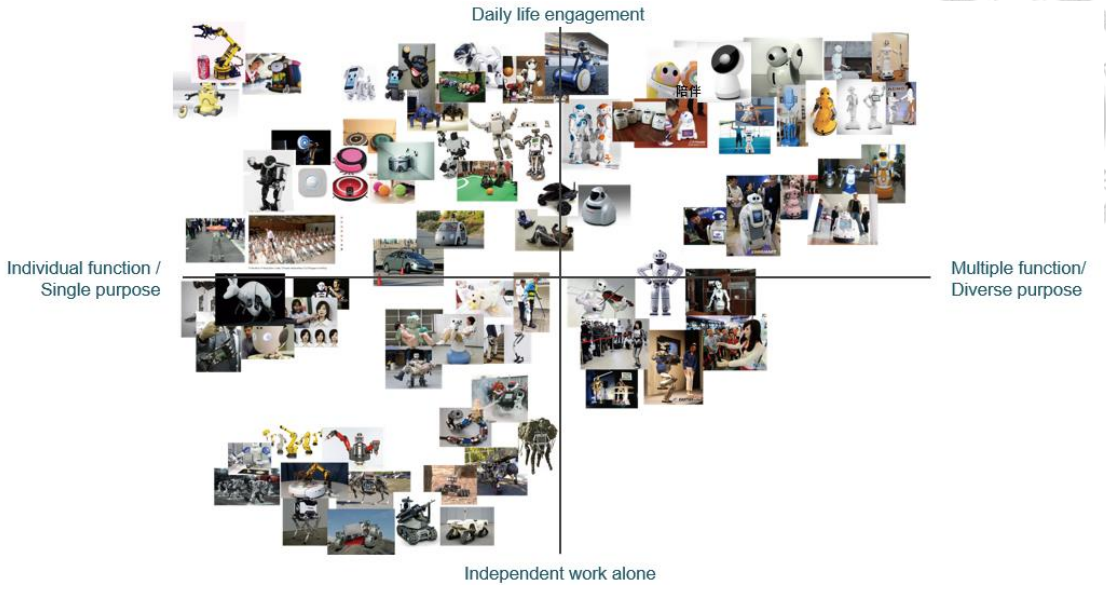

Figure 2.2-1: ASUS Robot Position and Scenario

For the current service and campaign-oriented robots are in the multiple function & daily life engagement category. Also, ASUS divided robots' functions in 10 categories: basic capabilities, home assistance, entertainment, automation, sport, companion, security, medical, education, and military.

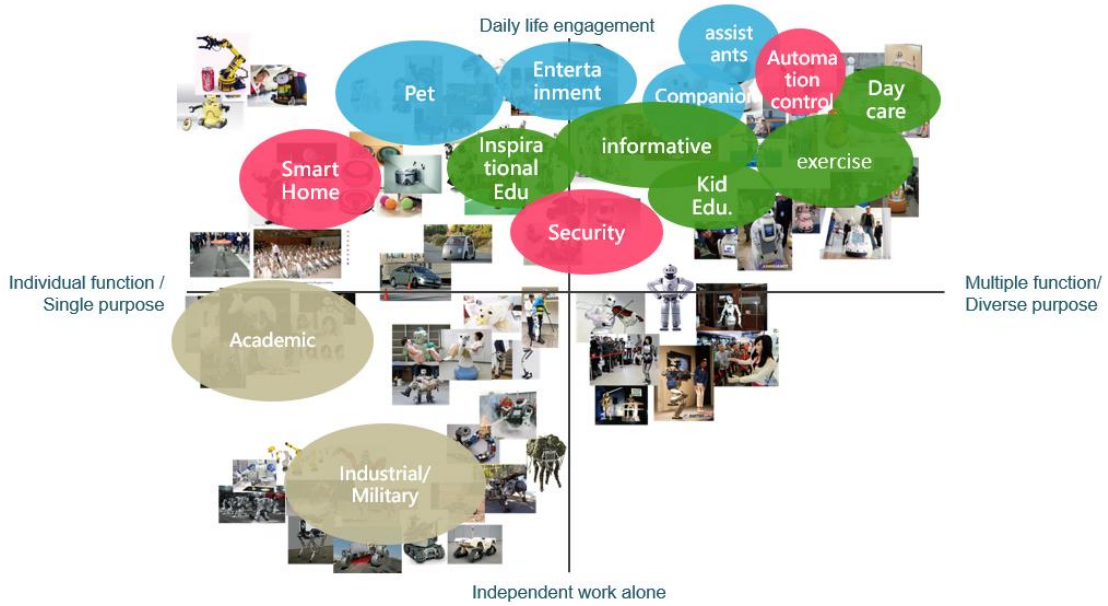

Figure 2.2-2: ASUS Robot Position and Scenario Categories

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After defining robot's capabilities, ASUS Robot department listed the features that they thought Zenbo should be equipped in order to be a home & companion robot.

2.2.1 Product Gender and Age Definition

Base of ASUS research department, they found out 50% of home robots are named in male's names, 48% are female names, and 2% are neural. For the age, because the product limitation, it is positioned as 2-year-old little boy.

2.2.2 Product Facial Expression

80% of Zenbo's emotion are positive, and 20% of Zenbo's emotion are negative.

2.2.3 Product Voice Definition

Most of cartoon voice of little boy is from female voice, for example: Doreamon, and Carayon Shin-Chan. As Zenbo is multiple function robot, ASUS defined Zenbo voice by using female's voice.

2.3 Product and Services Provided

2.3.1 Overall Core Capabilities

- Speaking and Listening: dialogue system, voice recognition.
- Vision: facial recognition, object detection
- Motion: actions, movements
- Emotion: 24 Facial Expressions
- Machine Learning: image recognition, speak-to text, natural language

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understanding.

2.3.2 Overall Cognition

- Touch sensor: detects touch
- CIR: Help with home automation
- Sonar sensor: object avoidance
- Drop IR sensor: Prevent falling off from stair, table
- Line sensor: Follow tracks which is assigned

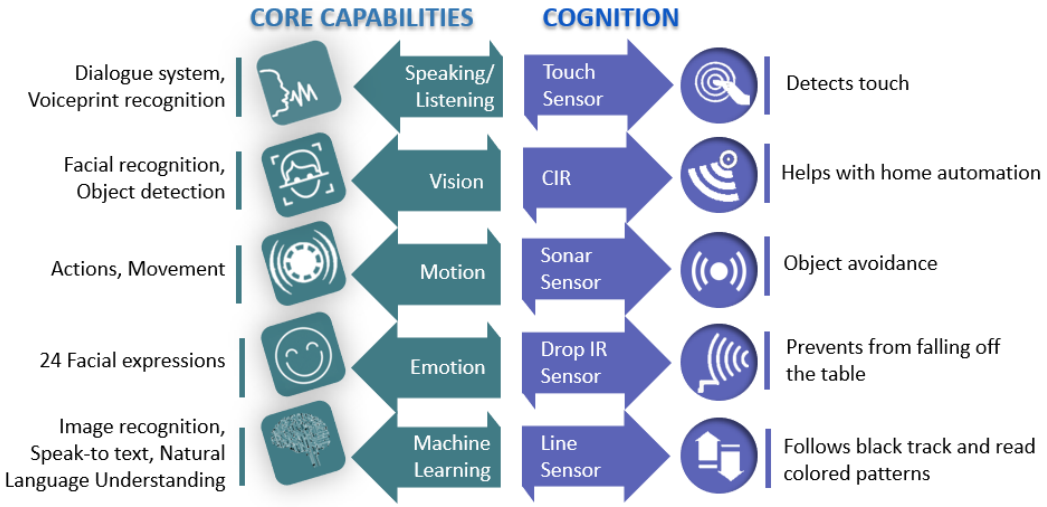

Figure 2.3.2: Zenbo Core Capabilities

2.3.3 What can Zenbo Do

It can be used for remote video recording, providing information, real-time reminders, voice-operated appliances, emergency alert for home safety and daily life helper. It provides services for food, clothing, housing, transportation, education and entertainment. It also provides interactive digital contents for educational entertainment and programming games for logic training.

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- **Household Helper:** Zenbo helps users with the trivial housework, including:

A. It provides the 24-hour taxi reservation service by voicemail.

B. It records the online shopping habit of the user and becomes a helper for smart online shopping. It will broadcast the discount for the preferred type of product actively and users won't miss any discount.

C. It offers online recipes and culinary videos for beginners and masters and help users to easily satisfy the appetite of everyone in the family.

D. Users can command Zenbo to make an immediate online reservation for "home cleaning service" to make home tidy and clean.

