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From products to experience ecosystems: Haier's 'Internet of Food'

Haier had come a long way since Zhang Ruimin took it over as a failing Chinese Collective-Owned Enterprise in 1984. Since then, he'd been able to transform it into one of the world's leading appliance manufacturers, known for quality and innovation. Haier was also noted for its bold geographical expansion, which had included buying iconic European brands, such as Candy, and, in 2016, the venerable General Electric Appliances (GEA), one of the world's most established white-goods firms. Along the way, Haier pioneered a new managerial philosophy: *RenDanHeYi*, a policy of staying close to the user (a term Haier preferred to "customer") where employees were encouraged to act as entrepreneurs and held accountable for their actions. More recently, it had put the digital agenda at the heart of its approach, leading a revolution in household appliances and aspiring to be the leading ecosystem brand in the Internet of Things (IoT) – a distinction duly conferred on it by BrandZ™ in 2019.

However, Haier's ambitions went far beyond merely getting appliances online. Connected household devices were becoming commonplace – but Haier aspired to develop 'application uses' that could leverage product innovation. The Internet of Food started with smart connected appliances, but then a far-sighted entrepreneur founded a new Smart Kitchen Ecosystem Micro-Community (EMC), dubbed the 'Smart Kitchen EMC', that took an end-to-end approach to delivering chef-originated, pre-prepared meals direct to consumers. This involved linking various collaborating actors along the supply chain (organized, within Haier, as Micro Enterprises) to form an ecosystem that extended from farm to plate, ultimately creating a 'killer app' that could leverage Haier's IoT innovations and blend them into an exciting and compelling experience for the end user.

Haier had plenty of competitors in the increasingly complex world of networked kitchens. From appliance competitors like Samsung and LG to ecosystem stalwarts like Google and app specialists, everyone had their own idea of how a 'networked kitchen hub' might look. Moreover, solutions differed between countries – even within Haier and its US subsidiary, GE Appliances, suggesting that each market would require a different approach. The question remained: Who would offer a winning combination? And how should firms compete in such changing contexts?

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Haier was well placed to pursue such innovations. But what would these innovations consist of? And, how should it differentiate between solutions that had emerged in China and those which had emerged in the US, through GEA? Would the 'ecosystem strategy' in this experience economy develop along similar lines in both China and the US, and what strategies held the most promise for the future?

Becoming an IoT leader

At the corporate level, Haier had clearly stated its desire to ride the digital wave. In 2019, Qingdao Haier, the core company of the Haier group, changed its name to 'Haier Smart Home' to reflect the group's strategic focus on IoT technology. The Haier Smart Home app, launched in 2020, supported more than 6,000 Haier products including washing machines, refrigerators, wine cabinets, air conditioners, water heaters, kitchen appliances, water purifiers and more, all linked together and aiming to cover a web of needs for the customer. Essentially, the Smart Home app turned the consumer's smartphone into a 'master' remote control for every IoT device in their home. Through the app, they could carry out sophisticated functions such as setting automatic alerts to reorder dishwasher detergent or scanning barcodes on frozen food to automatically instruct a Haier microwave how to cook it.[1] Updates to the Smart Home app ran parallel with the rollout of new Haier products that were smart-home enabled. At the time of writing, the app has integrated the functionalities of automatically heating the user's home when they wake up, or turning on the air conditioner and opening the curtains when the app senses that the user is within 50 meters of their front door[2].

Such innovations reflected Zhang's own managerial philosophy. In a 2020 white paper, he remarked that 'in the mobile Internet era, enterprises either own platform brands or are owned by platform brands; in the IoT era, enterprises either transform into ecosystem brand leaders or become partners of ecosystem brands'. With understandable pride, he noted that in 2019 BrandZ™ had rated Haier the only IoT ecosystem brand among the top 100 most valuable global brands.

Zhang's white paper argued that 'the IoT era calls for a mode that can break the traditional industry/category barriers and effectively promote dynamic multilateral cooperation across industries'. Brands that fit in this mode are called *ecosystem brands*. Such brands, and the ecosystems they built, led to different ways to add value, as **Exhibit 1** shows. Rapid iteration and the possibility of recombining products and services allows the firm to focus on 'scenarios' from customers' lives. This, in turn, enables mass product customisation and opens up the opportunity to deliver seamless experiences by leveraging data created through customers' interactions with the brand.[3] The result, as **Exhibit 2** suggests, is not only revenue, but customer excitement and engagement too.

In strategic terms, the 'devices + app' approach creates a multi-product ecosystem[4] where the customer can manage their entire household electronically. It also reveals new use cases – that is, new ways to add value for the consumer that are based not only on Haier's own devices, but those of other brands too. These value bundles would be co-created by Haier and its complementors, collaborating in multi-actor ecosystems.

The landscape of competing ecosystem offerings

Many industry players were trying their hand at a digitally connected value proposition, as **Exhibit 3** shows for the US market. So, the challenge for Haier was to offer a fresh, distinct value proposition that could stand out in a crowded space.

First, leading appliance manufacturers such as AEG had invested to make their top-of-range appliances connect to the internet, enabling smartphone control.[5] This also provided a unique-access app for all appliances from the same manufacturer.

Other competitors, like Samsung,[6] went a step further. They aimed to enthrone the humble fridge as the digital hub of the home – the place where a family gathers while cooking or just hanging out. Linking with other platforms with whom Samsung had agreements, customers would use the fridge for a variety of uses:

1. Controlling the smart home through linkups with Nest (heating), Yale (locks and security), Phillips Hue (lighting) or Amazon's Alexa (media and information)
2. Ordering food online through US partnerships with AmazonDash (Amazon's grocery delivery business), Instacart and Purdue Farms (a manufacturer of processed food)
3. Controlling streaming media through links with Spotify, Pandora, TuneIn and Amazon Music
4. Family and productivity apps, video calls and notes.

In this new, volatile space, traditional lines of competition blurred, industry boundaries melted away and – as a result – competition was intense. While Amazon happily slotted into Samsung's offering, it also offered its own home hub solution that linked not only its own smart devices (including Alexa) but also any others the customer might own, which could be connected via Zigbee.[7] Amazon was aware of the potential that home devices had, to enable a seamless experience for replenishing, and it had already developed a scale-enabled machine, Dash Smart Shelf, that was connected to Amazon's Alexa and its grocery delivery arm Dash for automatic order fulfilment.[8] In early 2022, it was also reportedly working on an Amazon Fridge, which would aim to be a home-hub.[9]

Google (Alphabet) also offered a hub through its subsidiary Nest, which could manage Alphabet services such as YouTube plus third-party channels like Netflix. Google's assistant could help customers follow a morning or evening routine, watch the news, follow recipes, make calls and connect to any compatible device.[10] Google also worked with Smart kitchen and personalized shopping software startup Innit to help "grocery retailers to deliver personalized services across the entire meal journey, spanning online, in-store, and at home"[11] – all mediated by Google, of course.

