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Pratik Tarafdar
XLRI—Xavier School of Management, pratik_tarafdar@yahoo.com

Indranil Bose
NEOMA Business School, indranil_bose@yahoo.com

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How Should Mydbots Manage Innovations in Consumer Robotics?

Pratik Tarafdar
XLRI—Xavier School of Management, Delhi-NCR
pratik_tarafdar@yahoo.com

Indranil Bose
NEOMA Business School
indranil_bose@yahoo.com

Abstract:

A Malaysia-based firm Mydbots entered the high-technology market with its digital innovations in consumer robotics space. The impending challenges the firm faced included making the technology ready for the market, developing consumers' mindset to adopt the technology, and planning the vision and diffusion of future product innovation. By meeting these challenges, it planned to emerge as a leader in consumer robotics. The case expects students to critically analyze the firm's background and the prevailing market conditions to propose a comprehensive approach that can help the firm convert its innovation vision to innovation diffusion in the high-technology space. The case study intends to initiate a meaningful discussion among students about how to manage robotic innovations in consumer markets by overcoming the associated technological and marketing challenges.

Keywords: Consumer Robots, Digital Innovation, Emerging Technologies, High-technology Innovation, Robotic Innovation, Robotics, Teaching Case.

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1 December, 2019, Mydbots Office, Kuala Lumpur

Gary Yeoh relaxed in his office while sipping a cup of tea. He reflected on how his company had developed into a full-fledged robotics company after struggling for years. He remembered the time when Mydbots had adopted automation technologies with a plan to prosper in the industrial space. In particular, the company focused on robotic process automation for work in industrial manufacturing by using artificial intelligence (AI) to develop industrial software solutions. Since the market had become highly saturated due to large industrial leaders, he had to leave the industrial automation technology field. At that time, robotics had begun to gain traction in the consumer space with players such as Ecovacs Robotics from China, iRobot, and Neato Robotics from the United States leading the global market. Yeoh saw an opportunity to use his company's expertise in robotic process automation, and Mydbots concentrated all its resources toward developing domestic robots. In 2014, Yeoh envisioned opportunities to develop Mydbots as a robot brand not only in Malaysia but also worldwide. Today, Mydbots represents a key player in the robotics market.

Mydbots built itself as the Malaysian consumer robot brand that disrupted the market for floor cleaners, window cleaners, lawn mowers, and so on. In a press conference, Yeoh relived his journey at Mydbots through his storytelling. At the end of the conference, he faced the most anticipated question: "What was the biggest challenge that could hinder the growth of Mydbots in the future?". Yeoh remarked in a thoughtful voice:

> *Robots in the consumer world occupy the high technology space. The major challenge that we are facing is to diffuse such high technologies in the mainstream market. The difficulty is to build easy-to-use front-end interfaces and develop the consumer mindset so that they adopt the technology and realize its potential. This involves two-way communication. We need to understand the market needs and align our product innovations accordingly. At the same time, we need to educate our customers through an integrated, innovative, and transparent channel of marketing communication.*

Yeoh believed that the company should continuously invest in research and make products that outperform the competition, but he did not know the right execution strategy that balanced innovation with marketing to follow to become the market leader in this space.

2 Types of Consumer Robots

Consumer robotics dates back to the early 1960s when the American animated sitcom, The Jetsons, featured Rosie, the robotic maid. Subsequently, popular Hollywood blockbusters such as I-Robot, Star Wars, Transformers, Wall-E, Bicentennial Man, and many others began to introduce consumer robotics to the world. Popular science fiction and media ideated consumer robots that provide assistance in daily chores. In the year 2007, Bill Gates (2007) heralded the onset of the consumer robotics era and paralleled it with the personal computer industry back in the 1970s. Tractica reported that consumer robots had reached US$3.8 billion in worldwide sales 2016 and expected that the market would expand and attain a market value of US$13.2 billion by the end of 2022. The organization also forecasted that the number of consumer robot shipments worldwide would increase greatly from 10 million in 2016 to 50.7 million units annually by 2022 (Sahi & Kaul, 2017). Figure 1 provides more details about the growth of consumer robotics over the years.

Consumer robots comprise various robots designed and developed for domestic activities. They assist humans in their daily tasks at home and in the office. The robotics industry has always focused on industrial robots. However, recently, we have seen renewed interest in consumer robots due to rapid technological advancements in AI, sensors and actuators, and hand-held computing devices such as smartphones, tablets, and laptops. One can broadly classify consumer robots into four different categories based on their applications (Frost & Sullivan, 2016b): 1) personal and educational robots, 2) domestic and task robots, 3) security and surveillance robots, and 4) social and home robots.

First, personal robots serve as personal assistants that help people with their daily tasks, such as scheduling meetings or calls, providing reminders about essential tasks, generating recommendations for a better lifestyle, collecting information and enhancing one's knowledge for the task at hand, and so on. Example personal robots include office assistant robots and therapeutic robots. Similarly, educational robots assist students by providing a better learning experience. They provide different toolkits for educational purposes and adopt different teaching practices to enable students grasp the subjects easily.

They also provide effective educational assistance to children with special needs. Such robots include coding robots and laboratory robots.