Zenbo can also connect to music platforms for streaming and playing music on demand with high quality. It acts as a smart DJ to create a great atmosphere or play music on demand.

ASUS worked with the National Police Agency on the "Joint Project for Smart Home Safety" to turn Zenbo into a security guard. Zenbo Notifies the police immediately once detecting any threat to the home safety. The police take actions instantly to guarantee home safety.

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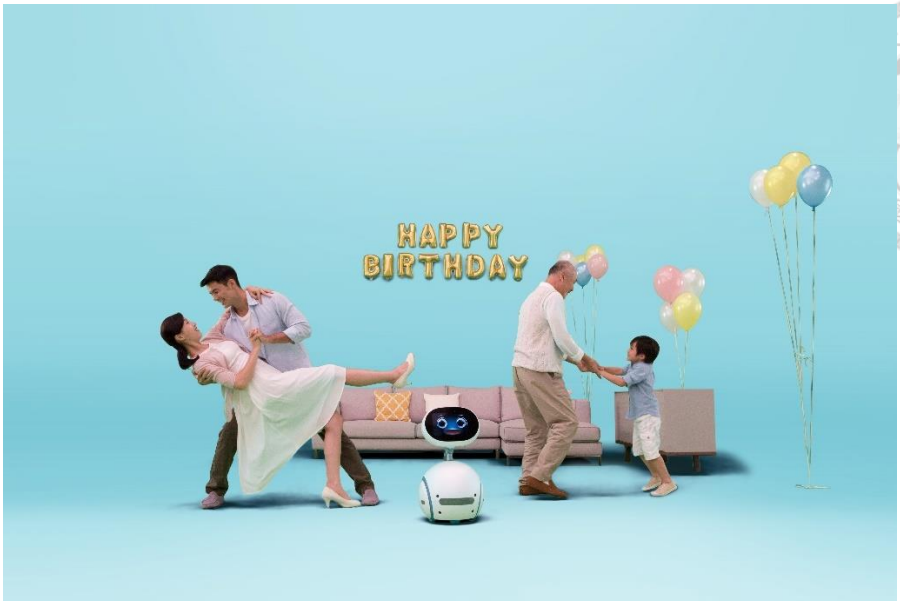

Figure 2.3.3-1: Household Helper

- **<u>Educational Playmate</u>:** Zenbo offers abundant learning material and interesting interactive functions to train kids for logical thinking.

A. Zenbo preloads fun interactive stories. The bookseller that works with ASUS uploads hundreds of new storybooks to Zenbo Store for users to download.

B. In the interactive educational game " Fun Quizzes", interactive modules are provided to inspire kids to learn happily and achieve balanced development. These modules include "Sing and Dance", "Great Virtue" and "Life Skill".

C. The programmable game is built with fun graphical interactive interfaces. Our kids can start learning programming from childhood. The game gets the kids from the next generation to be interested in programming to build a foundation for the most critical comprehensive competitiveness.

D. Zenbo has a user-friendly design and allows family members to guide their

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elders to share their lives on Facebook, watch YouTube videos, shop online and even make an appointment with a doctor in the hospital. Therefore, the elderly can enjoy the happiest aspects of smart digital life.

Figure 2.3.3-2: Educational Playmate

- **Sweet Companion:** Zenbo connects various daily-life services. It is mobile and can be remote controlled for emergency.

A. Users can upload the prescription for chronic disease issued by the doctor and the medicine will be delivered to the door. Users no longer need to go out and wait in line.

B. Users can pat Zenbo and request help when emergency occurs. They can also wear ZenWatch 3 and if they fall, ZenWatch 3 will trigger Zenbo and notify emergency contacts, who can remote control Zenbo to move closer to users. Therefore, it would be able to check the condition of the users via the built-

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in camera.

C. Zenbo adjusts the lens angle for easy and natural remote video recording based on the face angle and expression of users.

D. Zenbo is the photographer for family members and records life's moments. Users can use Zenbo to take pictures and uploads anytime and share feelings of the moment with friends.

E. Users can get weather forecast easily by voice command to know the weather instantly, whether it is hot, cold, sunny or rainy.

F. Zenbo is built with the infrared function. With a few simple steps, Zenbo is able to remote control the TV, air conditioner and most of the 3C products.

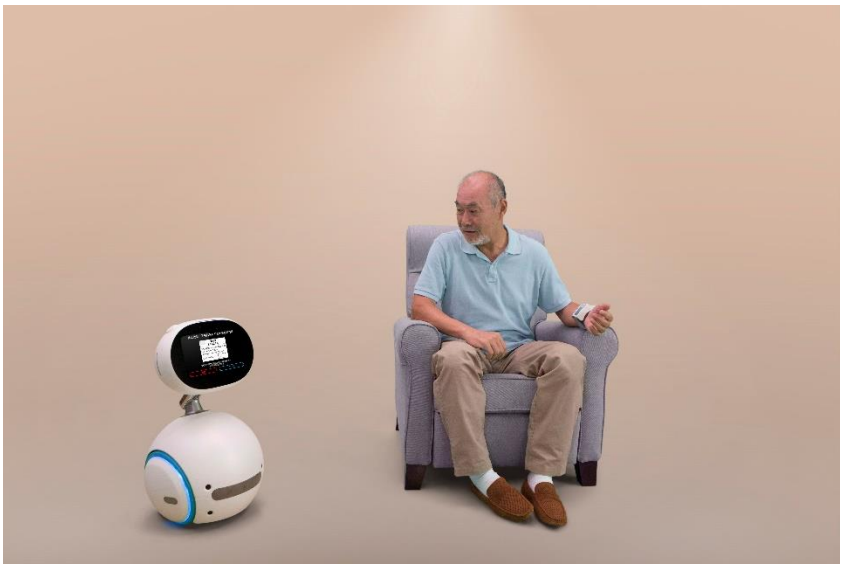

Figure 2.3.3-3: Sweet Companion

Overall, Zenbo is positioned a friendly and capable home robot designed to provide assistance, entertainment, and companionship to families and meant to

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address the needs to each family member. To fit in the home scenario, ASUS designed 30+Apps in Zenbo to meet the needs for home members.

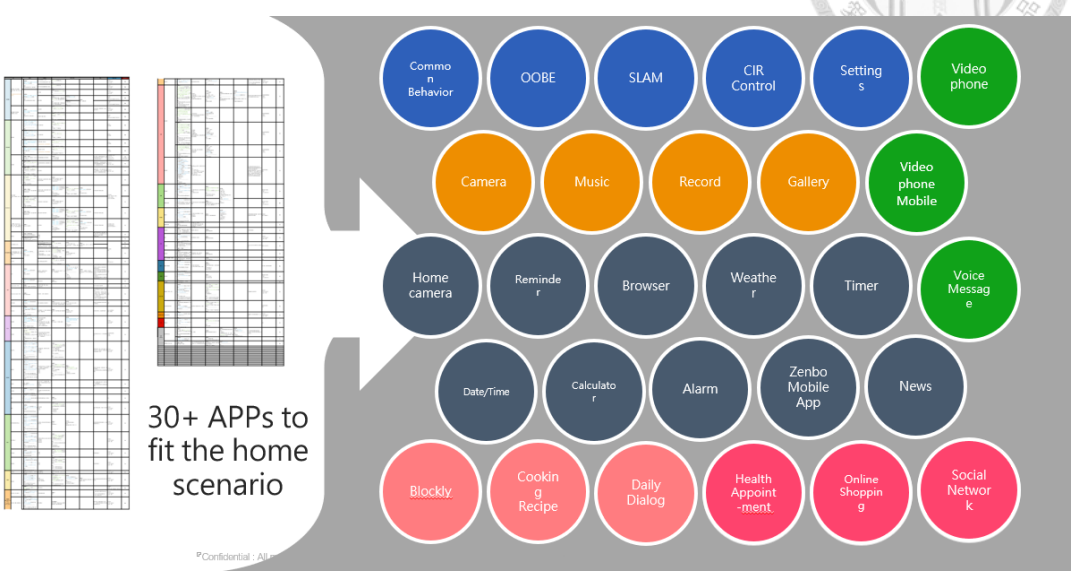

Figure 2.3.3-4: Zenbo built in Apps

2.4 Zenbo User Profile

Base on Google Analytics on Zenbo official website (https://zenbo.asus.com/), we found out the users are mostly come from United Sates and Taiwan. Also, the 63% of user age is around 35-44. User's gender is 81% of male and 19% of female. Their interests are mainly highly tech oriented and most of website visit come from referral sites like tech blogs, mobile products oriented. Users ager for healthy, safety for family, and willing improve living quality with new technology. Their education are mostly college and grade school. They have higher education and social status.

