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Document information

Author(s) and contributing partner(s) - if any

Name	Organisation	Contribution
Leonardo N. Rosenberg	035 Technion – Israel Institute of Technology	Main author
Yale T. Herer	035 Technion – Israel Institute of Technology	Reviewer
Sonja van Uden and Jeanne Hendrinks	021_1 Brainport Smart District	Helmond section
Pete Pättiniemi	022_1 Forum Virum Helsinki	Helsinki section

List of abbreviations

FVH	Forum Virium Helsinki
MD	Micro-depot

Contents

1. Executive Summary

Micro-depots are a shared logistics facility. This means that providing support for efficient transport of goods and pickup and delivery is its main *raison d'être*. Taking into consideration the high density of urban areas and the struggle for resources, however, this deliverable aims to expand the functionality of micro-depots by identifying potential auxiliary business models that can operate simultaneously at the same location and bring more added value to city residents and businesses alike. Particularly, from the business point of view, the shared micro-depot network may foster innovation by the implementation of new technologies or new operations, as well as reduce costs, given that resources would be shared.

We propose a framework to categorize possible auxiliary business models to serve as a guide to municipalities and companies interested in implanting and using the shared micro-depots network. As we see it, there are two main types of possible auxiliary businesses. The first involves services that are currently widely available, but that can utilize the micro-depot structure to facilitate these services either in terms of timeliness or cost effectiveness. The second depends heavily on the network structure and the consolidated services to become viable and attractive to the customer.

This deliverable also presents the ideas and planning from the testbed side regarding the implementation of auxiliary business models at their locations.

2. Introduction

The shared micro-depot (MD) network offers a solution to the last-mile problem in urban areas, a situation badly in need of resolution. On the one hand, last-mile logistics creates traffic congestion and generates harmful emissions, but, on the other hand, the need for frequent and convenient deliveries to customers is steadily increasing.

Given this reality, we propose to make the most of the shared MD network and solve other possible problems residents of an urban center might face. Accordingly, the auxiliary business models for MDs we present help tailor each network to its surroundings. In other words, each city can offer different services in its networks to better suit the needs of the surrounding population. This guide gives a general structure that auxiliary businesses can have and we illustrate it with a few examples.

In 2015, three-quarters of the European population lived in urban areas and this number is expected to reach over 80% by 2050 [1]. This significant number reflects a reality of urban centers that can be characterized by tiny, crowded apartments, consumerism and extensive use of disposable products.

People who live in a densely populated area usually prefer to be in, what they believe to be, a good location and this consideration generally counterbalances the option living in a larger house or apartment. Once they abdicate space, people also surrender owning *convenience* items, keeping in their home mostly the

essentials for their daily routine. These convenience items do not necessarily have to be luxurious; they can be objects that are expensive to buy if not used very often or too large and take up more room than the residents are willing to spare.

Consumerism is characterized by low-quality products being constantly sold. They are low quality because companies need to keep selling them to continue making money. So, for example, a blender cannot have a lifespan of 20 years because then people will only buy one every 20 years. This concept of planned obsolescence is applied to different kinds of products and the European Union is aware of this problem and is already battling it [2]–[4]. Moreover, hectic yet comfortable modern urban life makes people believe it is perfectly fine to use a disposable piece of plastic for only a few minutes or even seconds and then throw it away—another element of consumerism. These features result in waste accumulation and pollution. While thinking of possible auxiliary businesses for the shared MD network, we have to consider this reality and how to approach it to achieve a sustainable business in a sustainable city.

Sustainability for many of the proposed auxiliary businesses comes from, on the one hand, each being small scale. They are too small to justify their own storefront. On the other hand, each offers particular advantages to the locals because the MD will be close, very close, to the user's place of residence (or possibly another frequented location, e.g., place of work or transportation stop). The shared MD network we consider comprises many MDs that aim to reduce the negative impact of transportation of goods inside the city, while offering multiple auxiliary businesses whose goals are to provide services that offer value to residents.

We divide the auxiliary businesses into two groups:

- Standard: Business models that involve services that are currently widely available, but that can utilize the MD structure to facilitate these services either in terms of timeliness or cost effectiveness.
- Enhanced: Business models that are not commonly available outside the shared MD network and can utilize the MD structure to provide services or aspects of services that are not readily feasible using home delivery.