Even competitors from more distant sectors had eyes on the prize. For example, Italian energy stalwart Enel launched Homix, an all-in-one solution for customers to manage their smart home and save on energy bills, while also interfacing with Amazon's Alexa ecosystem.[12] Other competitors like Kiwi offered data interfaces to link players from various ecosystems.[13]

In terms of the key competitors, as **Exhibit 4** shows, each manufacturer had its own approach. One option was to rely on partnerships for interoperability – such as Bosch, which had chosen to partner with companies such as Chefling, SideChef, Kitchen Stories, Drop and Innit to grant users

access to a wider variety of meal preparation providers. In this setup, a Bosch fridge could be connected to a GEA oven to prepare a meal. An alternative approach was to rely on acquisitions of Food AI and AI start-ups for in-house development of smart cooking solutions, exemplified by Samsung's acquisition and integration of Whisk into its SmartThings platform. A final possibility was a mix of the two previous approaches, exemplified by LG simultaneously partnering with SideChef, Innit, and Fresco to provide smart cooking solutions, whilst simultaneously developing its own app called ThinQ Recipe.

As if this opportunity landscape wasn't complex enough, key firm actions would have the impact of reshaping it. The acquisition of Whisk by Samsung, for instance, was ostensibly what drove Whisk's strategic change of heart from a complementor with an open API, intent to offer the shoppable recipe API to various smart kitchen actors, to one that is increasingly shunning anyone other than its new corporate parent, Samsung, as a means to support the Samsung ecosystem.

Even among the meal preparation providers, strategies varied along various dimensions. As **Exhibit 5** shows, in addition to device manufacturers, a myriad of more specialised participants had also emerged, many not directly engaged in the appliance side but solely focused on food and recipes. While actors such as Innit focused on providing healthy and diet-friendly solutions to their end users, others such as SideChef focused on the learning dimension, partnering with chefs to provide higher-end interactive cooking lessons.

Overall, the market was quickly moving beyond offering tech-savvy users the convenience of controlling appliances remotely. In China in particular, the competitive landscape was populated by a greater variety and complexity of players. As **Exhibit 6** shows, other than traditional home appliance companies such as Haier, Midea, Gree and Changhong, who had focused their value proposition on the development of smart home appliances such as smart ovens and washing machines, there was also competition from internet-based titans such as Alibaba and Baidu, who were focused on smart speakers and TVs; 3C enterprises[14] such as Xiaomi and Huawei, who offered all types of devices from small speakers to all-encompassing smart home ecosystems; and a variety of niche actors such as Orvibo and Aqara who engaged in smart security systems.

The Internet of Food and Haier's approach in China

To pursue its Smart Home strategy, Haier wanted to unlock the full potential of its devices by making *scenarios*, rather than products, its key focus (**Exhibit 1**). To do so, it would need more than solid product design, good connectivity and reliable APIs; Haier also needed new ideas, rooted in the customer experience and tested at ground level. To find them, it turned to its entrepreneurial structure. And as **Exhibits 4** and **5** indicate, this meant a transformation not only in how value was added, but also how people responded to opportunity.

Drawing on its new focus on scenarios, Haier launched a range of IoT ecosystems, including the Internet of Clothes (clothes and laundry), the Internet of Blood (collection, processing, and transfusion of blood in events such as the Beijing 2022 Winter Olympics) and the Internet of Food (kitchens and cooking), which is our focus in this case.

Haier's Internet of Food (IoF) was envisaged as a one-stop solution for the consumer's eating experience that went far beyond merely purchasing appliances (see **Exhibit 7**). The overarching concept was to bring together food suppliers for ordering, logistics for delivery, smart fridges to store the food, smart ovens and microwaves to cook it and smart dishwashers to wash up

afterwards.[15] IoF smart devices would feature touchscreens that could display recipes and deliver cookery classes, specifically designed for Haier, while Haier's Smart Home app brought everything together into a seamless experience.

In March 2021, Haier unveiled its first smart fridge at the Appliance & Electronics World Expo in Shanghai. The company's press release announced:[16]

> *The fridge intelligently identifies family members using facial, voice and image recognition, as well as RFID, and delivers personalized services based on their user profile and historic usage data. The platform also uses RFID to deliver intelligent management after storing items in the fridge – enabling users to trace the source of an ingredient, link the fridge to other smart appliances such as the oven, identify the freshest and most healthy foods, and set a reminder to automatically replenish supplies when low. Budding cooks can also enjoy seamless livestream broadcasts over the 5G platform, where they can learn to cook with a chef and become a culinary master.*

As this video shows, the smart fridge included an internet-connected touchscreen set into one of its doors, and could also be synced to the Smart Home app.[17] Users could control the temperature in different compartments of the fridge, while the device itself could recommend recipes based on the ingredients it contained. In China, owners could set up automatic orders and pay for their purchases wirelessly: Haier's app also vied to be the portal of choice for buying food, with its own set of collaborators to supply it, such as No 1 Central Store, Khorchin Beef and Holy Land Village Eggs (see **Exhibit 9).**

The Kitchen Experience ecosystem: Restaurant-quality end-to-end support

The core smart fridge technology encouraged customers to buy in to the multi-product Haier ecosystem and stay loyal to it. It catered to a limited range of use cases and promised some additional revenue from ongoing services post-purchase. However, Haier was still looking for its 'killer app' – a downstream scenario that would provide a genuinely compelling reason to buy. That meant encouraging entrepreneurs to flesh out the IoF ecosystem with new products and services that customers valued, realising the benefits outlined in **Exhibit 10**.

This is where the entrepreneurship fostered by Haier's organisational design played a crucial role. One important entrepreneur in this respect was Zhang Yu. He started his career with Haier in China, marketing the firm's high-end brand Casarte refrigerators and washing machines. Visiting potential customers in their homes, Zhang noticed that many were uninterested in standalone appliances, but aspired to have a fully fitted kitchen with appliances built in. Inspired by this insight, Zhang applied to launch the Smart Kitchen Ecosystem Micro Community (EMC) in 2018.

To find transaction partners, Smart Kitchen EMC used EMC workbench, Haier's new IoT platform. EMC workbench had been designed to help MEs contract with each other and connect with customers. With this in place, plus help with administration costs, Zhang and his ME sought to make an 'experience ecosystem' a reality. It would enable Haier's customers not only to own a swanky kitchen, but also to replicate restaurant-quality food in the comfort of their homes, without the drudgery of doing all the food preparation themselves. This idea had come to Zhang during a visit to a Xibei restaurant, where he learned that chefs often produced meals quickly by preparing and part-cooking certain ingredients in advance.[18]

Zhang set his sights on delivering the 'end-to-end customer scenario', focusing on an all-in-one offer for a particular use case: Peking Duck, a notoriously difficult dish that was usually only eaten in restaurants.

Zhang originally leveraged the Haier Smart Home App to orchestrate the process, but he soon was able to benefit from another venture that was incubated in Haier in November 2020, Alphesh.[19] Alphesh, that would take the form of a mini-programme in WeChat (China's equivalent of Facebook, Amazon and Google all rolled into one). Alphesh allowed shoppers to order prepared dishes, manage the entire order process and connect eight other brands of smart appliances to their Haier devices in order to produce the sort of fine dining experiences that would normally be the preserve of 'five-star restaurants'.