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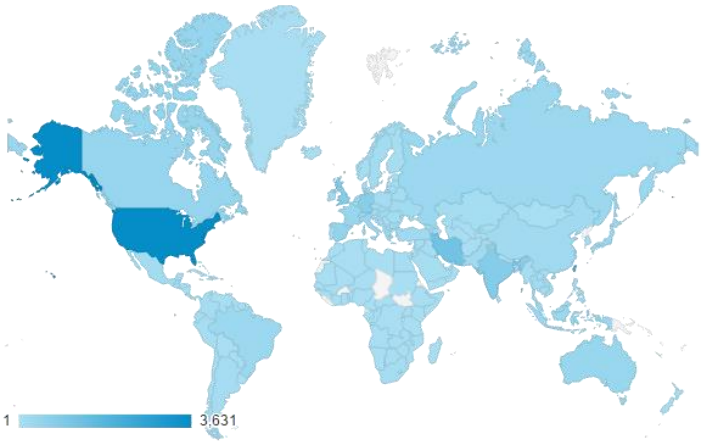

Figure 2.4-1: Zenbo user demographics on Google Analytics

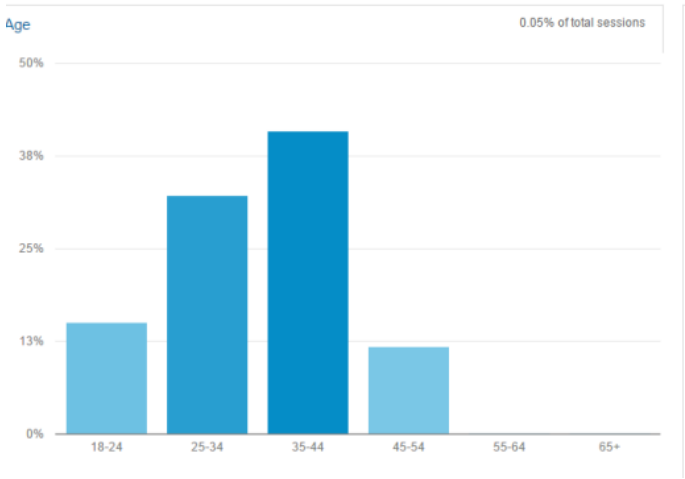

Figure 2.4-2: Zenbo user age on Google Analytics

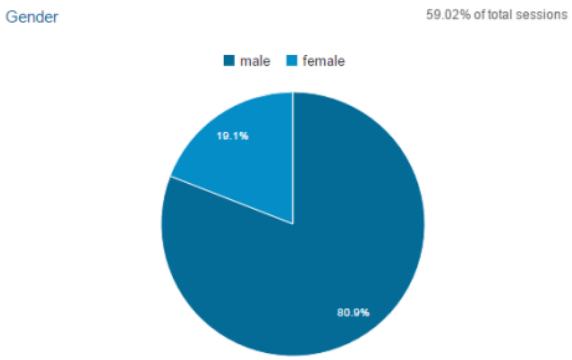

Figure 2.4-3: Zenbo user gender on Google Analytics

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2.4.1 Zenbo User Profile Illustration

- John (for example) is 42 years old, has a wife married for 12 years and 2 kids, a 10-year-old boy and a 4- year-old girl. He works as a manager in tech company, with a $1500,000 income per year.
- He loves his family, but sometimes he's sad about not having time to read bed time stories to his little girl, or a sweet alone time with his wife.
- John's mother is 68 years old and lives in another states alone, still quite healthy other than the chronic illness which need to take medicine regularly.

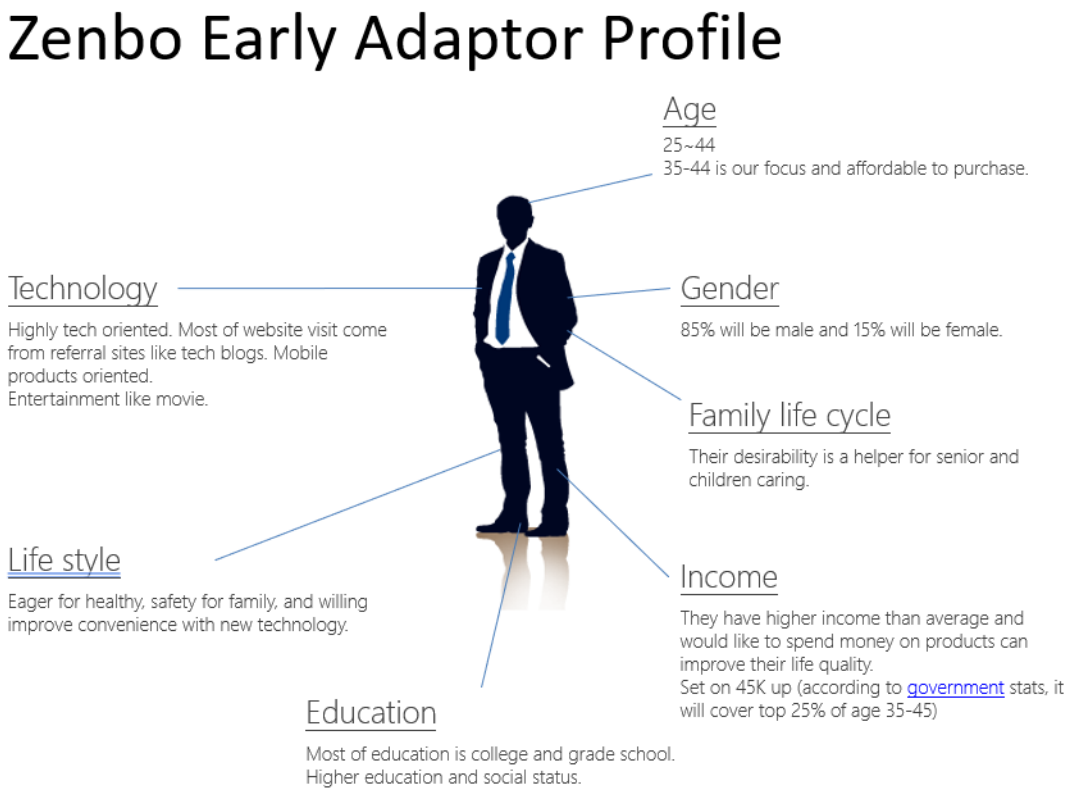

Figure 2.4-4: Zenbo early adaptor profile

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3. ASUS ZENBO BUSINESS MODEL CANVAS

Zenbo the ASUS robot is launched in 2016, which is aimed to provide companionship, assistance and entertainment for household members. The business model initially covers strong product features that build by internal R&D and developers. Then, through Zenbo forum and marketing to attract potential customers which are stated in the Business Model Canvas below.

<table>
<tr>
<td rowspan="2">Key Partners
- Zenbo Developers
- Design House
- Film and entertainment company
- Partners to co-op to build Zenbo App</td>
<td>Key Activities
- B2C Marketing and sales
- B2B Business Development
- Distribution and retailing</td>
<td rowspan="2">Value Proposition
- Great present
- Good companion for elderly and children
- Educational toy
- Experiment
- Great attraction</td>
<td>Customer Relationship
- Zenbo forum
- Zenbo developer club
- Social media</td>
<td rowspan="2">Customer Segments
- Family, specially parents
- Educational institute
- Government</td>
</tr>
<tr>
<td>Key Resources
Zenbo brand, Zenbo app, factories</td>
<td>Channels
Retail, online, event and roadshow</td>
</tr>
<tr>
<td colspan="3">Cost Structure
- R&D development cost
- Marketing cost
- Employee salaries</td>
<td colspan="2">Revenue Streams
Zenbo sales, Zenbo App store, customized app building</td>
</tr>
</table>

Table 3: Business Canvas of ASUS Zenbo

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3.1 Value Proposition

Zenbo is a home robot designed to provide assistance, entertainment, and companionship to families. Zenbo helps senior enjoy digital life and safeguard health, entertains kid with interactive stories and games, enriches the home as a household helper. Also, Zenbo can attract people's attention at the stores to greet customers, and because of its appearance Zenbo usually is a present among families. Most importantly, Zenbo serves as an educational companion and object for robotics studies.

3.2 Customer Segments

The target audiences of Zenbo include parents, children and elderly in the household. However, 90% of purchasers are fathers in the families. Also, schools specially pre-schools, elementary schools and universities are key customers. Pre-schools purchase to entertainment children. Elementary schools purchase Zenbo to educate students in programming classes. Universities purchase Zenbo for experiment and research. Government is also one of the key customers. They purchase Zenbo as a means to show the achievement base on the Executive Yuan's AI polies. (AI Taiwan Action Plan, 2019).