From the customer's point of view, there are at least three different types of auxiliary business models as shown in Figure 1. That is, customers may interact with the network in three different ways: through pickup or delivery, exchange, or making use of what we call activity space. These businesses may require different special conditions, such as electricity, temperature control, and open/closed space.

There is no one-size-fits-all suite of auxiliary business models and each implementation of an MD can provide a different solution depending on the externalities. The models that should be offered depend on many factors:

- Culture of the population/community: Different communities have different needs, and a tailored MD deployment should recognize and meet these needs.
- Needs of the population/community: Even within the same culture, different communities have different needs. These may arise from the current availability of services in a particular area.
- Location of the MD: The auxiliary offerings of an MD will depend on where in the city the MD is located. To illustrate, we provide some examples:

- Residence centered: When the MD is located close to a transportation hub, the commuting population would benefit most from auxiliary business models such as car battery exchange (versus being less relevant if located closer to the customer's home or office).
- Work centered: When the MD is close to where residents work, they would benefit most from auxiliary business models that allow people to run their daily errands easily during short breaktimes.
- Entertainment centered: When the MD is near entertainment/vacation spots, the auxiliary business models such as temporary bag storage would be beneficial.

We divide the remainder of this chapter into two parts. The first section presents our ideas for standard auxiliary business models. The second part details the enhanced auxiliary business models. In both sections we use the three categories of business models presented in Figure 1.

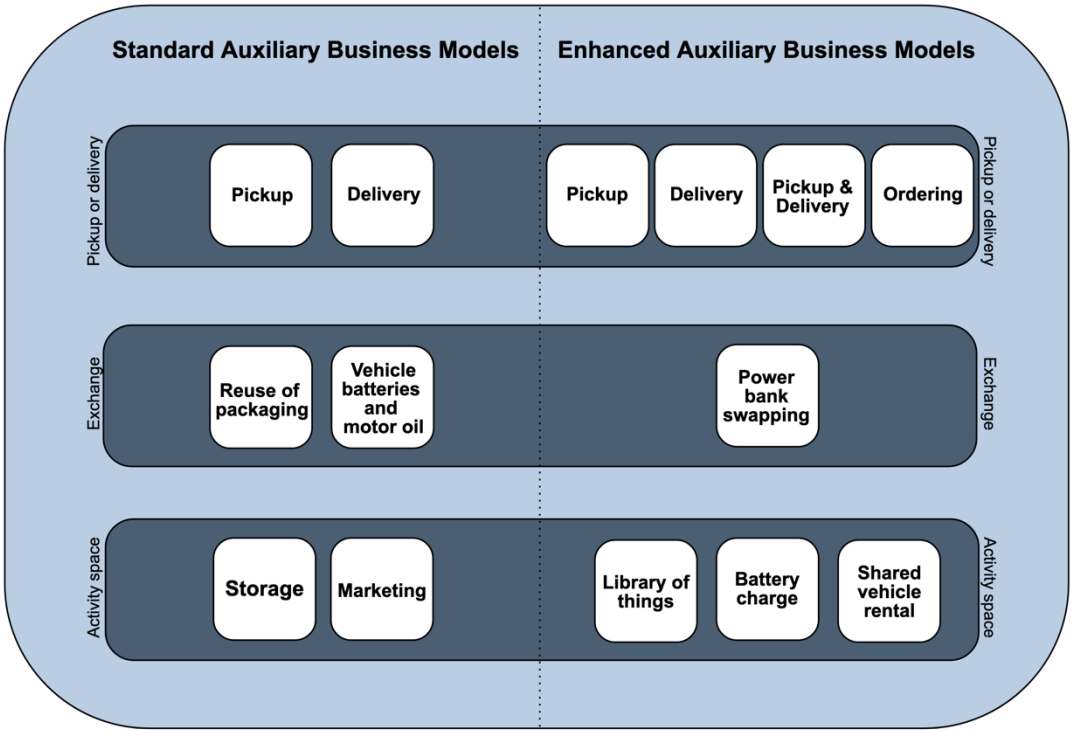

Figure 1 Auxiliary business model categorization.

3. Standard auxiliary business models

The standard auxiliary business models consist of business models that are already implemented in different places throughout the world. The main difference brought by their implementation in the shared MD network is that they will benefit from the gains of using the MD structure. We categorize them in terms of three perspectives from the customer's point of view: pickup or delivery, exchange, and activity space.

