The impact of Automated Parcel Stations (APS) on e-commerce's last mile delivery: Case Of Pop Box

Project Report

ABSTRACT

What customer value most while shopping through E-commerce portal? An obvious answer is convenience. How to give enhanced customer satisfaction is a key challenge for all E-commerce portals. Ensuring hassle free delivery is one of the critical aspect of customer satisfaction. The report examines the impact of Automated Parcel Stations (APS) on e-commerce's last mile delivery by using case of PopBox.

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Contents

Literature Review

There are two facets of literature review i.e. empirical literature review and framework literature review. The framework literature review gives a principle underlying of the research however empirical literature provides a deep understanding of either some experiment or event with respect to a specific target segment. The chapter of literature review provides foundation of research. It not only helps in developing the understanding of the research area but also gives an insight into existing pool of literature. The literature review also helps in developing the gap in existing literature which would facilitate in developing the hypothesis (Saunders et. al., 2012).

The chapter of literature review comprising of five sections. First section explains about the growth and challenges faced by e-commerce Industry. Some empirical evidences from Malaysia has been captured. Second section explains a specific issue of last mile delivery and conduct a comparative analysis of Last Mile delivery methods. Third and fourth section narrates about Automatic Parcel Stations and explains how it solves last mile delivery problems. Fifth section uses the case of PopBox to explain the process flow of an APS. Sixth section, explains other technological advancements which are trying to solve last mile delivery problem and assesses their impact on APS.

Growth and challenges of E-Commerce Industry

The emergence of E-Commerce is not a phenomenon of 20th Century but existed in form of electronic data interchange for standardized computer to computer exchange of information either within organization or between two organizations (Mckinsey,2016). However such transactions were limited to business and common people has limited role to play. However with arrival of internet in 1993, and its rapid adoption by masses helped World Wide Web in establishing itself as popular medium for commercial transaction (Zwass, 1996). People realizes that doing transaction on internet is not only convenient but also cost efficient and

provide more options to buyers (Alka and Murlidhar,2013). Since E-Commerce operates in a networked environment, it also helps in diminishing the geographical and political boundaries. E-commerce brought whole range of products on the networked platform where people can buy and sell. Further, E-Commerce businesses also helped businesses to remove the traditional middle man such as wholesalers, distributors and retailers from the value chain. However, E-commerce business models give rise to different types of intermediaries such as network providers, authentication and certification services, data base provider, and electronic payment system (Mckinsey,2016). Therefore value chain of E-commerce system give rise to an entire new value chain which reduces the cycle time in which goods travel from manufacturer or original supplier to consumers. The value chain of both traditional and E-commerce model is shown below:

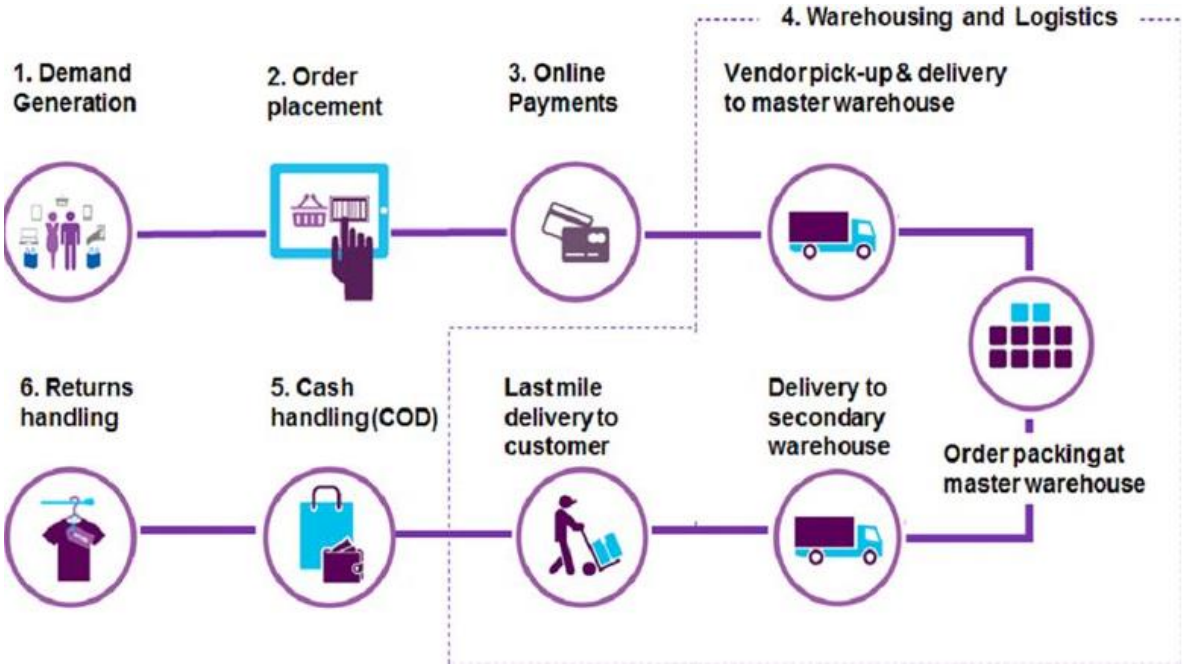

Figure 1: Ecommerce Value Chain (Mckinsey, 2016)