The dish would be ordered through Alphesh and arrive, frozen, within three days. Once in the customer's freezer, it could then be prepared in three steps: (1) unpack and arrange the ingredients (duck, pancakes, hoisin sauce, spring onions), (2) place the duck in the steam oven and (3) scan the QR code on the packaging with a smartphone, automatically transmitting cooking instructions to the steam oven, which duly cooked the duck in around an hour and a half. Meanwhile, the consumer could watch a video on Alphesh explaining how to dice the spring onions and steam the pancakes to create the finished dish.

So much for the consumer's side of the story. Meanwhile, backstage, the Smart Kitchen ME had to build an entire IoF supply chain to bring the Peking Duck from farm to table, including farms, abattoirs, food manufacturers and logistics, right through to smart kitchen appliances, with the ME itself acting as a hub connecting all these complementors. For example, a farming partner had to be identified to provide specially fed ducks, which were only raised on a handful of farms in China. Special packaging was needed to keep the meals fresh during transportation and storage. Chefs, motivated by Haier's strong brand, were happy to work with the firm and offer it exclusive recipes. To ensure that the meals were chilled correctly at home, the ME had to work with Haier's internal refrigeration team to identify the proper temperature-control parameters. Finally, the ME had to collaborate with a smart oven supplier so consumers could cook the duck with just one click. The idea was that, in addition to the revenues created by the programme, the excitement with the capabilities of the Smart Kitchen would make customers stick with Haier and become life-long clients.

Haier's Chinese competitors

While the launch of the Smart Kitchen ME made Haier the first ever player in China to offer a full ecosystem solution for ready meals, it was not without its competitors.

Two other Chinese companies, Midea and Hema, offered some elements of a similar service. Home appliance maker Midea was quick to follow Haier's lead, launching a new series of smart kitchen products in 2016 that included smart microwave ovens and rice cookers[20]. Alibaba was another competitor. The e-commerce giant had already opened its first Hema supermarket in China in 2015, which was designed to be a high-tech supermarket integrating online, offline, logistics and data across a single value chain[21]. Hema customers could use their mobile phones not only to pay for groceries and ready-made meals automatically by scanning barcodes as they shopped, but also to have their shopping bag delivered directly to their home address, or even have their fresh produce cooked by a professional chef in-store.

Following the launch of the Smart Kitchen ME, more competitors entered the smart kitchen arena and the complexity of offerings increased. Smart fridges, which had been labelled in the Chinese media as the centrepiece of the IoF ecosystem since they were the only device that is left on 24 hours a day[22], had seen an influx of new players. Major home appliance competitor TCL entered the fray, as did the specialised new player Viomi, which offered a smart fridge built in partnership with Xiaomi's smart home operating system[23].

Beyond China, Haier was involved in more IoF ecosystems – in particular in the US, through its iconic subsidiary, GE Appliances, which competed in a different landscape, and with solid roots in innovation and market positioning.

GEA and IoF innovations in the US

Well before Haier acquired it, GEA had been an industrial leader. As a part of General Electric, one of the US's most iconic conglomerates, it was the first major appliance firm to pursue an early interest in connectivity by adding data sockets to its devices. In 2014, Kevin Nolan, GEA's CEO, co-founded FirstBuild[24] alongside Matt Philips and Venkat Venkatakrishnan (both of whom have since moved on). FirstBuild was one of the first corporate makers' spaces in the world: a global co-creation community that harnessed the power of the maker movement to change the way home appliances are conceived, designed and manufactured. The idea was to enable fast prototyping – a sign on the wall read 'a prototype is worth 1,000 meetings' – and develop new concepts drawing on external insights and resources. For instance, to validate innovation concepts, FirstBuild used crowdfunding to gauge users' potential interest, defray costs and bypass the lengthy approval process that a venerable, risk-averse industrial firm like GE would usually be expected to have. This agile approach allowed GEA to build the *Monogram Hearth Ovens* (dubbed the "Ferrari of indoor electrical pizza ovens", with a cult following), *Opal*, a chewable nugget icemaker, a mushroom grower, an indoor smoker and a talking washer machine.

Haier's acquisition of GEA meant that there was renewed interest in innovation. GEA wanted to innovate around their microwave ovens and ventilation units (heat extractors). Looking at Samsung's smart fridge (described above), they realised that while sales of the unit were modest, it still acted as a powerful tool for building brand awareness. Intrigued shoppers were drawn into playing around with the fridge in store, and even if they were ultimately put off by the price tag, the Samsung name stayed in their minds.

GEA's Microwave and Ventilators ME decided to work on something similar for their products. They added a display screen to the ventilation unit situated above the hob/oven and connected it to the internet through Android. A position above the hob was more convenient for consumers to follow recipes, the team reasoned. The initial idea was refined by adding a camera that would show the user's face – plus a second camera trained on the hob, so they could show other people what was cooking by video link. Now they could follow along as their grandmother shared the secret of her meatball spaghetti or take a cooking class during which the tutor could keep a watchful eye on their progress.

A further development, rolled out in 2018, was pans with Bluetooth connectivity that could be synchronised to the cooking hob through an app called the Kitchen Hub for perfect results every time. The GEA team would demonstrate this capability in stores by making crepes and

encouraging shoppers to have a go themselves. Another innovation, scheduled for 2023, was an AI microwave that would alert the consumer if they had missed out an ingredient.

Once appliances were online, they could be updated over the internet, so features stayed up to date. Capitalising on this feature, GEA continually released new screensavers, clocks, weather apps, train schedule and sounds.

One appliance that benefited from online updates was the internet-connected smart convection oven. A new air-fry feature enabled consumers to use less oil than with traditional frying[25] (and also steered consumers towards using their ovens). While the feature was standard on all new GEA ovens, owners of an internet-enabled model could simply update the software and the feature duly appeared.[26]

Similarly, to offer carefree cooking of the traditional Thanksgiving meal, GEA created Turkey Mode[27], which offered 'step-by-step instructions on the SmartHQ app or the oven's LCD screen for how to use a meat probe and exactly where to position the oven rack… Turkey Mode does the cook-time math and executes the perfect cooking algorithms for a juicy bird that reaches an optimal doneness at 170 degrees'[28].

The Kitchen Hub, selected as one of the best innovations at the Consumer Electronic Show (CES) 2019 and 2020, was designed to be the operations centre of the kitchen. It combined a microwave with a cooker hood, video cameras and a smart display, for the ability to video chat and livestream while cooking. The Kitchen Hub could also download apps including recipes, streaming services, games and so on, and allow users to control their other appliances and devices.

GEA had taken a different approach from Haier: rather than offering complete end-to-end solutions, its aim was to be as interoperable as possible. It wanted to be a *part of* 'smart and networked' kitchens, but not necessarily the orchestrator of them.

That said, drawing on the capabilities it had built, GEA developed the Smart HQ App, which connects to and controls all GE appliances in the home. Smart HQ allowed consumers to monitor their appliances, preheat or adjust the oven, find recipes, order parts, and so on.