3.1. Pickup or delivery

The pickup or delivery businesses are based on reaching the customer at her or his home (or other convenient locations such as transportation stops or place of work). For this standard case, they are subdivided into two groups from the customer's point of view: pickup and delivery.

Pickup

The pickup service operates when the transportation company working for the closest MD goes to the customer and picks up an item to be delivered somewhere else. This can be done for regular mail and parcels by scheduling a pickup time upfront.

Reverse logistics

The European Union has mandated that producers are now responsible for recycling their products [5] and MDs can play a huge part in this. MDs can forge partnerships with manufacturers so as they would pay the MDs to collect and ship products that customers return for recycling. Customers could receive payment for turning in products for recycling, such as what already happens when returning glass bottles. An example would be furniture recycling: manufacturers can reuse good material from old furniture to produce new products instead of using new raw material. This helps create a circular economy and reduce our consumption of natural resources.

Delivery

The delivery service operates when the transportation company working for the closest MD goes to the customer and delivers an item. This can be done for regular mail and parcels ordered online.

3.2. Exchange

The exchange business models have, at their core, the fact that both parties—the customer and the business—both give and receive something during the transaction. This exchange can occur by giving an item and receiving a different item or by the customer giving an item and receiving something in return from the business, either an object or a service.

Reuse of packaging

In the (very) old days, a milkman would deliver fresh milk to people's homes and collect their empty bottles on the same trip [6]. The concept of recycling may, at first, seem like taking a step backwards in time, with citizens ceding a bit of the convenience of modern day life. Nevertheless, when exchanging empty glass bottles for full new ones, we are reducing the use of plastic and limiting the number of glass bottles that are needed. In one model, customers would either have their bottles picked-up at home or go to the MD with their empty bottles and receive monetary credit for them. This credit could be used immediately or in the future for purchase of new full bottles. Customers would pay a higher cost for a full bottle at first, but as they return bottles, they would receive a discounted price. This model could be applied to returning empty milk/soda/beer/wine bottles and getting filled new ones and to many other retail products that can have reusable packaging. Packaging cleaning products, coffee, personal hygiene items such as deodorant and shampoo in reusable containers are just a few examples of what can be done to create a more circular and less wasteful economy.

Vehicle batteries and motor oil

In another model, when an automotive battery dies, customers could order a new battery to be delivered to their home or to the nearest MD and then turn in the old battery sometime afterward. Alternatively, they can have the new battery delivered to them while the old battery is collected in parallel at the same moment. This is particularly useful since when a battery dies, it is expensive to move the car and obtaining a new battery is particularly difficult. Being able to return the old battery when receiving the new one is essential for environmental reasons. In fact, it is illegal to dispose of automotive batteries in landfill sites or to incinerate them [7]. For motor oil, the same principles apply, since one cannot dispose of this oil as one pleases. Having the oil changed at one's convenience, either at home or at the nearest MD, which would be much closer than a service station, would be of great value for the customer.

3.3. Activity space

When the customers interact directly with the physical structure of the MD, they are actively using the MD space. Therefore, the activity space business models require the customer to eventually be present at the MD.

Storage

Using the structure provided by the MD to store customers' items in lockers or storage units.

Small items for a short period of time

If one is away from home or out of the office and does not want to wander around with heavy items, or if one wants to leave a document/package for someone else to pick up, renting lockers is an effective way to keep items safe and not have to carry them at all times. MDs would provide space and safety. Using an MD in this way would allow the exchange of goods between two ordinary citizens without the need for them to physically meet. All they would have to do is send a code. This would be made possible by renting a locker for a period of time.

Larger items for a longer period of time

In the case of having to vacate a home or office, and not yet having a place to move into, or if there are objects that are too big to keep at home and are not used very often, placing them in a nearby MD could possibly help. Self-storage unit rentals at the nearest MD would only be available at large versions of the shared MDs, given the necessity for enough room to store large items at a close-to-home location.

Marketing

There could be screens inside the MD, in the customer service area, with multiple paid advertisements or government announcements. In addition, affixed to the MD's exterior, there could be paid wall advertisements or government announcements.