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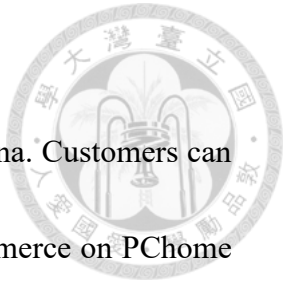

3.3 Channels

The main focus sales countries are Taiwan, and mainland China. Customers can purchase Zenbo through ASUS's official website, and E-commerce on PChome and Momo. Also, ASUS connect customers in roadshows and local marketing events.

3.4 Customer Relationships

ASUS opened a Zenbo forum and Zenbo developer club which serve as win-win platform to receive customer feedbacks for internal product feature improvements. Also, this forum can interact with customers directly to maintain the brand preferences. Asus also continues to generate buzz through owned media on Facebook, Line, Twitter, Youtube, and LinkedIn.

3.5 Revenue Streams

Zenbo sales are main revenue streams. Also, the revenue comes from sales of Zenbo App on Zenbo App Store. For B2B sales, when customers purchase Zenbo, it usually come as a package, including Zenbo and customized app that can apply specifically on the customer's business.

3.6 Key Resources

Zenbo brand connected the relationship with customers and developers are the main resource to continue product building. Also, Zenbo Apps and factories are

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considered assets to ASUS that are needed to sustain and support the business.

3.7 Key Activities

The key activities for Zenbo B2C strategy are focusing on various marketing events. For B2B, they need to expand opportunities though many potential business developments from banks, hospitals, museums, government officials. They develop products starts from product developing, manufacturing, distributing, retailing to deliver to the end customers.

3.8 Key Partnership

The successfully business comes from good quality products and associate with every partner including product developers, product design house, researchers to study customer needs and behaviors and provide insights to executive team and RD team for feature building. Also, the film and entertainment company to create good marketing assets to reach customers. Also, the distributors and retailers are taking consideration here.

3.9 Cost Structure

The company cost structure will be recognized from R&D development cost, marketing cost, employee salaries, equipment material and distributor commission.

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4. MARKET ANALSYS

4.1 Market Survey

A questionnaire survey about “Zenbo User Experience in Taiwan” was conducted to investigate customer’s user experience after using Zenbo at home. The objective of this research is to examine customer’s behavior and gain feedback for product future development. The questionnaire contained following parts:

- Introduction (demographics information about respondents)
- Motivation of purchasing
- What features do you like the most about Zenbo
- The barriers of using Zenbo and the reason

The questionnaires were sent out in electronical format using ASUS E-Survey system (Refer to Appendix) and a total of 159 respondents’ feedbacks were collected. The target respondents consist of different group: parents, beta user, and high-tech professionals.

Out of the 159 respondents, majority of respondents are male (89.7%). Many of them use Zenbo during 18:00-24:00 (76.7%). They usually spend 30 minutes to 1 hour using Zenbo (30.8%).

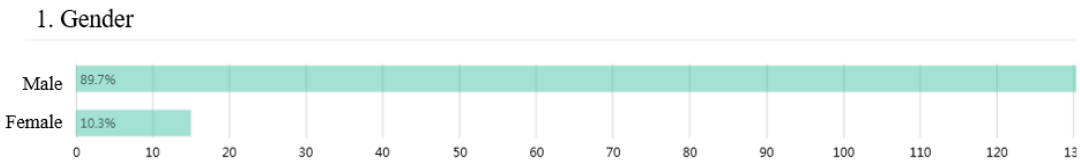

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Figure 4.1-1: Zenbo user's gender

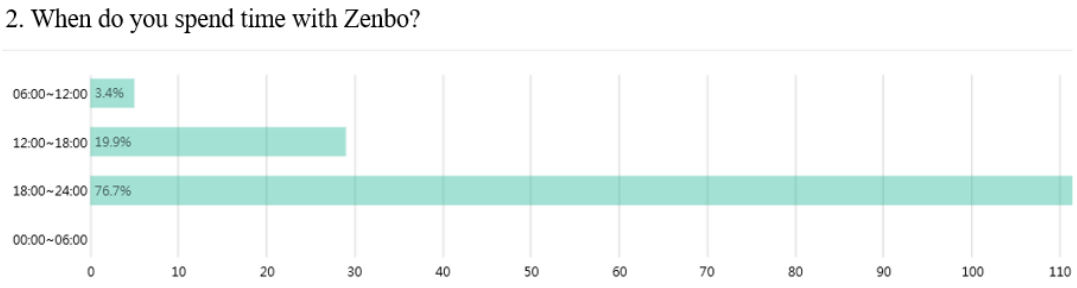

Figure 4.1-2: When do you spend time with Zenbo

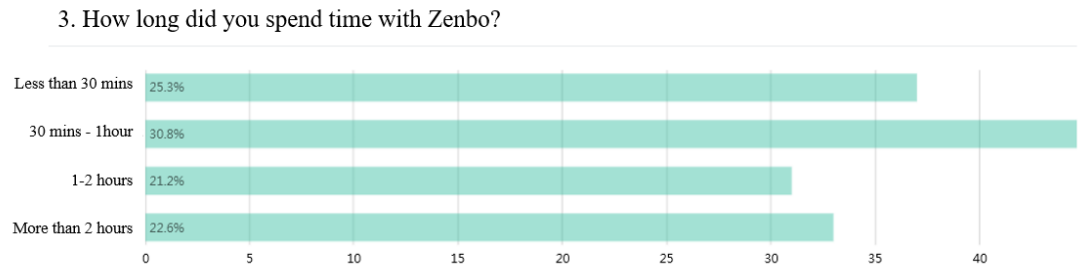

Figure 4.1-3: How long did you spend time with Zenbo

The next two sets of questions were to collect answer to identify which features of Zenbo that the respondents like the most. Generally, most of respondents like to use Youtube (13.3%) and Music (11.1%). Features which were designed for children including Shimajiro (9%), Story (9.8%), Scratch (3.1%) which are not the features that the respondents prefer. Also, features which were designed for elderly including Hospital registration (0.9%), Video call (8.4%), Browser (2.8%) are also receive less likes from respondents.

We found out Zenbo which is designed as a home robot for children, elderly

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family members, and parents, but none of features are typical highly used based on the 159 respondents' feedbacks we collected.