Building GEA's US-based ecosystem: Partnering and applications

GEA also built relationships with complementors who could help it offer more convenience and value to the final customer. Hestan, a cookware company that had integrated temperature sensors into its Cue pans and also moved into the guided recipe space, offered the ability to link its high-end Café products to GEA's. Once this was done, the pan – guided by the online recipe app – would be held at exactly the right temperature and turn the heat up or down automatically as required.

GEA also launched an ME called Chibo to offer interactive cooking classes – connecting home cooks with food influencers and creating goodwill for GEA. Chibo proved particularly relevant during the pandemic, when people were stuck at home with time to experiment with new recipes[29]. (It was wound down in 2022[30].)

The focus of all these relationships was customer convenience. As Kevin Nolan, CEO of GEA, noted, 'Following our Zero Distance philosophy, we are working with all the players in the US because this is what our consumers are demanding. We want to provide seamless experiences,

regardless the platform or network consumers choose to have at home. For this reason, we have washers and dryers with [Amazon's] Alexa incorporated, voice activated and alerts options with Sonos and Android touchscreens. We can orchestrate our own ecosystem or join existent ecosystems if it makes more sense to the consumers.'

In building its own ecosystems, GEA followed Haier's lead in working with particular customer groups and focusing on specific needs. For instance, GEA worked with the orthodox Jewish community in the US – more specifically, Brooklyn, NY – where it saw a chance to assist a community that was traditionally underserved by the industry. It partnered with a leading authority in Jewish law and a local firm who developed electronic devices for the community to develop the Shabbos Kosher Oven series, which helped Jewish users comply with the requirements for Shabbat while enjoying convenient meal preparation.[31]

Building ecosystem success for GEA

As Kevin Nolan reflected, 'When I took over as CEO our goal was to be the number one appliance manufacturer in America, [and] we are well on our way to achieving that. Now we want to be the leading ecosystem appliance company in America. What does that mean? To truly think ecosystems, you can't put yourself in the centre. We say we're not the centre, we're just part of a user's experience. And we need to find everybody that takes part in the user's experience, and how do we partner with them to create more value. This is what FirstBuild did – while we had it before 2016, Haier has embraced it. FirstBuild […] is an open platform – anyone can come in, it's a micro factory. Our view is through co-creation, you bring people together. And it's not the firm that tells you what to work on; it's your users. We do co-creation to discover our ecosystems.'

An example was the standalone ice-maker Opal, which made ice *nuggets,* the chewable ice preferred by high-end bars and burger chains. While it was originally dismissed as unworkable, enthusiasts allied with a rebellious team within FirstBuild and secured crowdfunded/prepaid funds to the tune of $2.7M, making production possible and engaging a broad range of enthusiasts. Opal was so successful that it forced GEA to rethink its decision, made several years before, to drop its small-appliances division. And while some products go on to create their own new MEs, FirstBuild continues trying out new stuff – like the idea of a home mushroom-growing machine, which generated great excitement, much to the surprise of GEA's leadership. Enthusiasts lent their support via crowdfunding and pre-orders, generating the cashflow to turn the idea into reality without a lengthy capital-bidding process. As a result, Mella[32], the $349 mushroom-growing unit, has already paid for its development costs.[33]

Who should drive the ecosystem?

The success of FirstBuild showed that seeking out niche markets, building bridges in the innovation process and connecting to aficionados downstream was a winning strategy. However, the battle for the digital hub of the house was not yet over, and no clear winner has emerged.

Success in the more entrepreneurial culture of US inevitably meant partnering with others, and GEA has already taken some steps in this direction. For example, it joined forces with Google Cloud to 'benefit from Google Cloud's seamless integration with other Google platforms and

technologies such as Android and Google Assistant while also being able to tap into powerful capabilities like Vision AI' to offer a more personalised experience.[34]

However, there were bigger questions still to answer. Given that several major industry players were already trying to orchestrate their own ecosystems, should Haier align with them – or build its own? Should it aspire to be an orchestrator, or be content to remain a partner? As Kevin Nolan pointed out, why should GEA presume that it would, or even should, be the orchestrator? Why not focus on interoperability as opposed to leadership?

Should GEA proactively support the development of standards, or merely participate with open standards as they emerged? How much interoperability with others' offerings should it aim for, and how much should it engage with their ecosystems? How could GEA best learn from those who have built ecosystem success, to push for ecosystem innovation in an organisation still driven by reliability?

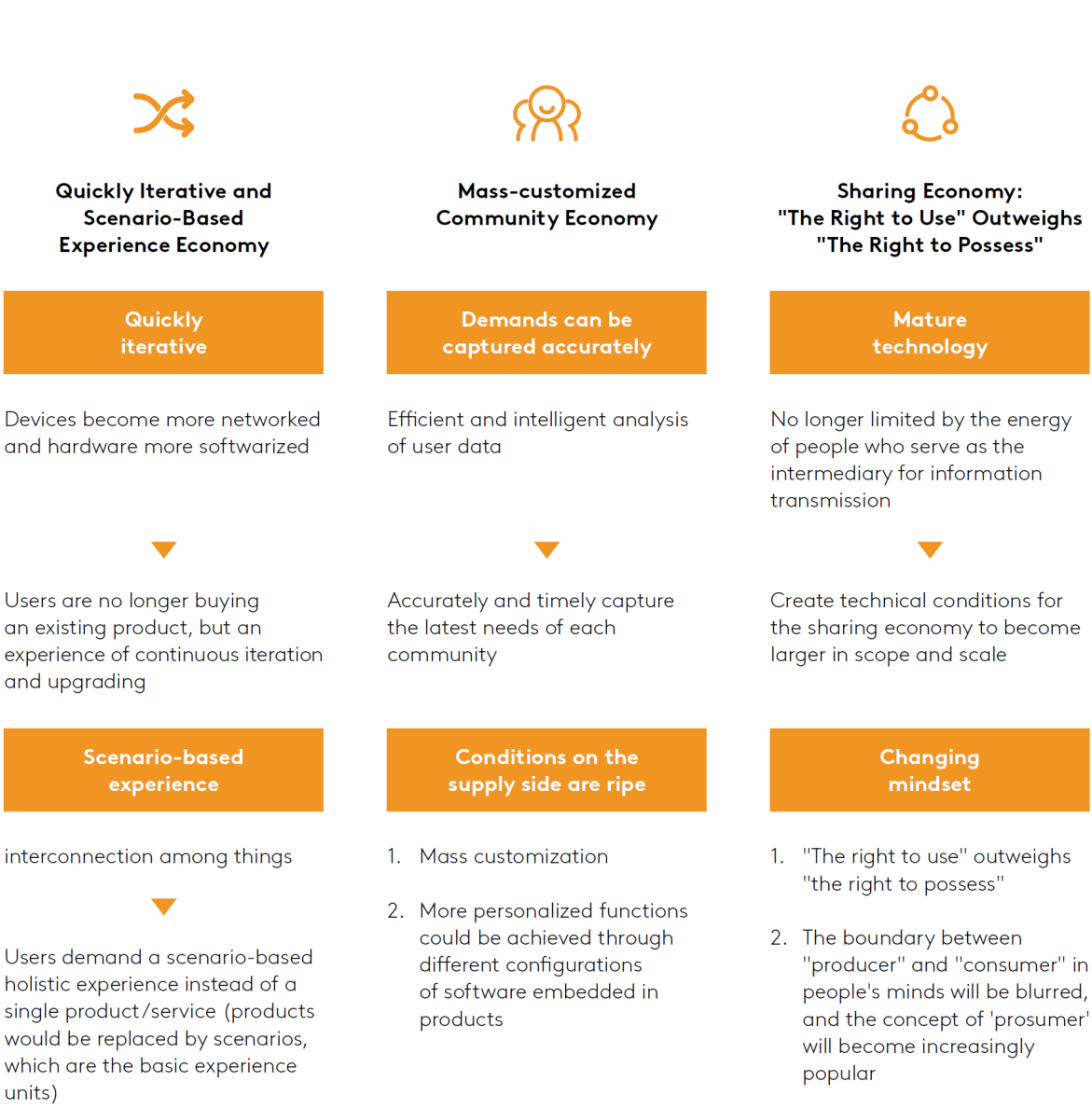
At a more operational level, how should GEA decide how far to support those ventures, like Chibo, that don't generate revenues? How much differentiation should there be between markets, and between geographies? Should GEA try to identify scenarios – as Haier had in China – or wait for customers to tell it what they wanted? And, if the latter, should it curate customer communities where they could share their views? Should it expand its view from the technology to cook the Thanksgiving turkey to encompass the entire supply chain, as it had done so successfully with Peking Duck?