4. Enhanced auxiliary business models

The business model ideas presented in this section are enhanced because they rely heavily on the network structure. They are made possible either by the consolidation of services or by the mandatory use by customers of the MD facility. Without these preconditions, these models are either infeasible or not relevant. The use of the same MD space by different businesses also adds more value to the customer and to the real estate located in a high-density area. Instead of having many locations, each one serving a single purpose and perhaps being idle for extended periods, the shared component minimizes the negative effect on the community, by making the most of fewer resources. Moreover, it is possible for different auxiliary businesses to share the same human resources, thus preventing the MD from becoming overcrowded with

personnel not related to its core business. We divide the enhanced auxiliary business into three, as in Section 3: pickup or delivery, exchange and activity space.

4.1. Pickup or delivery

In the enhanced business models for pickup or delivery, the structure of the MD is a fundamental part of the user experience. The interaction between the customer and the MD directly at the MD is the main difference from what was presented in Section 3.1. Note that since this is a shared network, there is a single point of interaction. Given that in this model the customer comes to the MD, we add two new possibilities besides pickup and delivery: pickup & delivery and ordering. The business models in this part, accordingly, also include ordering. Pickup uses the infrastructure of the MD not only to improve the process, but also as a fundamental part of the business core. The delivery component allows the customer to order personalized items at the MD.

Pickup

The customer goes to the MD to pick up an item either with human interaction or through lockers. MDs would offer shared or dedicated lockers for third-party companies to use as delivery points for online shopping. The lockers could either have or not have a refrigeration system. This could be preferable to home delivery as it would release the customer from having to wait at home for the delivery. The attractiveness would depend on the proximity of the MD to the person’s place of residence. Examples would be groceries, general e-commerce, meal and takeout food services.

Delivery

The customer goes to the MD to deliver an item either with human interaction or through lockers. MDs would offer shared or dedicated lockers for third-party companies to use as pickup points. With this system, the customer could send items, using the locker, for the MD company to deliver to its final destination. This works for common mail and parcel delivery and it eliminates the need for the company to go directly to the customer's home or the other way around, since the MD is meant to be close.

Pickup & delivery

Providing a service vis-à-vis an item

The customer goes to the MD to pick up/deliver an item either with human interaction or through lockers. This item will receive a service. MDs would offer shared or dedicated lockers for third-party companies to use as pickup and delivery points. With this system, the customer could collect and/or send items through the locker for the company to provide its service. An example would be a laundry service: customers could

drop-off their clothes and a laundry company would collect them, wash/dry-clean them and return them to the locker in a preestablished amount of time. Payment could be made on site to the laundry company using an intelligent system. Another example would be technical support for laptops, in which the customer would send their computer for analysis and then receive the laptop back after repair.

Many-for-one home service

MDs can offer two or more services at once when interacting with the customer, which generates more value to the system as well as to the customer. This is made possible by the shared component of the network. That is, the consolidation happens given the shared facility and transport of multiple players and allows different services to reach the customer together.

With the consolidation it is also possible to arrange a specific day for all items to be home-delivered together. This service is already provided to Amazon Prime users who can benefit from Amazon Day [8].

Possible examples of many-for-one home services would be combining pickup/delivery of parcels and mail, pickup/delivery of laundry, pickup of waste and recyclable items at a single visit to a customer or pickup of personal items to be stored or delivery of items that were stored.

Ordering

MDs would offer a catalog of products that need to be personalized for each customer in a unique way. In this way, the customer would have to go to a MD to check the options and make their choice on the spot. This system would enable customers to order the correct product from a close to home location. After ordering, the product can be sent directly to the MD or the customer's home. Two possible examples are:

Paint ordering

The MD would have a color palette. Customers would be able to use the palette to order paint without leaving the vicinity of their home, instead of paying for a color-fan that would be barely used. They could also easily take the palette to their home and conveniently return it to the MD. A color palette is expensive in relation to the number of times an individual uses it and being able to physically see the colors ensures that the customer sees the real color and not that presented on a computer screen, which is not true color.

Eyeglass ordering

The MD would work as an eyeglass frame showcase, with multiple frames available. Once a customer picks a frame, the MD would order a frame with the correct lenses for the customer. The customer, then, would pick them up in a couple of days or have them sent to their home.

4.2. Exchange

The exchange in the enhanced models occurs when the exchange transpires in the MD facility and is part of its core operations. That is, the action of swapping objects and/or services occurs inside the MD instead of at the customer's home.