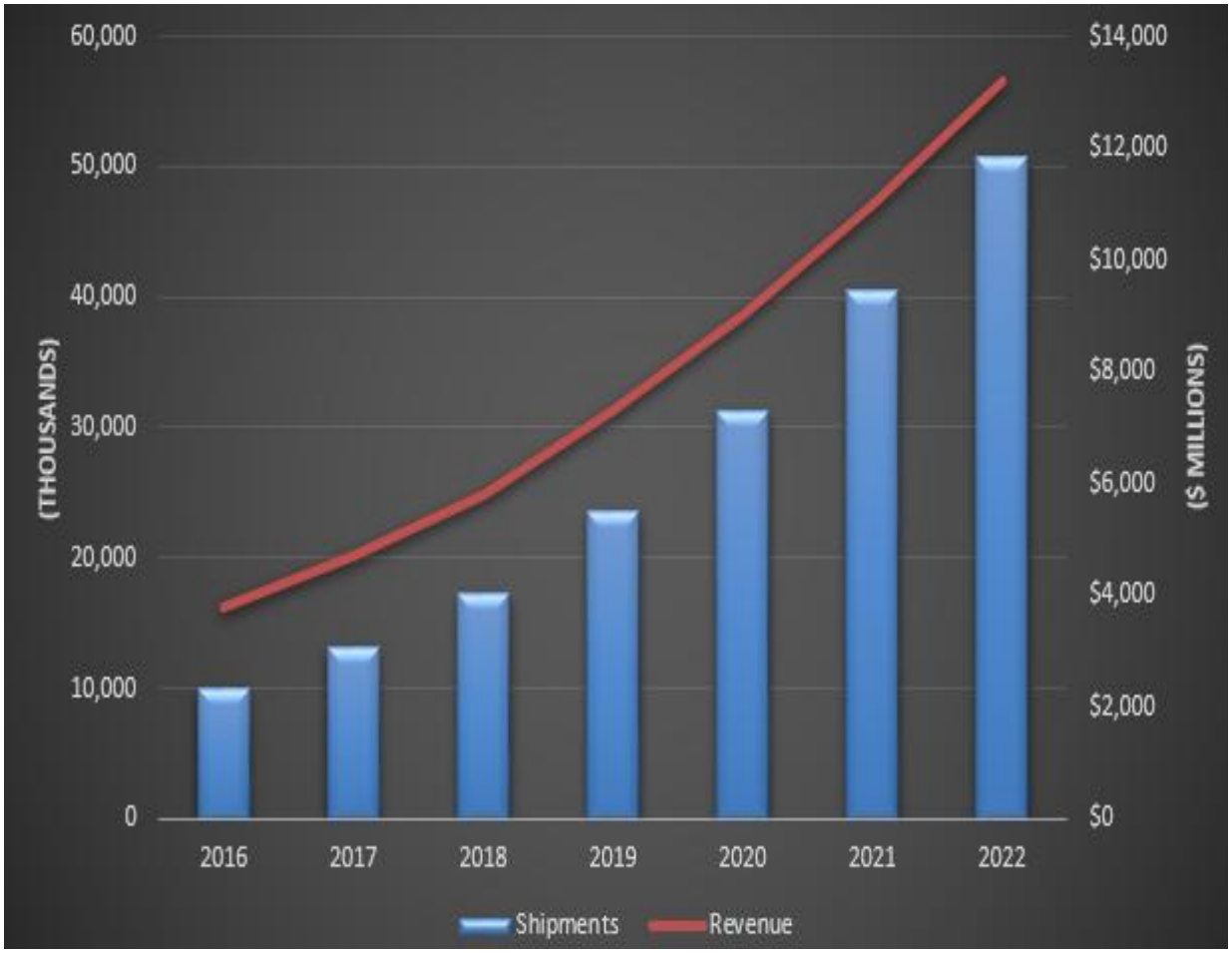

Figure 1. Revenue and Shipments for Consumer Robotics in the World Market: 2016-2022 (Sahi & Kaul, 2017)

Second, domestic and task robots perform household chores such as vacuuming, cleaning (floors, windows, and swimming pools), gardening, and cooking. These robots perform tasks in an operationally and economically efficient manner. With the advancements in technology, domestic and task robots can conserve environmental resources (such as electricity, water, etc.) and effectively build a sustainable ecosystem. Such robots include vacuuming robots, kitchen robots, mowing robots, and pool-cleaning robots.

Third, security and surveillance robots ensure safety by alleviating security threats. They monitor homes, offices, and other building spaces to detect any anomalies and report them to users. For example, they can sense problems such as fire, burglary, and other incidents and alert the concerned authorities (such as fire department and police station) to deal with them. Such robots include consumer unmanned aerial vehicles and robot supervisors.

Fourth, social and home robots have the capability to socialize with humans. They interact and communicate with people and execute several roles in the home (such as security personnel in a house, an entertainer during leisure hours, a maid in a kitchen, and a teacher for a student). Social and home robots can hear, see, and speak to provide human-like assistance in social relations. Such robots include toy robots and robot friends. Figure 2 provides details about shipments in the consumer robotics industry according to robot type. The figure also showcases the global demand for each robot category.

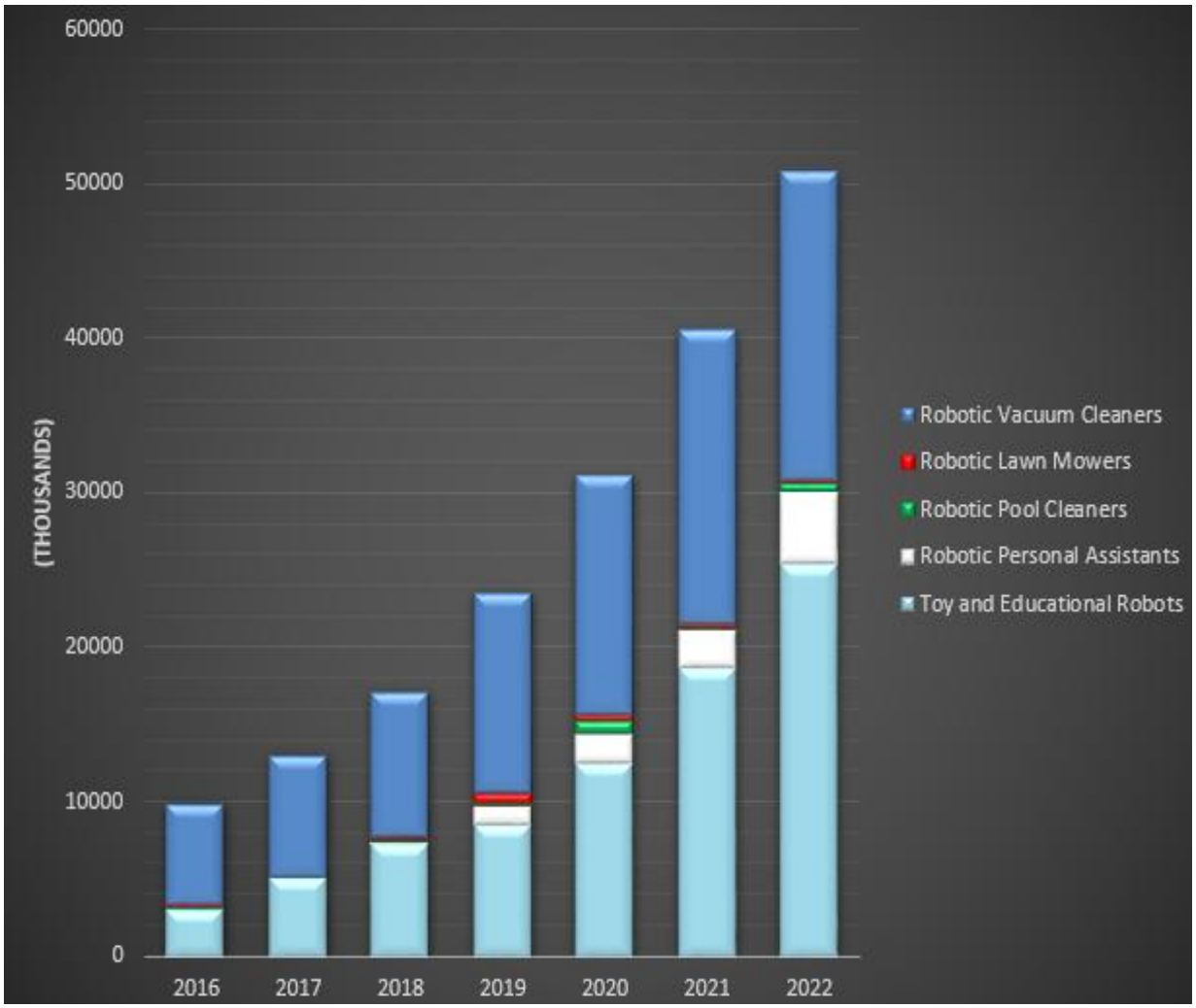

Figure 2. Shipments of Different Type of Consumer Robots in the World Market: 2016-2022 (Sahi & Kaul, 2017)