Regulations are very different in the US, as were commercial and cultural norms. What would that mean for GEA, and the entrepreneurial culture it hopes to build? In China, it had let a thousand flowers bloom and invested in the most promising ones – but would that approach translate well to the States?

From a country-based to a global view in ecosystems

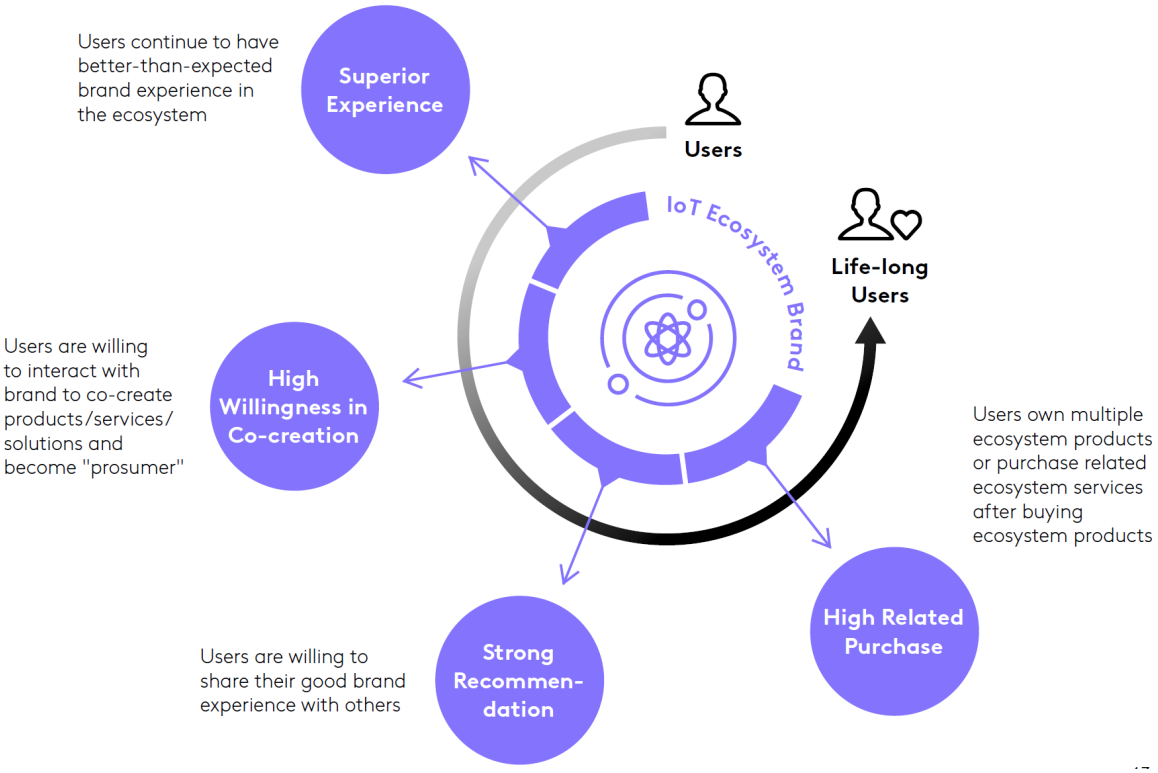
While Haier's undoubted success and dominance in China had allowed it to build an innovative set of offerings in the IoF, its approach was not identical to that followed in the US. Yet the philosophy of being close to the customer and innovating with the engagement of users was a strong common thread. As Haier looked into the future, how could it combine – if at all- its US and Chinese ecosystem approach? And, how should it position vis-à-vis the ever more complex and interwoven set of ecosystem competitors, small and large? Haier and GEA had successfully pushed the boundaries of innovation and ecosystem thinking in many ways. In 2022, as it contemplated its home market and the US alike, it had to decide where to take them next.