Power bank swapping

Note that MDs must have a power source to run its normal operations and thus having power for battery charging is available by default. Customers would pay a monthly/yearly fee and they would carry a power bank with them. In the case of dying battery they could turn in their power bank and grab a full one. This way, they would not have to charge it when depleted, but only swap it at the nearest MD.

4.3. Activity space

The activity space for enhanced business models focuses on the concept of sharing. The idea of shared MDs is cooperation to improve business and urban lifestyles on different fronts. Its aim is to promote a more sustainable lifestyle and avoid cluttering small homes. One of these fronts is helping citizens make do with limited resources, be it lack of space, money or time. The activity space also provides value for the community that it is adjacent to the MD, since its residents would participate in the shared and circular economy.

Library of things

MDs would have a space whose purpose is to store items that people typically do not use very often, are expensive and/or are too large to be kept in a small house or apartment. Customers would rent these items for a limited amount of time (different times for different kinds of items). Such items could be, but are not limited to:

- Beach equipment (chairs, parasol, cooler, floaters, …)
- Kitchen equipment (grinder, pasta machine, blender, food processor, mixer, juicer, barbecue grill, …)
- Tools (drill, nail gun, standard toolbox, power saw, steam cleaner, …)
- Party accessories (large hot water urn, hot plate, punch bowl, sound system, …)
- Luggage, suitcases, duffel bags
- Gym equipment (dumbbells, steps, rope, mat, trampoline, …)
- Specific weather gear (umbrella, raincoat, windbreak coat, scarf, gloves, blanket, fan, …)

This service could be modularized, i.e., each line of products is independent of the others. This allows tailored MD service for the area in which the facility is located. For example, a beach module is only reasonable in cities that have a beach.

Battery charge

Phone-charge locker

There would be lockers at the MDs and in them an energy outlet with charger cables for different phone models. Customers could leave their phones inside the locker while charging.

Cars (electric)

Outside each MD there could be a number of charging stations for electric cars.

Shared vehicle rental

Both locals and tourists could profit from using shared vehicles to get around the city. Although for many city inhabitants owning their own car is not a necessity, sometimes they need a car to transport large objects or other people around town or for a quick getaway outside the urban area. This type of rental empowers people to get to places not reachable by public transportation. This would be offered as shared electric cars and bicycles.

5. Transfer of auxiliary business models

After discussing the framework with the testbeds, each city held discussions with their business partners to better understand their own needs and the operational feasibility of implementing auxiliary businesses at their MDs. This section describes the ideas, future possibilities and planning of each testbed. Figure 2 summarizes their intentions in our proposed framework.