3 Competitive Landscape of Consumer Robotics

3.1 North America

North America constituted the largest market for consumer robots in the world. Similarly, it had a high level of development in consumer robotics and a high level of adoption among consumers. A large number of American households used task-based robots to support their everyday activities. The culture of embracing innovations and entrepreneurship provided an impetus for organizations to design and develop new robotic technologies in the US. Some key players in the consumer robotics market in this geography included iRobot Corporation and Neato Robotics.

MIT roboticists Colin Angle, Helen Greiner, and Rodney Brooks founded iRobot. It had sold more than 20 million robots worldwide. It had deployed robots to unfold mysteries about the Great Pyramid of Giza, found harmful subsea oil in the Gulf of Mexico, and saved lives in areas of conflict and crisis (Robot, n.d.). In 2002, iRobot entered the consumer robotics space with Roomba, the floor vacuuming robot. In 2015, after a series of versioning, it introduced Roomba 960, with intelligent visual navigation and cloud-connected app control, to the market. It could vacuum continuously for up to 75 minutes. In case the battery ran out, it automatically recharged itself from a power source and resumed its task. With advanced technological attributes embedded in it, it operated much more efficiently than similar products on the market. This advanced robotic solution has attained a large-scale adoption since its launch.

Joe Augenbraun, J. B. Gomez, and Linda Hirschhorn Pouliot ideated Neato Robots in Stanford's Annual Entrepreneur Challenge (Daigneault, 2017). However, in 2017, Germany's Vorwerk Group acquired Neato

Robotics in order to dominate the consumer robotics market in Europe. Neato Robots launched its first product in 2010. An intelligent laser guidance system constituted Neato robots' most distinguishing characteristic. In 2015, it launched Wi-Fi enabled Botvac Connected Series vacuum cleaning robot that it integrated with its patented LaserSmart Mapping technology that continuously scans room distance and transmits signals to help robots make movement decisions (Frost & Sullivan, 2016b). The robot could recharge automatically by docking itself in the charging base and adopted the company's proprietary D-shape to reach sharp corners. Its proprietary technologies proved worthwhile in performing household chores efficiently and boosted its adoption rate.

3.2 Europe

Market analysts considered Europe the emerging market in the consumer robotics industry. While Germany constituted the largest industrial robot market in Europe, the consumer robotics market had begun to advance towards technology development and technology adoption at the same pace. Sources estimated the domestic robotics market to have grown to more than €10 billion in 2020 from €3 billion in 2016 (Sparc, 2016). Domestic robots experienced double-digit growth in sales per annum in Europe. iRobot Corporation dominated the domestic vacuum cleaner market. However, the U.K.-based company Dyson that entered the market in 2016 had slowly begun to gain market share.

James Dyson founded Dyson in 1987 ("Dyson (company)", n.d.). This company came into existence with James Dyson's first bagless vacuum cleaner. Since then, it had made significant progress in advanced engineering solutions and come up with innovative products in the household appliance domain such as vacuum cleaners, hand dryers, bladeless fans, heaters, and hair dryers. In 2016, it launched Dyson 360 Eye, a robotic vacuuming solution integrated with an advanced 360-degree view panoramic camera system to better map rooms and detect obstacles. Dyson 360 Eye marked Dyson's entry into the consumer robotics space in Europe. The product received several positive reviews from its users, and the company planned to develop several other advanced robotic products for domestic tasks.

3.3 Asia Pacific

The Asia-Pacific region in general and countries such as China, Japan, and Korea in particular contributed significantly to technological advancements in consumer robotics. However, in comparison to North America, consumers in the region adopted robotics at a much lower rate. Though Japanese, Chinese, and Korean households keenly adopted consumer robotics, countries such as India, Indonesia, and Malaysia did so to a much lesser degree. Many organizations expected developing economies such as India and Malaysia to embrace consumer robotics in a big way in the future. Ecovacs Robotics from China and Milagrow Humantech from India constituted two market leaders in the Asia-Pacific region. They played an important role in infusing the robotic culture for domestic assistance in the markets in which they operated.

Ecovacs Robotics, which Qian Dongqi founded in 1988, was a Chinese technology company. Initially, the company operated as an original equipment manufacturer under the name TEK Electrical Co. However, in 2006, it rebranded itself to Ecovacs Robotics ("Ecovacs Robotics", n.d.). It focused on developing, designing, manufacturing, and selling robotic home appliances. It became the best-selling brand in China with a 65 percent market share, and its market share for robotic vacuum cleaning increased from five percent to 26 percent in the Asia-Pacific region within three years. In 2017, Euromonitor International declared Ecovacs Robotics the market leader in robotic vacuum cleaners in the Asia-Pacific region. In 2007, Ecovacs Robotics launched its first floor-cleaning robot, the DEEBOT 5 series, which underwent various changes to become DEEBOT M85. The company integrated DEEBOT M85 with its proprietary SMART MOTION technology for advanced floor cleaning. The company also gave it anti-drop sensors (to avoid falling while cleaning elevated spaces) and anti-collision sensors (to detect objects and obstacles). DEEBOT M85 created a widespread impact in the market by the end of 2018.

Milagrow Humantech, which Rajeev Karwal founded in 2011, was an Indian robotics company. It had the largest share in the Indian consumer robotics market. In 2012, Milagrow launched its first and best home cleaning robot in India named RedHawk, which marked the beginning of the company's journey in the consumer robotics space. Among its product portfolio, Aquabot 5.0, India's first wet-mopping and dry-cleaning robotic vacuum cleaner, proved popular among consumers. This robotic solution used the company's proprietary fifth-generation robotic software and came equipped with the water-washable high-efficiency particulate arrestance (HEPA) filter to remove tiny hazardous particles such as radioactive particles and pollen dust greater than 0.3 microns (Frost & Sullivan, 2016b). Apart from Aquabot 5.0,

Milagrow's Wheeme, the world's first body massaging robot, gained high popularity after its launch in Las Vegas at the Consumer Electronics Show 2013. Table 1 provides some details related to the robotics companies that we mention in this section. Table 2 provides the financial data for the publicly listed companies.