Exhibit 1. Rethinking value add in the IoT / ecosystem era



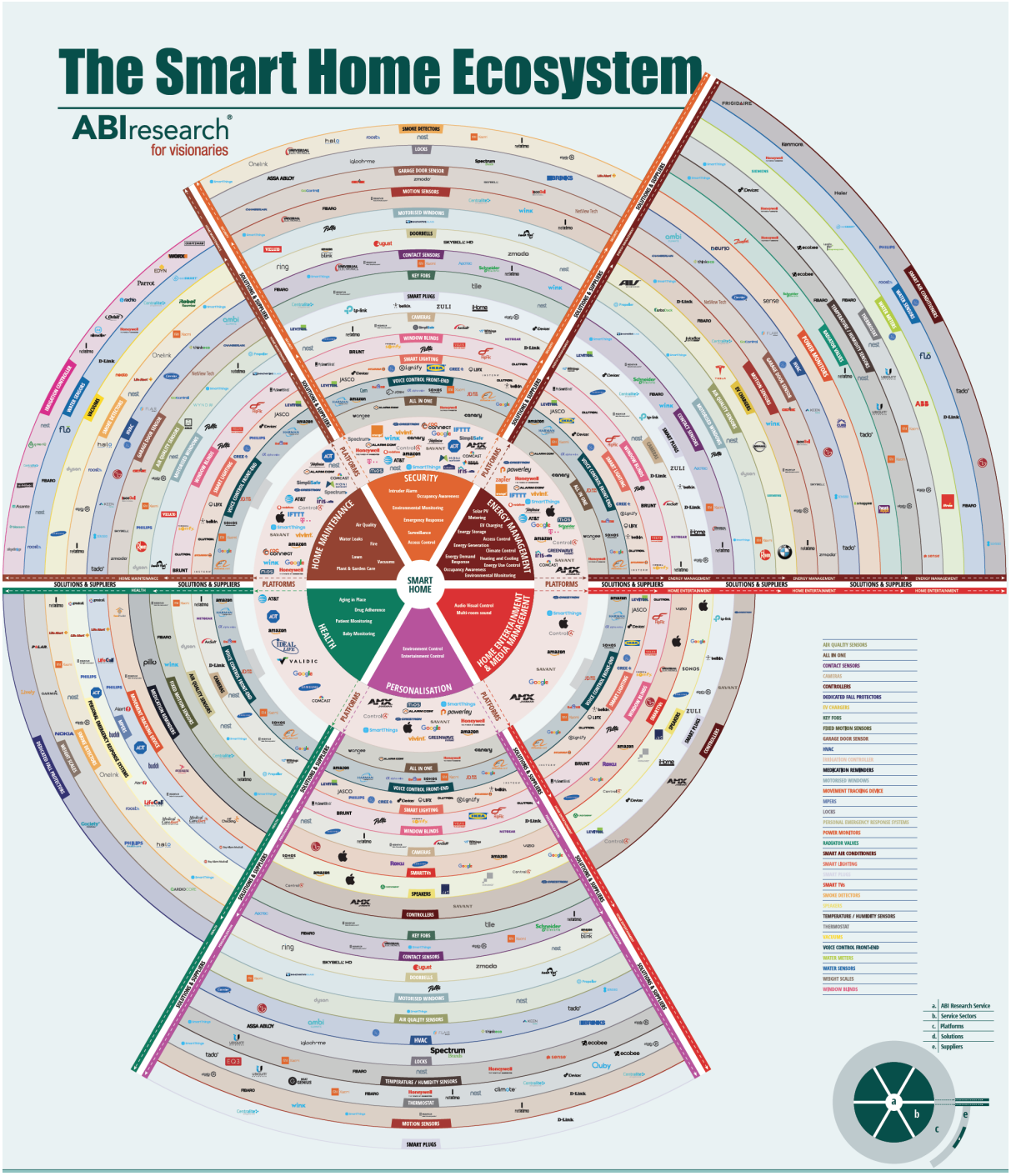
Source: Kantar, Oxford University's Saïd Business School, Haier, IoT Ecosystem Brand White Paper, September 20, 2020, www.sbs.ox.ac.uk/sites/default/files/2020-09/IoT%20Ecosystem%20Brand%20White%20Paper_0.pdf reprinted with permission.

Exhibit 2: Creating value add for ecosystem brands like Haier



Source: Kantar, Oxford University's Saïd Business School, Haier, IoT Ecosystem Brand White Paper, September 20, 2020, www.sbs.ox.ac.uk/sites/default/files/2020-09/IoT%20Ecosystem%20Brand%20White%20Paper_0.pdf reprinted with permission.

Exhibit 3: The Smart Home Ecosystem by ABI Research for the USA



Source: ABI Research, Smart Home Ecosystem Report.
https://go.abiresearch.com/lp-abi-smart-home-ecosystem-infographic

Exhibit 4: The architecture of the competition

Brand	Ecosystem app	IoF Partners/ Solutions	Comments	How open is the ecosystem?
Bosch	Home Connect  Smart home  	Innit, Kitchen Stories, Chefling, Sidechef and Fresco (partners)	Main focus: interoperability and partnerships Homeconnect app is compatible with various brands: Bosch, Siemens, Neff, Gaggenau, Balay, Thermador, Constructa, Pitsos and Profilo Maximum number of partnerships (40) for various scenarios and connected devices and services	Focuses on onboarding partners to expand its ecosystem. Readily allows development on its platform through API integrations, development of app solutions and new device connections, to create scenarios on the HomeConnect platform
LG	ThinQ 	Innit, Sidechef, Fresco, Tovala app (Partners) ThinQ Recipe (developed in-house)	Numerous IoF partners as well as various AI acquisitions to continuously develop scenarios on ThinQ app and ThinQ Recipe 'Scan to cook' feature, similar to Haier's	Open to development of software solutions and device onboarding on the ThinQ platform At the same time, focuses on building its own expertise in developing solutions in-house
Samsung	SmartThings  	Whisk (acquired)	SmartThings ecosystem is much bigger in terms of services apart from IoF. But difficult for independent players to develop solutions on SmartThings	Relatively closed, as app solutions cannot be independently integrated into SmartThings, but devices can be connected through partnerships. Bets on developing its own solutions
Whirlpool	Whirlpool app  	Yummly (acquired)	A fairly restricted ecosystem with very limited partners and offerings	Closed ecosystem with no option to develop solutions within its ecosystem

Sources: Bosch, LG, Samsung, Whirlpool (compiled by authors)

Exhibit 5. Non-appliance actors in the smart kitchen/Internet of Food space

	Chefling	fresco	innit	SIDECHEF	Yummly	Kitchen Stories	Whisk
Cooking community					✓	✓	✓
Video cooking tutorials				✓	✓	✓	
Meal recommendations	✓	✓	✓	✓	✓	✓	✓
Ordering groceries	✓	✓	✓	✓	✓		✓
Smart connected cooking	✓	✓	✓	✓	✓		
Main strategic focus	Acts as a personal AI cooking assistant, providing end-to-end cooking solution from meal planning to smart cooking, focusing on zero wastage.	Interopera-bility to onboard as many appliance brands as possible.	Providing customised recipes based on allergies, diet, and taste, facilitating a healthy lifestyle.	Partnering with chefs to provide interactive cooking lessons.	Integrating smart thermometer to measure temperature of meat while cooking more accurately.	Developing a community around the topic of food, where most recipes on the platform are by influencers desiring to build up a community.	Facilitating recipe manage-ment, meal planning, and grocery shaping. Developing communities for recipe sharing through social media platforms.