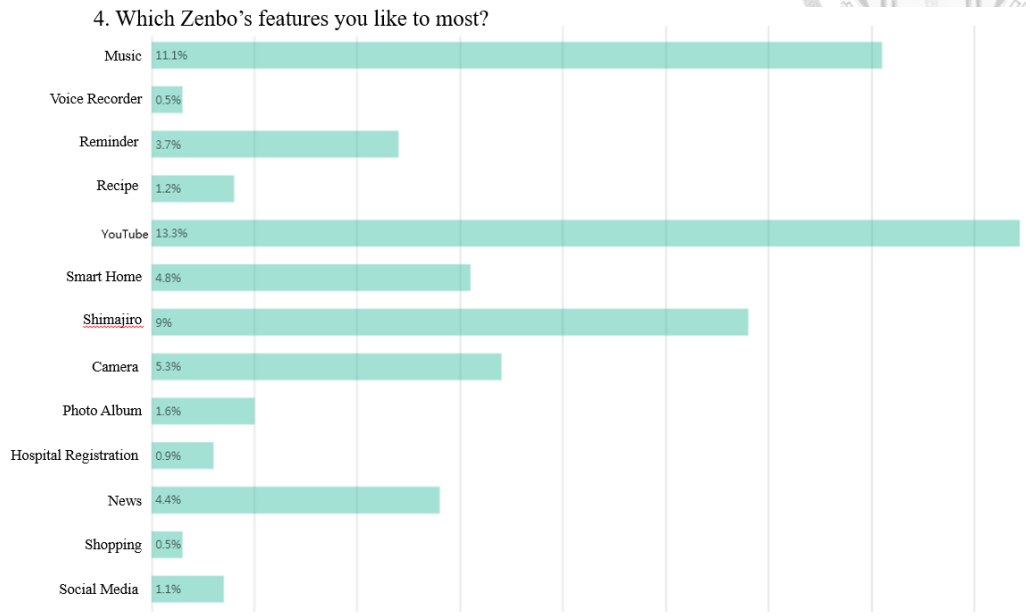

Figure 4.1-4: Which Zenbo's features users like the most

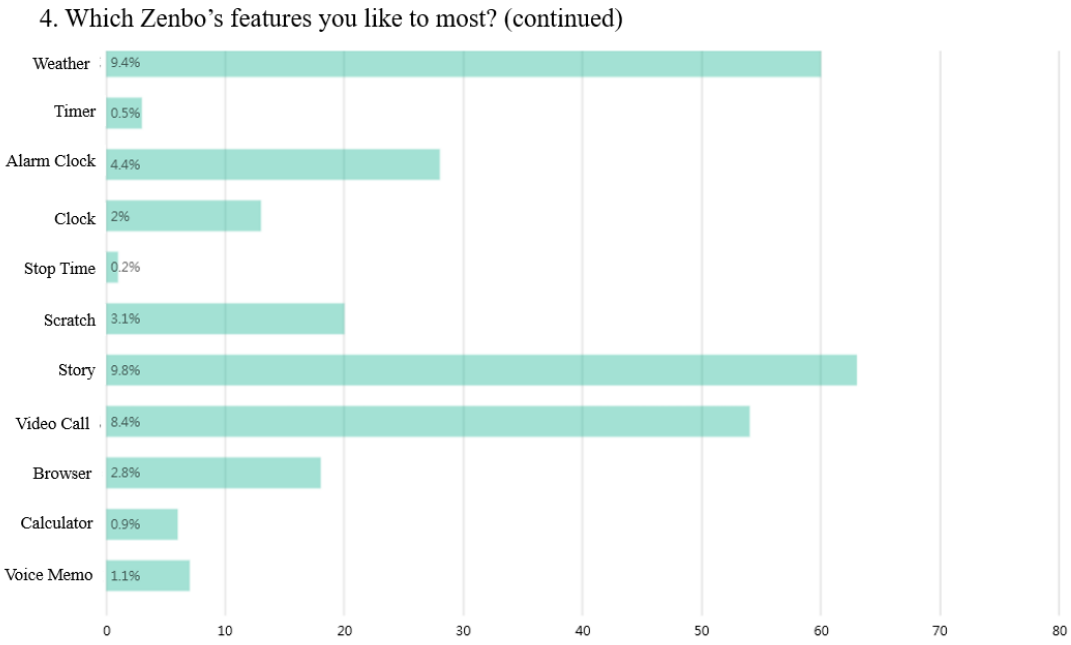

Figure 4.1-5: Which Zenbo's features users like the most (continued)

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Respondents were given 7 options where multiple choice options are allowed to answer the motivation to purchase Zenbo, including new product to tryout, research, develop software, companion for elderly, companion for children, as a gift/ present, to make life more convenient. Base on the questionnaire, the majority of respondents' (52%) motivation to purchase Zenbo is for their children.

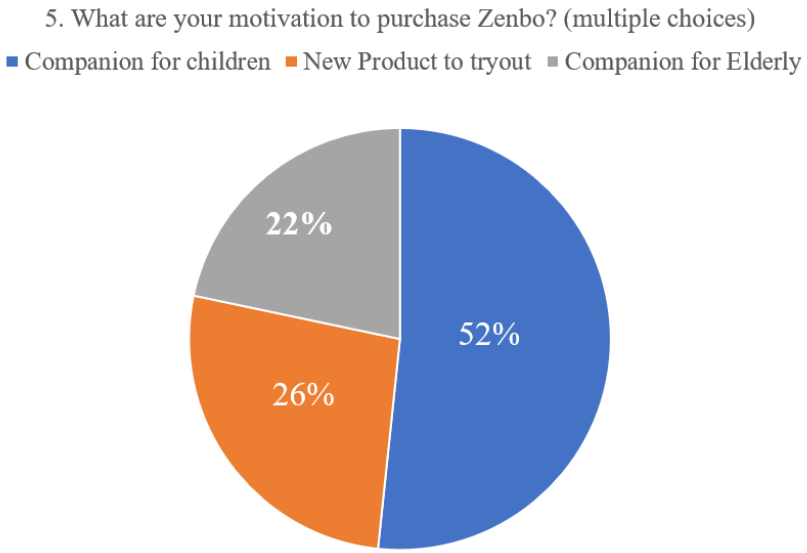

Figure 4.1-6: What are user's motivation to purchase Zenbo

Interestingly, we found out based on the questionnaire, although 52% of respondents indicate that the initial motivation to purchase Zenbo was for their children. However, the main user to use Zenbo are the purchaser themselves (39.4%) which are father in the family, and preschoolers only (23.2%) and elementary students only (17%).

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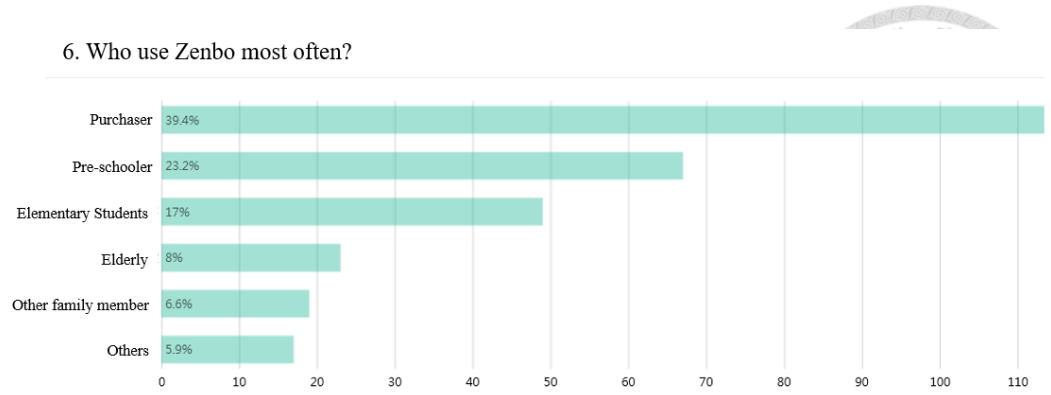

Figure 4.1-7: Who use Zenbo most often

Question 7's purpose is to find the barriers of preventing respondents from using features which are designed for them. Most of respondents think Map Building (28.2%) is difficult to operate.

The map building is to set up home map on Zenbo; therefore, Zenbo can recognize home environment and arrive the specific area, for example if the master command Zenbo to go to the kitchen, Zenbo will go to kitchen base on master's commend and the map that has been set up.

There are 26.8% of respondents think the Voice Recognition is hard to operate. The voice recognition which is the most important and basic feature of Zenbo because user need to interact and give command through voice and after Zenbo receive the command, then can lead to actions. Therefore, we can find out the reason of why most of features' usage are low because all the features need to be activated by voice commands.

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Especially, when Asus built Zenbo, the main purpose of Zenbo was to serve as home and companion robot for children and elderly. However, the voice recognition is hard for children and elder to follow. Therefore, we found out even the initial motivation of purchasing was for children and elderly, most of active users are the purchasers themselves.

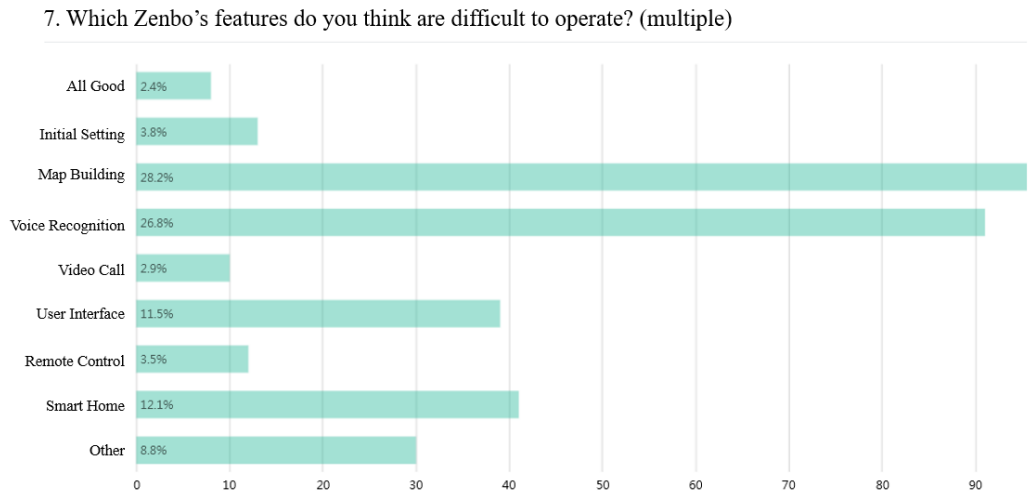

Figure 4.1-8: Which Zenbo's features are difficult to operate

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4.2 Competitor Analysis

4.2.1 Direct Competitor

The home and champignon robots will be classified as direct competitors for Zenbo.