Table 1. Details of Some Robotics Companies Around the World

	iRobot	Neato	Dyson	Ecovacs	Milagrow Humantech	Mydbots
Founded	1990	2005	1991	1998	2011	2014
Location	United States	United States	United Kingdom	China	India	Malaysia
Parent company	-	Vorwerk, Germany	-	-	-	-
Number of employees	1,032	129	> 12,000	> 5000	> 50	> 80
Number of patents	820	19	> 1,600	>800	-	8
Product categories	Robots for home, defense and security, healthcare, and workplace collaboration	Robotic vacuum cleaners	Robotic vacuum cleaners, hair care, hand dryers, and lighting devices	Robots for home entertainment and security	Robots for home, body massage, and educational purposes	Robots for home and educational purposes
Public/ private	Public	Private	Private	Public	Private	Public

Table 2. Income Statements for Publicly Listed Robotics Companies (All Values in Million US$)

	iRobot			Ecovacs			Mydbots		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Revenue	660.60	883.91	1092.58	458.75	682.65	854.05	81.21	107.62	201.11
Cost of revenue	341.29	450.75	537.16	303.34	432.91	530.87	70.32	84.89	152.35
Gross profit	319.32	433.16	555.43	155.41	249.75	323.18	10.89	22.73	48.76
R&D	79.81	113.15	140.63	2.56	18.11	29.87	0.87	1.12	3.23
Selling/general/admin. expenses	181.95	246.88	307.91	137.66	150.12	203.66	7.34	12.42	23.13
Operating expenses	603.05	811.22	986.76	449.27	614.83	772.17	80.14	99.23	181.43
Operating income	57.56	72.69	105.82	9.48	67.83	81.88	1.07	8.39	19.68
Net income before taxes	61.36	76.37	108.62	11.60	68.23	84.32	1.51	8.92	20.01
Net income after taxes	41.94	62.86	90.12	7.40	56.22	72.77	1.28	7.58	16.95

4 Mydbots

In 2008, Yeoh served as the Chief Information Officer for a business consultancy firm, Automasi. At that time, he decided to embark on the entrepreneurship path and build a company from scratch all by himself. In 2010, he founded Mydbots Analytics in order to provide end-to-end analytics and automation solutions to the industrial technologies for growth-seeking micro, small, and medium-sized businesses. At the end of 2014, he identified the emerging market of robots and foresaw opportunities in consumer robotics. He renamed his company Mydbots and focused his attention on manufacturing domestic robots. In 2015, Mydbots launched its first home cleaning robot in Malaysia, which marked the company's foray into the consumer robotics space. The company's robot portfolio comprised vacuum cleaner robots, lawn-mowing

robots, window-cleaning robots, and educational robots. Speaking about the product portfolio owned by Mydbots, Yeoh remarked:

> *We have established ourselves as a popular Malaysian brand in consumer robots with no tough competition in the local market. We hold a market share of 55 percent in the space of floor-cleaning and window-cleaning robots with the widest range of products in each category. Our in-house research and development develops the software and automated solutions with several customizations.*

Figure 3 shows the different robot types that Mydbots offered to its consumers. In its product portfolio, Eagle 4.0, Malaysia's first wet-mopping and dry-cleaning robotic vacuum cleaner, impacted the market quite intensely. Eagle 4.0 included several advanced sensors such as infrared sensors for detecting the robot's path and gyro sensors to manage the robot's rotational movement. Apart from Eagle 4.0, the lawn-mowing robot RedEye also gained popularity after its launch. RedEye used Mydbots' patented technology to manage complicated mowing patterns that arise from gardens' complex layout (e.g., due to bushes, changes in elevation, and other structures). Its advanced operating algorithms could consider all aspects of a garden's features before mowing it. RedEye received major customer appreciation, and one customer reviewed the product in the following manner:

> *At first, I thought it was a beautifully designed toy, but my wife said that she wanted to use it. I am glad that we did not return it. After about two months of usage, the laborious task of mowing the lawn was taken care of without any supervision. The RedEye from Mydbots eliminated the tedious and mundane household chore.*

With its wide range of domestic consumer robots, Mydbots created a strong market presence, particularly in Malaysia (see Table 2 for its financial performance over the years). However, to grow continuously and expand its customer base, the company needed to ramp up its product innovation and strategize marketing to continue its growth trajectory.

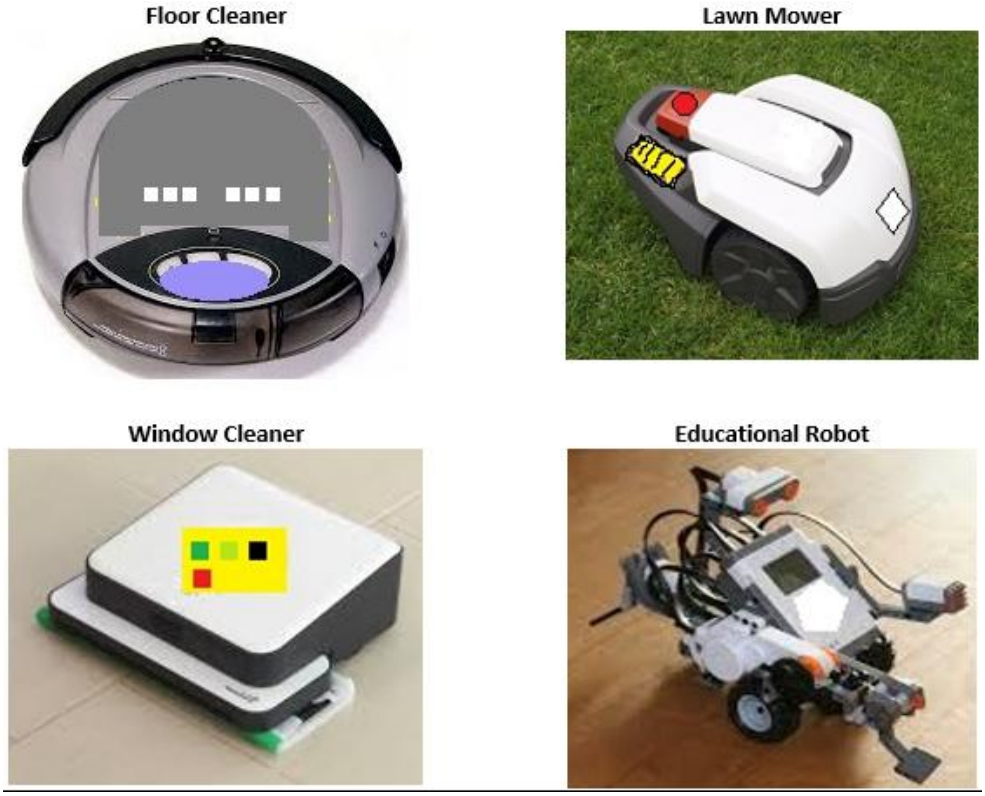

Figure 3. Types of Robots that Mydbots Sold

5 Innovation towards a Digital Ecosystem

The fourth industrial revolution or Industry 4.0 characterizes the widespread adoption of cyber-physical systems or smart systems in industries through increased automation and data exchange. Cyber-physical systems represent:

> *A new generation of systems with integrated computational and physical capabilities that can interact with humans through many new modalities. The ability to interact with and expand the capabilities of the physical world through computation, communication, and control is a key enabler for future technology developments.* (Baheti & Gill, 2011, p. 161)

These systems also influence consumers to engage with digitally connected products. The growth of cyber-physical systems is shaping a digital ecosystem through the continuous innovation and development of robotics technology. Figure 4 illustrates this trend based on patents in consumer robotics across different countries. Mydbots aimed to join and, more preferably, drive this ecosystem.