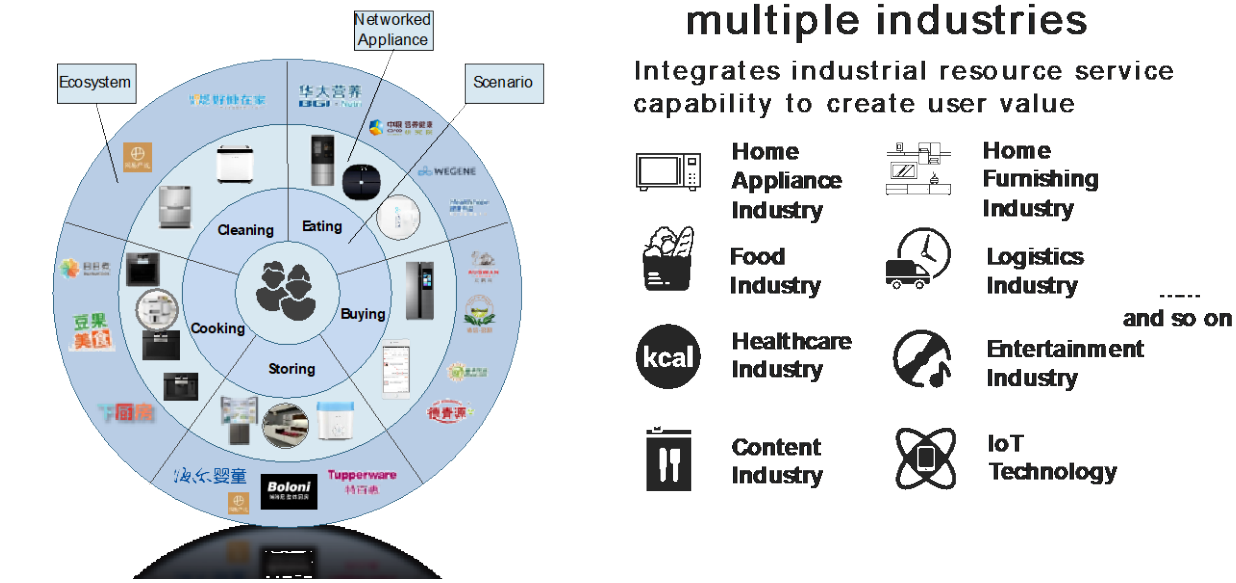
Source: Chefling, Fresco, Innit, Sidechef, Yummly, Whisk, Kitchen Stories (compiled by authors); additional information from Kitchen Stories: https://fueled.com/blog/recipe-app/#:~:text=Kitchen%20Stories%20is%20a%20recipe,%2Dby%2Dstep%20instructional%20videos

Exhibit 6. China's competitive landscape for smart-home devices (2021)

Company type	Company name	Sales coverage	Smart home product leadership
Internet-based	Alibaba	Global (China-focused)	• Smart Speakers • Smart TVs
	Baidu	Global	• Smart Screens • Smart Helpers
3C enterprise	Xiaomi	Global	• Smart Speakers • Smart Centralised Home System • Smart Small Home Appliances
	Huawei	Global	• Smart Home Solutions • Smart Ecosystem
Traditional home appliances	Midia	Global	• Smart Large Home Appliances
	Haier	Global	• IoT Ecosystem
	Gree	Global (China-focused)	• Smart Large Home Appliances
	Changhong	Global (China-focused)	• Smart Large Home Appliances
Niche appliances	Orvibo	China	• Smart Centralised Home System
	Aqara	Global	• Smart Security Systems • Smart Centralised Home System

Source: (Translated from) Qian Zhan Research Report (2022). https://bg.qianzhan.com/trends/detail/506/220408-3a1aa8e7.html

Exhibit 7. Haier's Internet of Food



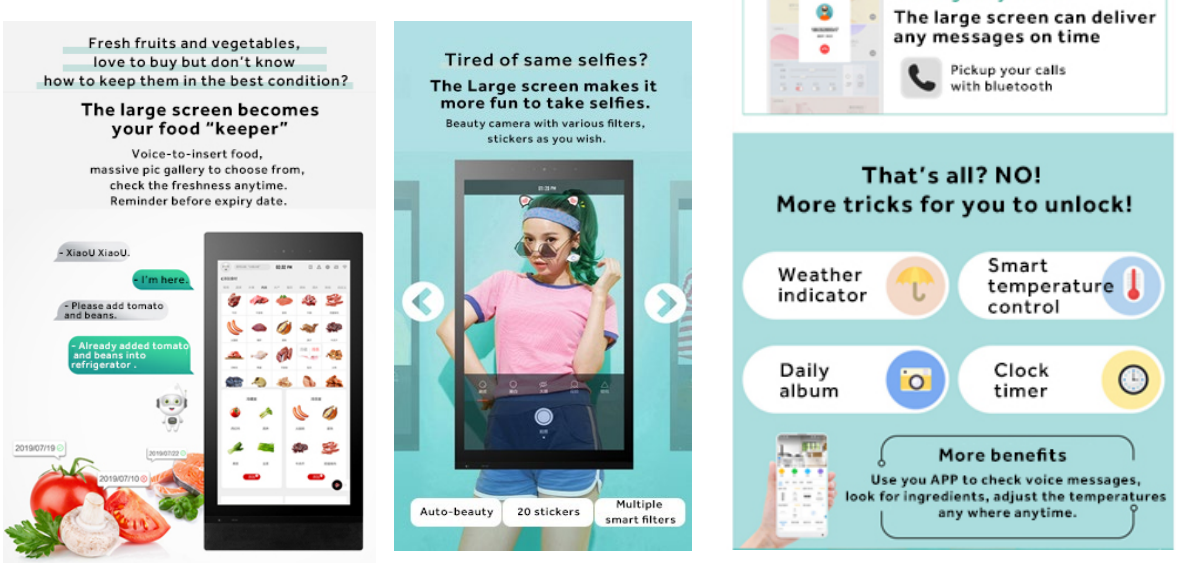
Source: Haier

Exhibit 8. Haier's Internet of Food

Perspectives	Criteria	Metrics
Brand Purpose Perspective	Strive to continuously create and pass on greater value for the society	Committed to the sustainability of environment and resources
		Devoted to constantly improving peoples' lives
		Empower various enterprises and entrepreneurs to continuously foster higher-level economic development
User Perspective	Offer unbounded products/services	Have a large number of categories/industries in the ecosystem
	Provide ever-evolving and customized integrated solutions	Offer scenario-based, seamless and integrated solutions
		Provide customized products/services/solutions based on users' needs
		Make continuous evolution of products/services/solutions based on on-going interaction with users
	Make life-long users	Superior experience: users continue to have better-than-expected brand experience in the ecosystem
		High willingness in co-creation: users are willing to interact with brand to co-create products/services/solutions and become "prosumer"
		Strong recommendation: users are willing to share their good brand experience with others
		High related purchase: users own multiple ecosystem products or purchase related ecosystem services after buying ecosystem products
Partner Perspective	Keep an open, diverse and dynamic ecosystem	Consist of diverse industries
		Have diverse types of players with different roles
		Maintain an open entry and dynamic optimization mechanism to continuously attract new members and eliminate underperformed members
	Enable sharing, collaboration and co-creation	Have a spirit of sharing (e.g. sharing underlying IoT technology, data resources or general business capability)
		Facilitate efficient collaboration among multiple partners in the ecosystem (e.g. by setting unified technical standards, business conduct standards, etc.)
		Enable each partner to bring its comparative advantage into play to jointly create solutions
	Achieve value-added sharing and win-win symbiosis	IoT ecosystem brand and its partners can both achieve growth in ecosystem revenue
		IoT ecosystem brand and its partners can both share added value derived in the ecosystem