4.2.1.1 Jibo (https://www.jibo.com/)

JIBO is a robot built to function in a home environment. It is based on an Artificial Intelligence and Natural Language Processing that learns and adapts over time. It is developed by Dr. Cynthia Breazeal at JIBO Inc. It is a device that can connect to the JIBO Cloud using Wi-Fi and can connect to smartphones using Bluetooth. It is primarily designed to interact with family members in the most human way possible. Apart from understanding natural voice commands, it can take pictures, read emails, assist in video conferencing and implement smart home concepts. However, the Jibo robot had exit the market on June 2018.

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Figure 4.2.1.1: Competitor analysis on Jibo

4.2.1.2 Kebbi (https://www.nuwarobotics.com/)

Kebbi was launched in the Chinese market. It is positioned as a companion robot aimed primarily for children which is able to play and chat with children. It comes with a facial recognition feature and can be programmed to work as a tutor, helping young students and preschoolers' study and practice English.

Figure 4.2.1.2: Competitor analysis on Kebbi

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4.2.1.3 Robelf (https://www.robelf.com/)

Robelf is targeting the home market to serve as a home/companion robot for both adult and children. It carries features clock, calendar, camera, album, weather, call, message. The primary objective of the robot is to survey one's house, as the built-in camera as it roams around allows the owner to monitor their abode when they are not there with the machine sending a message to the human if it suspects any unusual activity.

Figure 4.2.1.3: Competitor analysis on Robelf

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4.2.1.4 Arobot (http://robotics.adata.com/tw/)

ADATA Arobot robot is aimed on infant market. Arobot can recognize voices and people, and can read picture books or play with the baby using built-in games when the baby cries out. It has wheels on the bottom, letting the infant move the robot around using a smartphone app. There are infrared sensors on the bottom so that it will not fall down stairs or the like. It also come with a host of features for parents and guardians, allowing it to serve as a baby monitor and as a mobile battery.

Figure 4.2.1.3: Competitor analysis on Arobot

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4.2.2 Indirect Competitor

Voice Assistants which have voice recognition enabled function will be classified as indirect competitors for Zenbo. They are not home or companion robot, but voice assistants also carry basic interactive functions. If users only need an object at home which can interact in terms of telling stories or looking for basic information, users may have other options on the market. However, voice assistants don't carry educational functions include graphic programming platform or scratch which can train children logic thinking and problem-solving capabilities. Also, voice assistants don't have the ability to move which can't move or dance to entertain. Another feature that voice assistants don't have is vision which the voice call, remote control and camera are not able to function.

4.3 Competitive Comparison Grid

Comparing business performance to that of competition is a common and necessary business practice. Successful business regularly evaluates their business performance, including product and service performance to identify areas of strengths, and improvement as well as future opportunities. Two competitive gird tables are created based on google search result and personal

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experience for direct competition and indirect competition. These competitive comparison grids evaluate Zenbo's direct competitor and indirect competitor's strengths and weakness to show where Zenbo would stand and differentiate.

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4.3.1 Competitive comparison grid between direct robot competitor

No.	Item	ASUS Zenbo	Acer Jibo	Kebbi (Nuwa)	Robelf	Adata Arobot
Basic Information						
1.	Availability in Market	Yes	Yes	Yes	Yes	Yes
2.	Price	32G: NT$19,900 128G: NT$24,900	USD$499	NT $12,900	NT $16,888	64G: NT$$19,900
3.	Dimension (cm)	37x37x62	15x28	30.7x16.6x 38.1	35x29x85.5	30.5x33x54
4.	Weight	10kg	3kg	2.5kg	7kg	5.5kg
Function						
1.	Trigger Word	Hey, Zenbo	Hey Jibo	凱比同學 (Only in Chinese)	Hey Robelf	Hello 啵啵 (Only in Chinese)
2.	Vision Recognition	Yes	Yes	Yes	Yes	Yes
3.	Mobility	Yes (Can detect people and follow)	No	No	Yes	Yes, by remote
4.	Voice Recognition	Yes	Yes	Yes	Yes	Yes
5.	Feature for children	Yes	Yes	Yes	Yes	Yes
5.	Feature for Elderly	Yes	Yes	Yes	Yes	Yes
6.	With hand	No	No	Yes	Yes	Yes
7.	Features can be customized	Yes	No	No	No	No

Table 4.3.1: Competitive comparison grid between direct robot competitor

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4.3.2 Competitive comparison grid between indirect competitors

Item	**Zenbo**	**Amazon Echo**	**Google Home**
Voice Recognition	Yes	Yes	Yes
Weather	Yes	Yes	Yes
News	Yes	Yes	Yes
Transportation report	Yes	Yes	Yes
Clock	Yes	Yes	Yes
Calendrer	Yes	Yes	Yes
Music	Yes	Yes	Yes
Chat	Yes	Yes	Yes
Recipe	Yes	Yes	Yes
Shopping	Yes	Yes	Yes
Mobility	Yes	No	No
Vision Recognition	Yes	No	No
Educational Function	Yes	No It carries some stories but doesn't has scratch or programming features.	No It carries some stories but doesn't has scratch or programming features.

Table 4.3.1: Competitive comparison grid between indirect competitor

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4.4 SWOT Analysis

A SWOT analysis is employed to evaluate Zenbo's strengths, weakness, opportunities, and threats by identifying the internal and external factors that are favorable and unfavorable to Zenbo.

Strength (Internal)	**Opportunity (External)**
1. Diversity Features: Many functions to choose from. 2. Expansive Applications: Based on Android, Zenbo offers various, APIs, including dialogue, actions, expressions, IoT and other features that make Zenbo suitable for different applications. 3. Zenbo Management Console: Remotely manage multiple robot device statuses and update the system software to improve operational efficiency.	1. Based on potential user's demographic, there users are willing to try new technology product. 2. Based on the low new born rate, parents are willing to spend more resources on their children. 3. More schools to focus on programming and scratch education, therefore, schools will have higher interest to invest more budgets on educational tools.
Weakness (Internal)	**Threat (External)**
1. Technology Barriers: (1) Mobility: Zenbo is able to move, however, it can only move on flat floor. If the floor contain carpet, it will make Zenbo harder to move around. (2) Voice Recognition: Text-to-speech and speech-to-text technology are owned by ASUS. However, it takes time to build the database. 2. Department Cooperation: Projects are assigned directly by executive team. It will need extra effort to cooperate and gain resources from different departments.	1. More similar robots in the market which means more competitions. 2. Bargaining power from partners. (ex: KKBOX, Shimajiro) 3. There are many other products carry the same functions which can replace Zenbo

Table 4.4: Competitive comparison grid between indirect competitor

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4.5 Porter's Five Forces Model

Developed by Michael E. Porter of Hard Business School, Porter's Five Forces Model is used to analyze competitive forces of a business, and their underlying causes which reveals the root of an industry's current profitability while providing a framework for anticipating and influencing competition (and profitability) over time (Porter, 2008). By using this framework, ASUS Zenbo's positioning strategy can be easily reviewed against the current related industry in Taiwan.