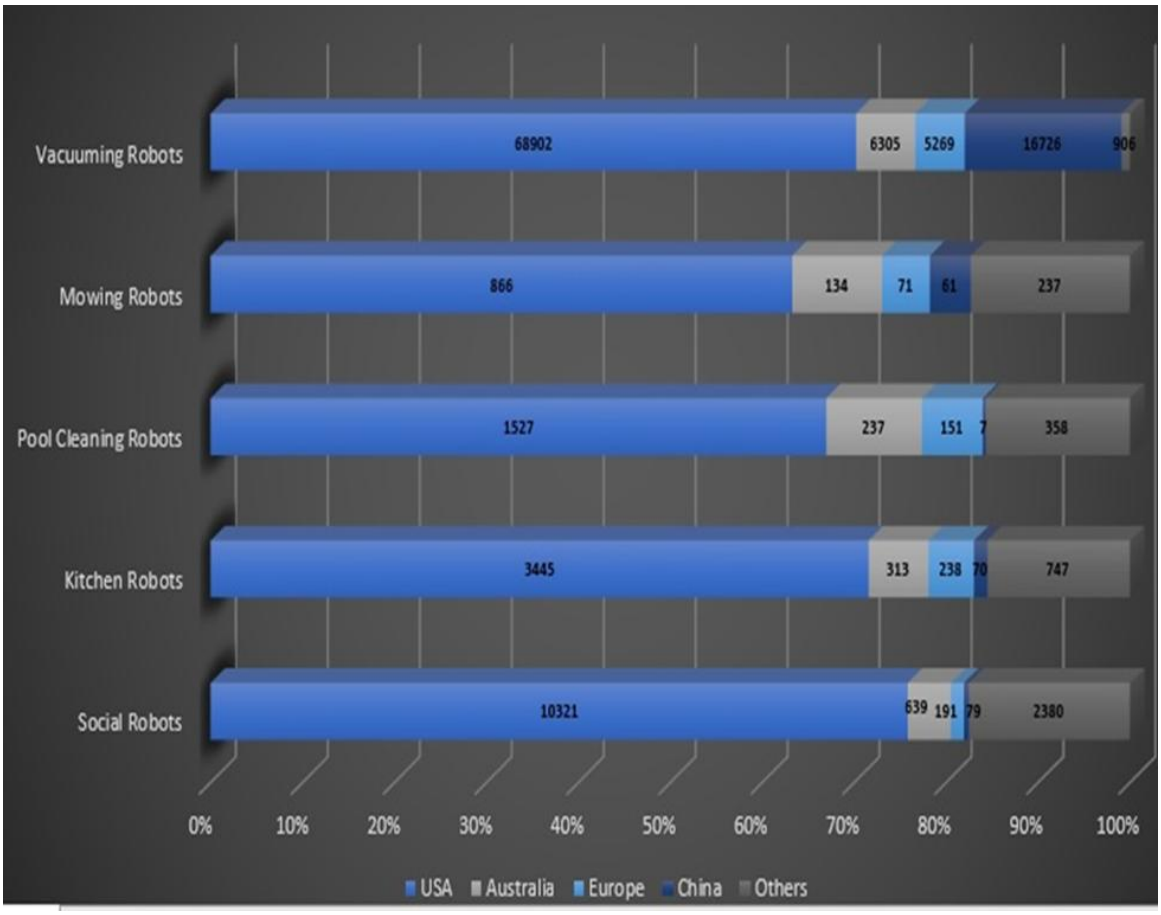

Figure 4. Patent Filing Trends of Consumer Robotics, 2006-2016 (Frost & Sullivan, 2016a)

Mydbots' efforts to incorporate Alexa Google Voice and the Internet of things (IoT) into its floor-cleaning robots exemplified the company's move towards digital innovation. While reflecting on the recent technological innovations that Mydbots brought to the market, Yeoh remarked:

> *In order to facilitate voice interactions, we incorporated Alexa and Google Voice features in our robots. In the category of lawn-mowing robots, we featured IoT abilities where the robot can communicate the task status on the mobile phone. It can show how much work has been done and how much is still left. In the category of floor-cleaning robots, we installed sensors for detecting anomalies in the home atmosphere, such as temperature rises, gas leakages, humidity, and so on.*

Mydbots had put in a strong and dedicated effort into creating innovative products and aligning itself with current trends in technology. The ubiquitous mobile Internet and the proliferation of handheld computing

provided the integrated platform for seamless communication between robotic devices. The consumer robotics industry had seen a gradual trend for various operational technologies to converge into an interconnected ecosystem. This trend allowed Mydbots to integrate its robotic devices with its various smart home solutions, which gave rise to an eco-friendly and user-friendly digital ecosystem.

Research and development (R&D) played a critical role in Mydbots. The R&D team recognized the market trajectory and could predict the future drift. Speaking about the IoT's role in digital transformation, Robert Hadees, Head of R&D at Mydbots, remarked:

> *When the intelligent personal assistants such as Amazon Alexa, Google Now, Microsoft Cortana, and Apple Siri started their endeavor to enter the home ecosystem, I had anticipated the move. Before their launch in Malaysia, we immediately partnered to integrate our products with their smart home solutions. We have been very proactive when it comes to a transformation to the digital ecosystem. Our customers will be mostly digitally driven, and we see these strategic alliances as the natural evolution of the entire robotic ecosystem.*

Mydbots categorized its product development into three separate streams: new product development (NPD), product improvement (PI), and service-level improvement. While NPD denotes the product development from scratch, PI denotes cases such as improving floor cleaners' the suction efficiency, carving out space for a bigger dustbin, making sensors efficient in detecting obstacles, and so on. Service-level improvements focus on a product's long-term reliability. The R&D team at Mydbots put a focused effort on each stream to make its technology ready for the market. The advent of technologies such as cloud computing, machine learning, 5G, natural language processing, computer vision, gesture controls, and speech recognition has contributed to higher productivity, better ease of use, higher user acceptance, and lower purchase and maintenance costs. One can achieve major technological innovation in consumer robotics through the developments in the robotic ecosystem's four pillars: 1) artificial intelligence, 2) information communication technology (ICT) and cloud computing, 3), mobile and 4) simultaneous localization and mapping (SLAM). We discuss each pillar in turn.