Source: Haier

Exhibit 9: Haier's Internet of Kitchen opportunities

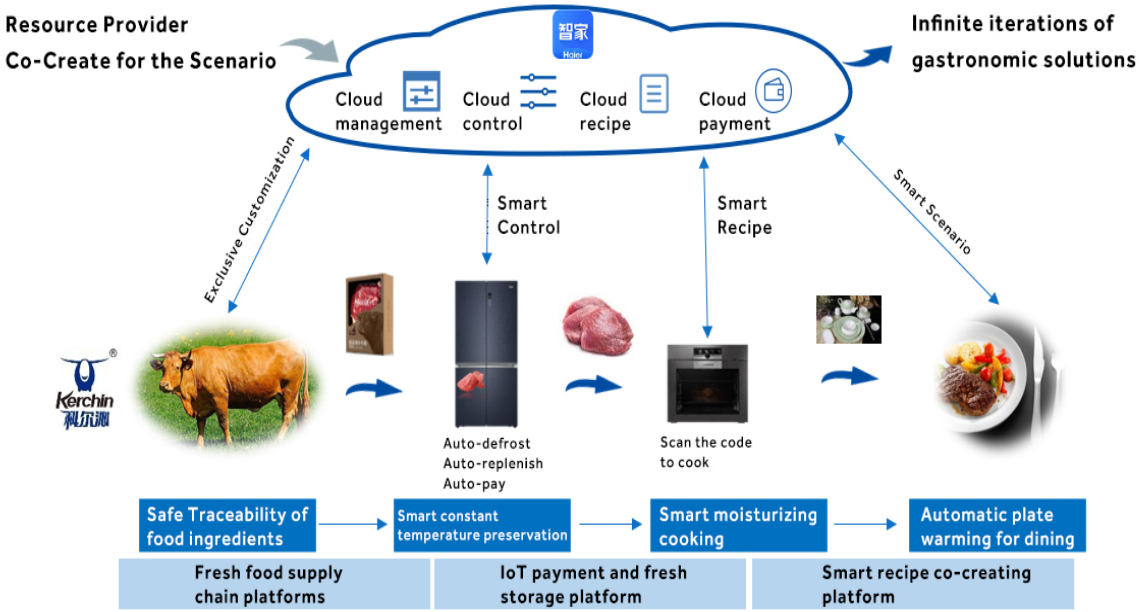


Source: taobao.com, translated by HMI

Exhibit 10. The Haier IoF prepared food consumer experience

Source: Haier

Exhibit 11. The Haier IoF prepared food infrastructure



Source: Zhang Yu, Haier Group. Translated by HMI

Exhibit 12: GEA Innovations

Kitchen Hub

GE APPLIANCES

KITCHEN HUB™

OWNER'S MANUAL & INSTALLATION INSTRUCTIONS

UVH1301

Source: GEA

Exhibit 13. Complementors and partners

Mella fungus grower

Source: IndieGoGo/FirstBuild; see www.indiegogo.com/projects/mella-the-smart-mushroom-fruiting-chamber#

Source: IndieGoGo/FirstBuild; see www.indiegogo.com/projects/mella-the-smart-mushroom-fruiting-chamber#/

Shabbos Keeper

Source: GEA

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[2] Haier Smart Home App (China), www.haier.com/markets/zhijiaapp/

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[4] See Jacobides, M.G., How to compete when industries digitize and collide: an ecosystem development framework, California Management Review, Spring 2022

[5] See e.g. www.aeg.co.uk/support/support-articles/cooking/ovens/connected-oven---how-to-set-up--onboard-your-appliance/

[6] See www.samsung.com/us/explore/family-hub-refrigerator/overview/

[7] See www.amazon.com/All-New-Echo-4th-Gen/dp/B07XKF5RM3

[8] See https://youtu.be/7Ie4k3gIKEY

[9] https://techcrunch.com/2021/10/05/amazon-is-reportedly-working-on-a-smart-fridge-that-tracks-whats-inside/

[10] www.youtube.com/watch?v=elXc31VDOlE

[11] See https://thespoon.tech/innit-teams-up-with-google-cloud-to-power-personalized-shopping/

[12] https://corporate.enelx.com/en/stories/2021/03/homix-smart-home-system

[13] See https://kiwi.innolab.org/

[14] '3C enterprises' is a coined term in China denoting companies that produce computer-based, mobile-based and media-based products.

[15] Clearly, each of the actors had a different interest as their own perspective was to cement their relative position. This is why Amazon, for instance, was keen to develop IoT enabled replenishing systems, especially in dry goods kept outside the fridge, which accounted for the majority of the shopping volume, hence the Dash IoT devices such as www.youtube.com/watch?v=elXc31VDOlE.

[16] Haier Smart Home Unveils World's First "Internet of Food" Smart Refigerator Compliant with New IEC Standards. Cision PR Newswire, March 24, 2021 https://en.prnasia.com/releases/apac/haier-smart-home-unveils-world-s-first-internet-of-food-smart-refrigerator-compliant-with-new-iec-standards-312611.shtml,

[17]For a video showing the fridge and phone app connectivity see www.youtube.com/watch?v=fN7IeEoBvXE&t=5s)

[18] Jacobides, M.G., How to compete when industries digitize and collide: an ecosystem development framework, California Management Review, Spring 2022

[19] Alphesh was developed with the support of Haier (which put in 30% of the costs) and executives that built Alphesh itself, who funded the rest. See (in Chinese) http://www.alphesh.com/portal/page/index/id/9.html

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[23] https://bg.qianzhan.com/trends/detail/506/220408-3a1aa8e7.html

[24] www2.deloitte.com/us/en/insights/topics/talent/business-performance-improvement/GE-FirstBuild.html

[25] www.geappliances.com/updates/oven-feature-air-fry

[26] See these videos for more information: www.youtube.com/watch?v=Rl3pyIc5QKA; www.youtube.com/watch?v=MroZ9ibcwXo; www.youtube.com/watch?v=M3V8-c3si6Y&t=6s; www.youtube.com/watch?v=2dKrXsuKdok; www.youtube.com/watch?v=zaWAJN8aKOw

[27] See www.youtube.com/watch?v=JYJ_yHCBj7o

[28] https://pressroom.geappliances.com/news/ge-profileTM-launches-first-of-its-kind-turkey-mode-to-ease-cooking-stress-for-the-most-high-pressure-meal-of-the-year#:~:text=Users%20simply%20select%20Turkey%20Mode,centerpiece%20of%20the%20Thanksgiving%20meal.

[29] See https://pressroom.geappliances.com/news/chibo-cooks-up-support-for-restaurants

[30] Our visit on 14/5/2022 showed the website being discontinued; an old impression only read "Dear Friends & Supporters of Chibo, almost 3 years has passed since we set out to create something new; an interactive experience to connect content creators."

[31] See www.geappliances.com/ge/shabbos/

[32] See https://www.youtube.com/watch?v=HkVZ4h1k99M&t=18s

[33] www.bizjournals.com/louisville/inno/stories/news/2021/10/21/ge-appliances-mushroom-grower.html

[34] See https://cloudcomputing-news.net/news/2021/aug/20/ge-appliances-signs-multi-year-smart-home-deal-with-google-cloud/