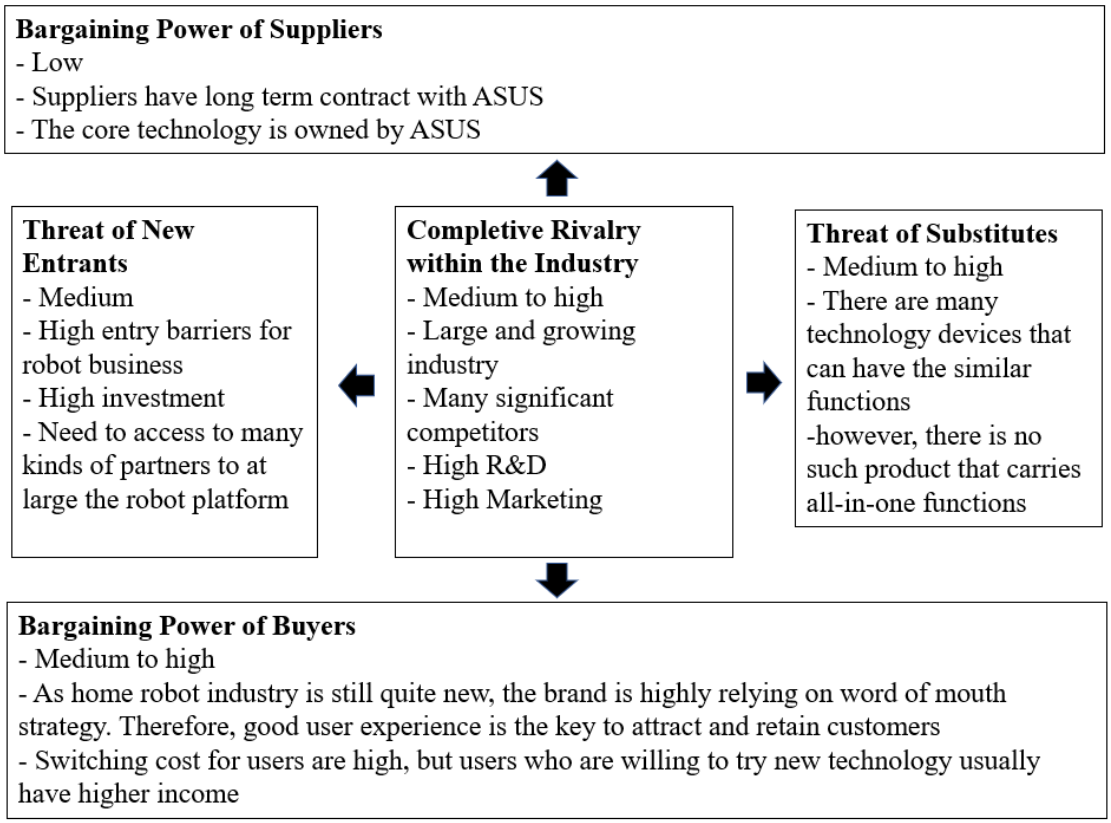

Figure 4.5 Porter's Five Forces Model for Zenbo

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5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In this case study, ASUS goal was for the product to become a companion in every household and the objective was to build a robot that can meet the needs for parents, children and elderly at home. In the market survey, we found out that most of user's initial purchasing motivation was for their children indeed. However, after the tryout period, we found that the most active users were the purchasers themselves whom were mostly the fathers of the houses.

Many of the users (parents) talked to us that their children love to play with Zenbo for bed time stories, and they love the singing and dancing functions. However, it is hard for them to activate Zenbo by pronouncing the "Hey Zenbo" correctly, especially for toddlers. Therefore, the users (parents) need to help them throughout the interaction with Zenbo. After failing to activate Zenbo for few time, the interest of interaction with Zenbo dropped significantly.

Another reason for the tendency of the rate of using Zenbo to decline was the Home Map setting which is the initial setting after purchasing Zenbo. The users need to set up the home map in the beginning. However, it will take a long period of time to set up from scanning home environment and marking the home areas and objects, and it is not easy to understand even reading the manual. The ASUS

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service center received many calls from users asking for help to set up the map. Also, the mobility is also a crucial point. Zenbo is able to move, however, it can only move on flat floor. If the floor contain carpet, it will make Zenbo harder to move around.

Figure 5.1-1 Home map setting

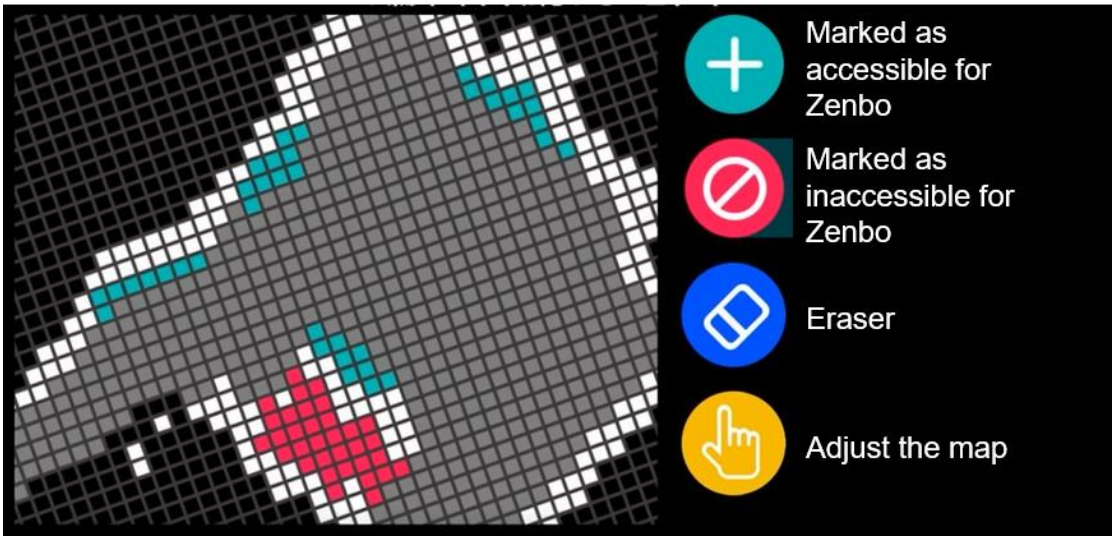

Figure 5.1-2 Marking the home areas

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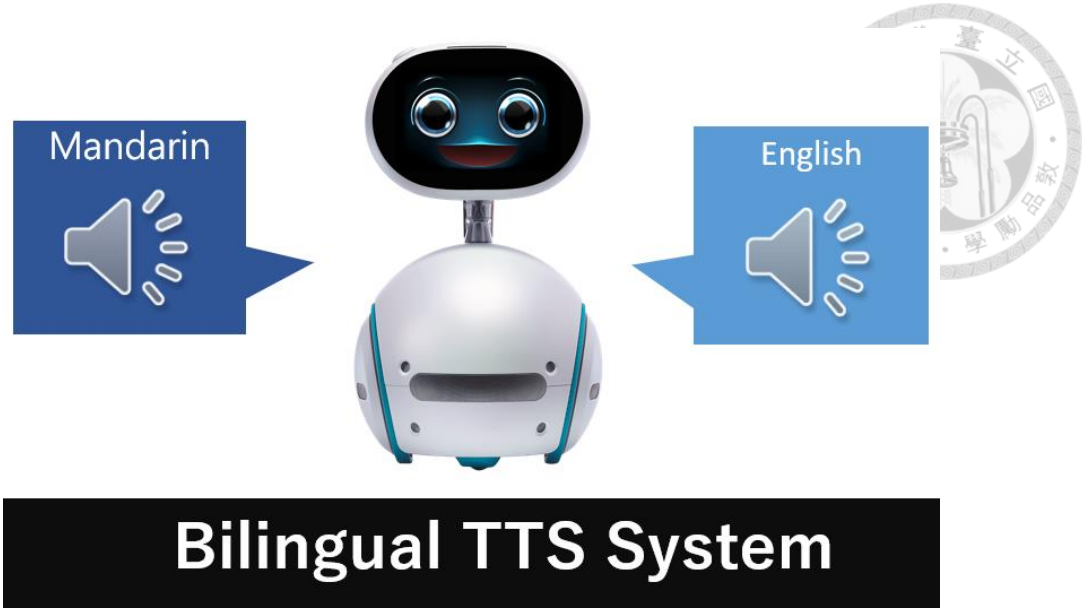

Figure 5.1-2 Optimization of TTS system

In order to enhance the user satisfaction to sustain business growth, ASUS would need to improve 1. Voice Recognition of Zenbo 2. Setting steps optimization. 3. Mobility.

5.2 Recommendation

5.2.1 Reposition – Educational Robot

Since developing a home companion robot will request high R&D resources, and based on the technology that ASUS invested could not satisfy each household members. Also, there are many substitutes in the markets that carry similar functions. Base on the users' experience and many feedbacks we have collected during in roadshow and marketing events, we think Zenbo can focus on one target audience first and continue to cultivate the functions which are they good at: the

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children's market to be an educational playmate. Firstly, the built-in apps which designed for children were the most well-equipped features and were the most recommended for example: stories and scratch/coding. Also, the functions are specifically designed for Zenbo which are unique and hard to replace.

- AI Education

  Covering all levels of learning from visual programming language to python, Zenbo Lab inspires AI applications from learning results to implement "Artificial Intelligence Education."

- Easily learn to code

  Compare visual programming language with Python to grasp Python logic and create various robotics applications.