5.1 Artificial Intelligence (AI)

AI has the potential to supplement R&D initiatives that focus on improving household robots' cleaning efficacy and performance. Speaking about his own vision for AI-powered robotics, Hadees remarked:

> *The future of robotics is AI. It will teach the machine to adapt to the environment without the customer's intervention. For example, a machine would identify the high-dirt areas and schedule to clean it twice for better efficacy. It is an adaptive behavior powered by machine intelligence.*

AI also plays an instrumental role in allowing organizations to develop cognitive capabilities in robots for real-time communication with users through chats or voice-powered applications and, thereby, create robots that offer a highly personalized experience.

5.2 Information Communication Technology (ICT) and Cloud Computing

Cloud computing and advanced communication technologies can enhance user-machine and machine-machine interaction in robotic systems. With advances in cloud computing infrastructure, organizations now have a better ability to use remote computational resources to drive consumer robots (known as cloud robots). Goldberg and Kehoe (2013) have described cloud robotics as "a new approach to robotics that takes advantage of the Internet as a resource for massively parallel computation and real-time sharing of vast data resources" (p. 1). Cloud robotics can be the catalyst for various innovations in mainstream consumer robotics. Also, when 5G appears in future, network capacity will increase, which will boost next-generation technologies such as intelligent robotics. 5G can provide download speeds of nearly 10,000 Mbps and much lower latency than 4G. It will have a peak downloading rate of more than 10 Gbps, one million connections per square kilometer, and less than one millisecond end-to-end delay (Frost & Sullivan, 2017). Therefore, 5G will certainly bring a paradigm shift in robotic innovations through efficiency in both human- and machine-centric communication and expand the cloud ecosystem computational paradigm.

5.3 Mobile

For users to widely adopt consumer robots, such robots need mobility, to integrate and connect with other devices, and to be easy to interact with. Thus, to serve customers' needs, a robotic innovation requires

mobile applications and software development efforts that support advancements in technology. Moreover, since mobile devices continue to increasingly integrate with consumers' daily routine activities, robotics companies need to develop mobile applications to ensure that robots can seamlessly communicate with the connected ecosystem and deliver value to the customers.

5.4 Simultaneous Localization and Mapping (SLAM)

Localization (i.e., how a robot determines its position and context with respect to the environment) constitutes a difficult process in robotics. To adapt to the environment and reach a high degree of autonomy, a robot builds a map using its sensors for localization and performs its assigned tasks. The research progress in SLAM will greatly impact the robotics field. Visual SLAM represents one major breakthrough in SLAM in terms of cost and performance improvement: it uses low-cost camera and optical encoders to reduce the localization cost by two to three orders of magnitude (Pirjanian, Karlsson, Goncalves, & Di Bernardo, 2003). It represents a breakthrough technology for consumer robotics because it can significantly improve the performance through visual information in cluttered environments such as homes and office buildings where range-based SLAM techniques generally fail. To elaborate, Hadees envisioned:

> *Visual understanding is one of the big things in consumer robotics. For example, at the present moment, a floor-cleaning robot learns to avoid all objects and covers the entire floor space. However, with time, we want it to have more intricate understanding about different objects which will open up the opportunity for intelligent cleaning, like dusting. If you instruct the robot to dust a coffee table and not a Ming vase, it should be able to differentiate between the coffee table and the Ming vase.*

A firm with superior and new technologies needed to emphasize innovation. Figure 5 shows Mydbots' innovation vision. However, managing the path to digital innovation in consumer robotics and making the customer aware of their value proposition constitute critical factors that firms needed to focus on. Mydbots did not represent an exception in this regard.

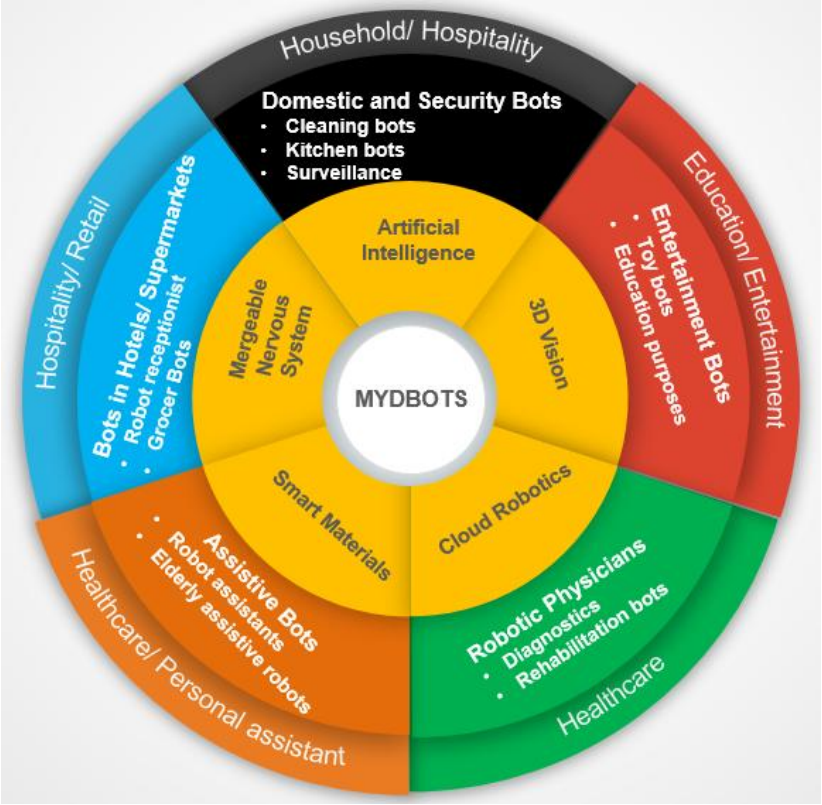

Figure 5. The Vision of Innovation at Mydbots

6 Integration of R&D and Marketing for Diffusion of Innovation

Yeoh noted:

> *At this present moment, the buyers of domestic robots mostly resemble the early adopters of technology. They are well read and possess sufficient technical proficiency. So, it is important for marketers to be knowledgeable and invest in their continuous knowledge to cater to such clients. The sellers should have the perspective of the buyers to bridge the chasm of understanding between them. We ensure pre- and post-sales demo of our product by our cross-functional teams in order to handle such problems.*

This statement indicates that designing and implementing marketing programs played an important role in understanding why consumers adopted high-technology products. Convincing consumers to accept a product entails changing their mindset about purchasing and using it. A major factor that impedes efforts to commercialize robots concerns users' reluctance to give control to such robots to perform domestic chores. Also, the significant costs associated with adopting and maintaining such robots adds to the challenge. Technologically innovative products (in this case, consumer robots) initially appeal to technology enthusiasts who feel excitement about new technology or to individuals who adopt and help promote such products early on. Accordingly, Mydbots focused on marketing programs and marketing channels to reach out and to communicate with such individuals. Mydbots' marketing channels constituted ecommerce, personal retail websites, retail chains, exclusive showrooms, and direct marketing. Figure 6 shows robotic vacuums and robotic lawn mowers from different brands in display at one retail store in Malaysia.