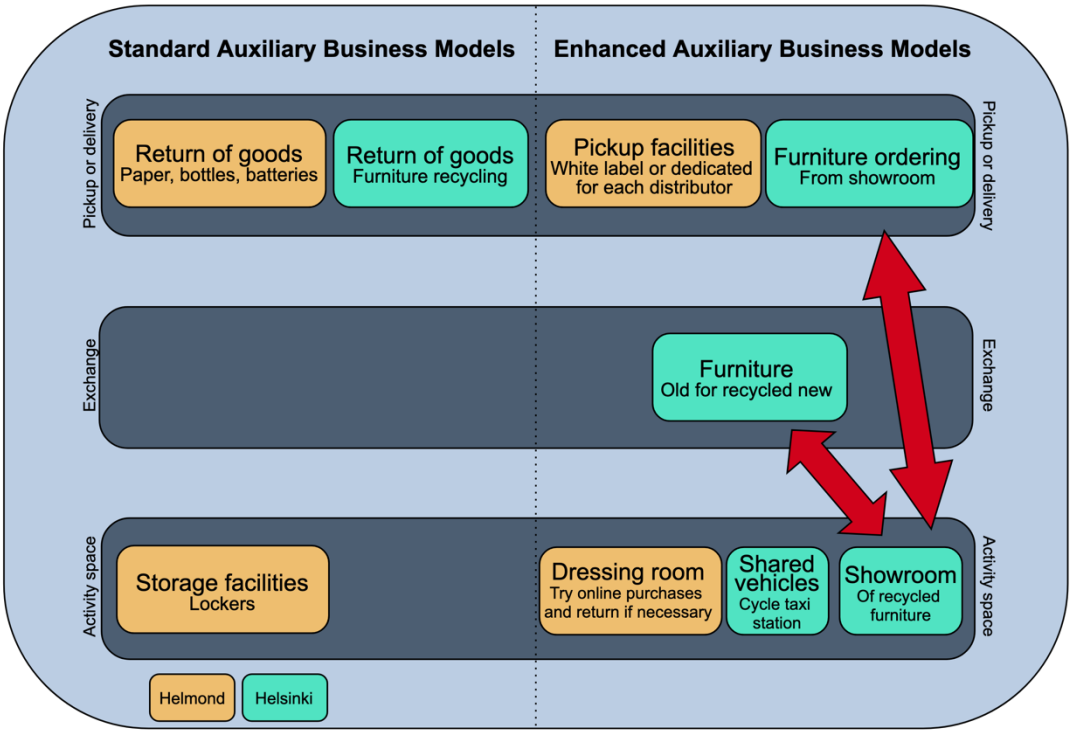

Figure 2 Planning of auxiliary businesses at the testbeds

5.1. Helmond

In general, in the contemporary Dutch parcel distribution system, home delivery is normal. Increased road-safety and CO_2 reduction laws could prompt a mind shift in favour of picking up things, when the location is well chosen.

The MD in the city of Helmond will be part of the new mobility hubs being built in the Brainport Smart District. In this district, fossil-fuelled vehicles are banned, which means that the neighbourhoods are not accessible for cars, but only for slow traffic such biking or walking.

To accommodate parcel delivery and/or pickup in the district, a distribution point must be set up. This distribution point can be complemented by other facilities to enhance the comfort and meet the needs of residents and visitors to the district. The construction of the district has not started yet and will be done in phases. This means that the distribution point and added facilities have to be scalable, accommodating an increase in the volume of transactions.

For the mobility hub itself, a number of different services are envisioned, such as charging stations, shared-rental services of bikes, scooters and cars, tool storage, and a kiosk for small beverages. Through various

channels we have started conversations with commercial providers to gauge their interest in providing these services.

For the distribution point itself, different ideas for extra services were gathered from commercial partners as well. They are the following:

- Return of goods (§3.23.1, e.g., paper, bottles, batteries)
- Storage facilities (§3.3)
- Pickup facilities (§4.1 white label or dedicated for each distributor)
- Library of things (4.3 lawn mowers, large kitchen equipment, party accessories, tools)
- Dressing room to enable customers to try on clothing that is delivered with the option of immediately returning it (4.1 and §4.3)

5.2. Helsinki

Forum Virium Helsinki (FVH), the innovation company owned by the municipality of Helsinki, approached multiple e-commerce flea market companies, to accommodate drop-off of their sold/purchased items. It even wanted to set up a photobooth at the shared MD. Moreover, IKEA was planning on having a recycling of old smaller furniture and home interior item point at the MD (§3.2), but due to internal matters this was not implemented at this moment. There were also discussions with a smaller furniture retailer to have a small showroom (§4.3) for their recycled home interior products (§4.1,4.2). Another possibility that FVH studied was to use the shared MD as a storage space for cycle taxis (§4.3). An EIT Digital initiative, which uses autonomous delivery robots with lockers for parcel delivery, called Last Mile Autonomous Delivery (LMAD), plans on using the MD as their depot. The shared MDs, thus, also serve as enablers for market penetration of innovative technologies—proving that they are extremely beneficial for businesses.

6. Concluding remarks

We proposed a framework for possible auxiliary businesses that would work in the shared MD network. This guide intends to help municipalities and their business partners to understand the opportunities of sharing an MD to add more value for the community while improving current business operations.

The idea of auxiliary businesses for the shared MD network is not to turn it into a small shopping mall, but rather to make the most of things with less. This way, increasing the value of the urban space used and providing residents with services that, without the consolidation at one spot, would be harder to receive. Moreover, companies can look at the shared MD network as an innovation hub, in which they can propose new paradigms and try them out with support from the local authority.

The main construct that underpins the entire concept of auxiliary businesses at an MD is the shared component. Besides possibly resulting in reduced costs of personnel and real estate, among other costs, the level of cooperation among business partners is the critical aspect that may prove that these models are good for both the end-consumer and for the companies themselves.

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