Figure 5.2.1-1 Children use Zenbo's game function

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Figure 5.2.1-2 Children play with Zenbo

Figure 5.2.1-3 Children using Zenbo's scratch function

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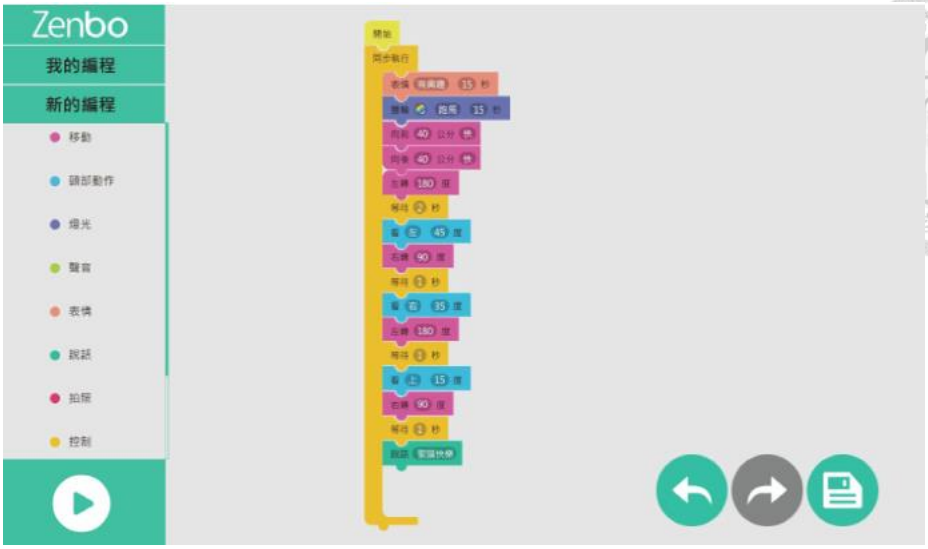

Figure 5.2.1-4 Zenbo scratch format

5.2.2 Reposition – Business to Business Robot

Instead of home companion robot, ASUS can also reposition Zenbo to be B2B robot. With many software that Zenbo carries, Zenbo can be customized based on the specific business's needs. The features can be designed base on each business model instead of many functions but hard to maintain.

With Zenbo's APIs open platform, we can develop and expand various robotics applications in different business fields, such as hotels, museums, banks, government officials, and schools.

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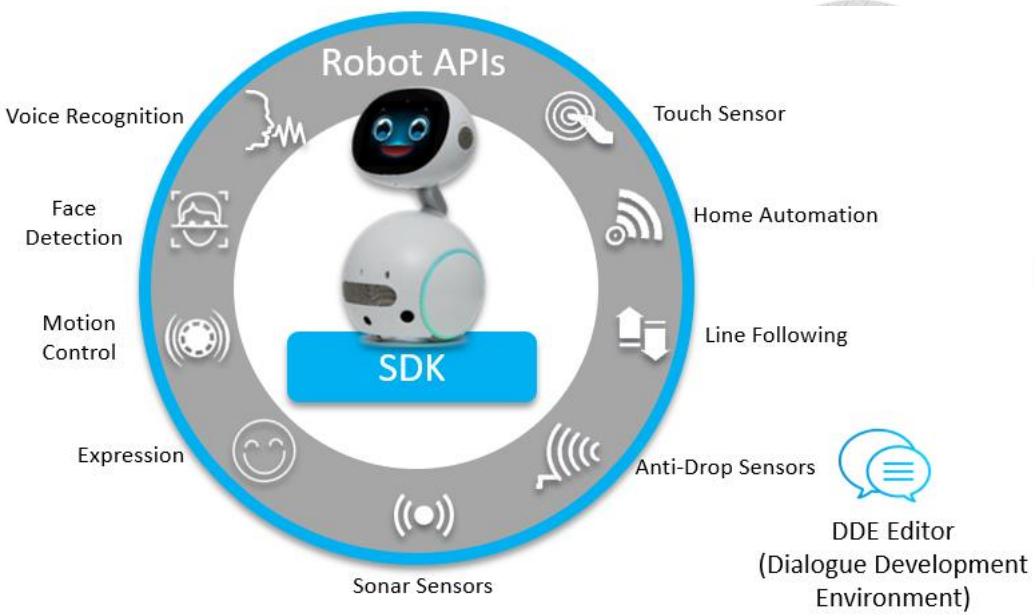

Figure 5.2.2-1 Zenbo software development kit

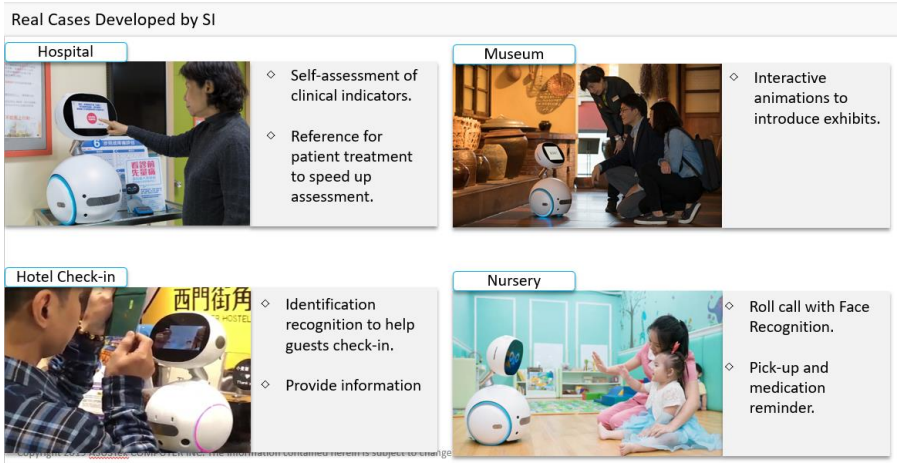

Figure 5.2-2 Zenbo B2B opportunities

5.3 Limitation and Future Work

Based on the survey data we collected, the interviewees are the parents; however, Zenbo's target audiences also include the children and elderly. In the future study, the interviewees should also include each target audiences.

Also, Zenbo's business strategy and business model should be modified include

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the price along with the re-position. Lastly, the artificial chip can take consideration for Zenbo future development to fit in the competitive robot market.

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REFERENCE

- SRA Research Group. (2014). *Seniors and Aging.* Retrieved from http://www.sra-researchgroup.com/core-competencies/seniors-and-aging/
- Markets and Markets. (2019). *Household Robots Market Global Forecast.* to 2024 Retrieved from https://www.marketsandmarkets.com/Market-Reports/household-robot-market-253781130.html
- World Health Organization. (2018). *World Health Statistics Data.* visualizations dashboard – Adolescent birth Retrieved from http://apps.who.int/gho/data/node.sdg.3-7-viz-2?lang=en
- Pew Research Center. (2015). *Family Support in Graying Societies.* Retrieved from https://www.pewsocialtrends.org/2015/05/21/family-support-in-graying-societies/
- Zenbo User Profile. (2016). *Google Analytics on Zenbo Official Website.* https://zenbo.asus.com/
- Taiwan Executive Yuan. (2019). *AI Taiwan Action Plan 2019.* Retrieved from https://english.ey.gov.tw/News3/9E5540D592A5FECD/1dec0902-e02a-49c6-870d-e77208481667
- Jibo Product Information (2019). Retrieved from https://www.jibo.com/
    - Kebbi Product Information. (2018). Retrieved from https://www.nuwarobotics.com/
    - Robelf Product Information. (2018).

doi:10.6342/NTU202000213

Retrieved from https://www.robelf.com/

- ADATA Arobot Product Information. (2017).

  Retrieved from http://robotics.adata.com/tw/

- Porter, M. E. (2008). *The Five Competitive Forces that Shape Strategy.*

  Retrieved May 4, 2015, from Harvard Business Review

  https://hbr.org/2008/01/the-five-competitive-forces-that-shape-Strategy

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APPENDIX

Survey Questionnaire on Zenbo User Experience in Taiwan

No.	Question
1	What is your gender?
	Male Female
2	When do you spend time with Zenbo?
	06:00-12:00 12:00-18:00 18:00-24:00 00:00-06:00
3	How long do you spend time with Zenbo?
	Less than 30 mins 30 mins - 1hour 1-2 hours More than 2 hours
4	Which Zenbo's features you like to most?
	Music Voice Recorder Reminder Recipe Youtube Smart Home Shimajiro (巧虎跟我玩) Camera Photo Album Hospital Registration News Shopping Social Media Weather Timer Alarm Clock Clock Stop Time Scratch Story

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	Video Call Browser Calculator Voice Memo
5	What is your motivation to purchase Zenbo? (multiple choices)
	Companion for children New product to tryout Companion for elderly As a gift/ present To make life more convenience
6	Who use Zenbo most often?
	Purchaser Pre-schooler Elementary Students Elderly Other family member Others
7	Which Zenbo's features do you think are difficult to operate? (multiple)
	None Initial Setting Map Building Voice Recognition Video Call User Interface Remote Control Smart Home Other

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