Figure 6. Robotic Vacuum Cleaners and Robotic Lawnmowers on Sale at a Retail Outlet

The direct marketing channels constituted the most suitable for reaching out and communicating with customers. Yeoh added:

> *Over time, we realized the direct selling model would be much more effective. Our marketing team can understand the consumer psyche much better when they can meet them in person. Sometimes, knowledge about consumers' living space can also help the marketing team understand how consumers will use a robotic product.*

Mydbots organized pre- and post-sales product demonstrations. It prioritized paid demonstrations in particular. While responding to the demo requests, the company meticulously profiled customers and examined their demographics, past purchases, and interests in order to identify serious customers who would invest in new technology and appropriately respond to her needs. Mydbots wanted to reduce its marketing and customer-conversion costs.

Mydbots identified the hospitality industry as more receptive to their robots than any other industry. Several hotel chains expressed openness to new ideas and technologies to curtail their operational and maintenance costs. To throw light on the direct marketing approach for such business-to-business (B2B) customers, Sophia Megat, Business Head of Mydbots, commented:

> *We identified the product opportunity in the hospitality sector. Several hoteliers showed genuine interest in our products. In order to expand our reach, we established a one-to-one connection with all the hotel chains and individual hoteliers through digital platforms such as LinkedIn, Facebook, and hotel websites. The results were truly magnificent. Our products and services got major appreciation.*

In parallel with executing the direct marketing model, Mydbots put in a significant effort to integrate its marketing R&D department. The company's engineers and marketers interacted continuously during the product development process. Hadees elaborated on the interaction between marketing and R&D at Mydbots:

> *For new product development, we ensure collaboration with the marketing team. For example, while designing a new schema robot, we brainstorm what could be an important feature to market it. This particular feature becomes an engineering requirement. With this collaborative nature of work between the two departments, we do not end up designing in a vacuum, and we do not end up designing a product no one wants.*

Mydbots' customer relationship management (CRM) system efficiently maintained business relationships with customers and retained them by responding to their problems in a timely manner throughout the customer lifecycle. Mydbots conducted customer-visit programs systematically and ensured that the customers continued to use their products. These visits allowed the company to gather intelligence about the customer experience with its products and align its product innovation with the prevalent market sentiment. Mydbots visited its customers with cross-functional teams so that it could disseminate customer intelligence systematically across all functions. Vincent Jeffrey, Service Manager at Mydbots, headed the sales division. He had come to deeply understand the sales and after-sales services for consumer robotics. He elaborated:

> *We have always put effort into understanding our customers. We tried to educate them when we felt they are not able to accept the technology. We made frequent customer visits to listen to their issues. Subsequently, personalized training and knowledge sharing helped them cope up with problems. In the process, we also came to know the demands of several customers. It helped us rethink our product concept and orient it according to the market needs.*

From understanding the consumer robot market, Mydbots realized that it needed to create robots that interoperated with one another in order to integrate them into home automation technology networks. In the future, smart homes will adopt an ambient intelligence paradigm and provide useful services to consumers in their current context. Rather than treating a robot as a single entity, Mydbots focused on interoperable robotic products to ensure it could provide ubiquitous services via collectively enhancing the degree to which the robots could understand users' context. Jeffrey remarked:

> *With time, we have found that we need to integrate home robotics products to survive and stay relevant in the smart home ecosystem. Essentially, the robots should start communicating with each other to complement their services. For example, the robotic vacuum cleaner can sense a home internally, while the robotic lawn mower can sense the home externally. Both should*

be able to communicate any contextual anomalies to the surveillance robot for its immediate action.

Therefore, the product development at Mydbots needed to follow a service-dominant logic perspective that focused on value co-creation through an integrated set of service robots. It would need to rely on AI, ICT, and mobile technologies to achieve this purpose. Figure 7 provides a schematic representation of the underlying architecture for an integrated home robotics ecosystem.

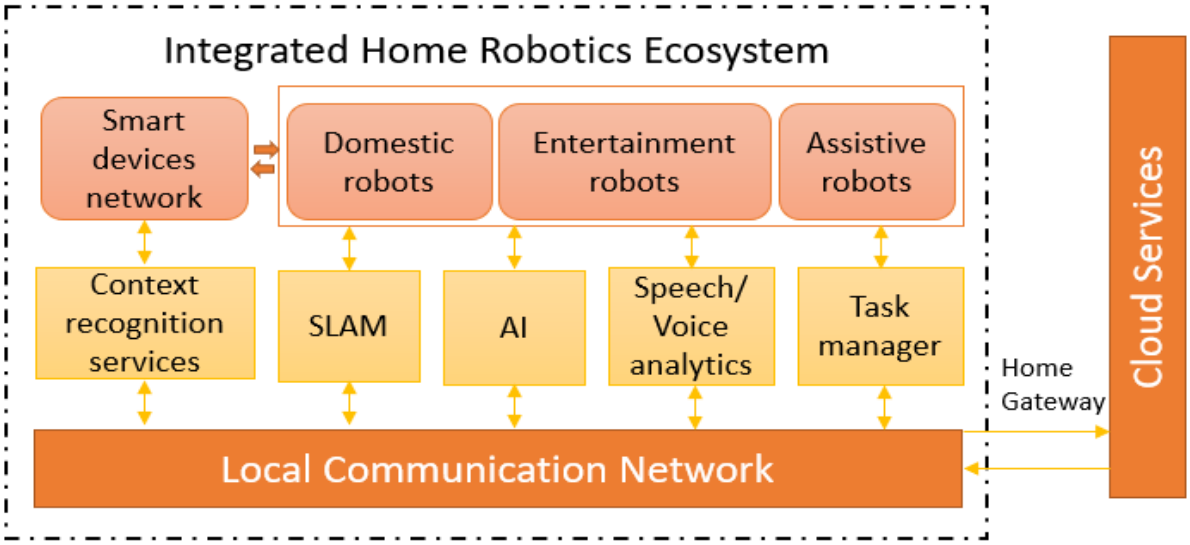

Figure 7. Conceptual Architecture for the Integration of Robots into a Network of Home Automation Technologies

7 What's Next

Organizations face numerous challenges in consumer robotics. Mass consumer products have pricing constraints and, thus, typically have lower price ranges. Managing a robot's hardware requirements in this budget poses a challenge. The R&D unit at Mydbots needed to think about developing new mechanisms and technologies that could work with low-cost hardware. Coupling these challenges with the market needs for improved tactile sensors and vision capabilities for mapping, real-time localization and navigation, and better mobility and sensitivity to the environment makes the technology readiness and maturity level hard to achieve. To ensure that consumers would continue to accept consumer robots, Mydbots needed to continuously invest in R&D and innovate via using digital data and physical products for cost-effectiveness, improving its robots' autonomy and performance, and seamlessly integrating its robots with users' lifestyle. Other technological challenges concerned cybersecurity, improved safety, and eco-friendliness through energy converstion.

In addition to the technological challenges, Mydbots faced difficulties in figuring out the complementary marketing strategies for its robotic innovations. Mydbots relentlessly tried to prepare itself with all resources to understand the consumer mindset and achieve greater customer-conversion rates. Though it successfully raised awareness about consumer robots and eradicate skepticism about its value, Yeoh believed that, unless the company could address low conversion rates, its marketing efforts would remain incomplete.

Mydbots wanted to continue their product innovation not only to extend its technological superiority in the market but also to increase its products' functionality, diversity, and integration capabilities. At the same time, it wanted to learn the market's needs and cater to the larger global market. The strategic imperatives that Yeoh envisaged reflect the same (see Figure 8). However, he faced a dilemma in finding a way to manage robotic innovation and align marketing communications to support product innovation management. If he could solve this dilemma, he could ensure that the company delivered the right robotics product to the right customers at the right time in a cost-effective manner. What product innovation could Mydbots create next? How could Mydbots continuously innovate? How could the

company fulfill its vision for innovation? Wouls Mydbots benefit from more strongly integrating its robotic products into smart home technology networks? What services could Mydbots offer to its customers based on such an integrated set of technologies? How could Mydbots ensure consumers adopt robotics at a large scale? Should Yeoh blend in digital marketing with more traditional marketing approaches? How could Mydbots tackle competitive threats from key global players and emerge as a leader in consumer robotics?

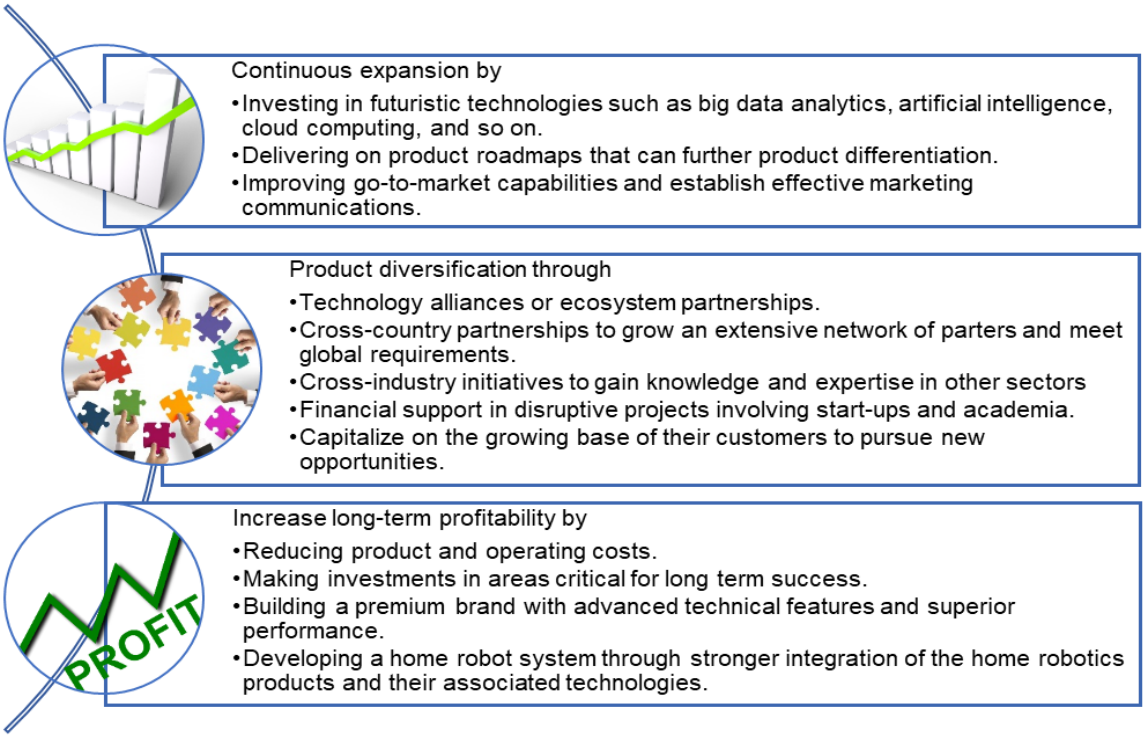

Figure 8. Strategic Imperatives for Mydbots

8 How Should Mydbots Manage Innovations in Consumer Robotics? (Teaching Note)

Instructors planning to use this case may contact the authors directly for access to the teaching note.

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About the Authors

Pratik Tarafdar is Assistant Professor of Information Systems at the XLRI Xavier School of Management, Delhi NCR. He holds PhD in Management Information Systems from the Indian Institute of Management Calcutta. He also holds a BSc in Mathematics and MSc in Applied Mathematics from the University of Calcutta. His research interests include cybersecurity, emerging technologies, business analytics, applied machine learning, and human-computer interaction. His research papers have appeared in *Decision Support Systems*, *Journal of Organizational Computing,* and *Electronic Commerce* and in proceedings of the International Conference on Information Systems, Americas Conference on Information Systems, and ACM SIGMIS Computers and People Research.

Indranil Bose is Distinguished Professor of Information Systems at NEOMA Business School. He is the Head of the Area of Excellence in Artificial Intelligence, Data Science, and Business. He holds a BTech from the Indian Institute of Technology, MS from the University of Iowa, MS and PhD from Purdue University. His research interests are in business analytics, emerging technologies, digital transformation, information security, and innovation management. His publications have appeared in *MIS Quarterly*, *Journal of the MIS*, *Communications of the ACM*, *Communications of the AIS, Computers and Operations Research*, *Decision Support Systems*, *Electronic Markets*, *Ergonomics*, *European Journal of Operational Research*, *Information & Management*, *International Journal of Production Economics*, *Journal of Organizational Computing and Electronic Commerce*, *Journal of the American Society for Information Science and Technology*, *Operations Research Letters*, *Technological Forecasting and Social Change*, and others. He serves as Senior Editor of *Decision Support Systems* and *Pacific Asia Journal of the AIS* and as Associate Editor of *Communications of the AIS*, *Information & Management*, and *Journal of the AIS*.