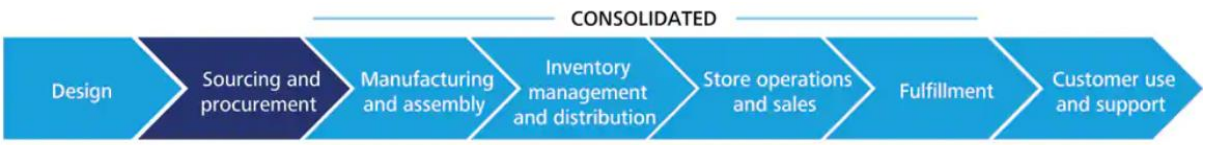

Figure 2: Conventional Business Value Chain (Angel, 2012)

The E-commerce business disrupted the traditional retail model and the entire retail industry observed a massive shift from brick and mortar model to E-commerce model. Consumers preferred to shop through E-commerce portal mainly because of following reasons:

- About 78% of consumer thinks that using E-commerce portal because they perceive it convenient and saves a lot of time (Foong, 2013).
- Roughly 51% of consumer thinks that they get better pricing at E-commerce portals than at conventional brick and mortar shop (Foong, 2013).
- Around 43% of consumers thinks that E-Commerce portals provide diverse and more selection options (Foong, 2013).
- Roughly 40% of consumers select E-Commerce because it provides better shipping options (Foong, 2013).

Therefore it can be inferred from above findings that convenience is the key driver which motivates people to buy from E-commerce portals. The convenience may be measured in terms of saving time or better shipping options etc. The shift in consumer behaviour give way to many domestic and international E-commerce players to operate in Malaysia.

Though E-Commerce business is based on disruptive and innovative value chain but at the same time it has its own challenges which is quite different than the challenges faced by traditional retail model. Some of these challenges are as follows:

- Quality Issues: With increasing number of E-Commerce portals, there is also increasing Quality related complaints from the customers. These quality issues may be related to expiry date of products, counterfeiting etc (Amani et. al., 2016)..
- Mismatch between actual and displayed product: At times E-commerce portals do not have the exact image of the product. In such cases E-commerce portals update the

product catalogue with either indicative image or the image provided by seller. These lead to the possibility that there would be a mismatch between displayed and delivered product (Amani et. al., 2016).

- Transit losses: The transit losses are primarily attributed to supply chain, logistics and warehousing. It may be because of mishandling of goods, or because of storing under inappropriate conditions (Ducret, 2014).
- Missing deliveries: This is one of the major concern which most of the E- Commerce companies are facing. Deliveries are primarily missed because at the time of delivery the customer might not be at the address. This is mainly because delivery is attempted during working hours. It not only reduces the degree of convenience – the biggest motivation of selecting E-Commerce but also increases the cost of service for E-Commerce portal (Ducret, 2014).
- Longer resolution time in case of return: Longer resolution time in case of return of the product is mainly attributed to delay in pickup, lack of appropriate reason of return, examination of legitimacy of cause of return etc. (Ducret, 2014).

Analysis of brief challenges faced by E-commerce industry indicates that challenges such as quality issues, mismatch between actual and displayed product, transit losses and longer resolution time in case of return are controllable challenges. By strengthening its operation the above mentioned four issues get resolved. However, it should be noted that the issue of missing delivery cannot be minimized only by strengthening its operation. This is primarily because of the fact that extrinsic factors such as consumer behaviour also affect the same . In subsequent section, issue of missing delivery would be described in detail.

Last Mile Delivery

This fact has come to the attention that the 'Last Mile' should be defined. What is a 'Last Mile'? It is the process which starts at the moment when a parcel is dispatched from the final distribution ground to the end receiver (which can be either an individual or a collection ground). (Gevaers et al., 2014). The complete supply chain of a company contains several logistics. There are few processes in the distribution logistic which make direct contact with customers to symbolize quality and boost the consumption experience of the customers. Despite of these facts, many companies under-estimate it and tend to delay or completely ignore to contact customers to know their remarks. The abstract of the discussion is therefore; "Last mile logistics is the last part of a B2C delivery process. It takes place within a predefined delivery area (e.g. urban area); including the upstream logistics to the last transit point until the destination point of the parcel. It involves a series of activities and processes, of critical value to all the involved stakeholders (e.g. Customer, Industry and Institution) within the delivery area" (Wohlrab et al., 2012)

The last step in the delivery service is Last mile logistics that includes many activities and processes, which are required to perform in order to complete the delivery from last distribution ground to receiving ground of a supply chain. (Lindner, 2011). Hereby, the human resources are the key factor for the last mile in a supply chain, the courier is delivered by a person to the door of customer, this is the only contact point where a customer is going to meet someone during the online shopping experience. A poor delivery encounter can very easily harm the customer perspective about online shopping. To make the last mile logistic successful the transporting company should try to create a balance between costs, profit and the quality of the delivery service. Now a day's e-commerce is in trend and further growing as the time passes and the last mile is key performance indicator for it. So, could this inspire the logistic companies to strongly desire to invest in improving their last mile distribution? Let's analyze the result of a research conducted investigate this reality, let us see the logistics

performance in UK during 2004: There were complaints from 30% of the customers about the delivery failure at first time according to the logistic provider's report, resulting in poor customer remarks and in un-ignorable logistic inefficiencies. (Ding, 2013). During the year 2006, the reports reflected that about 12 percent of home deliveries failed to be delivered, and around 50–60 percent of UK household customers were not at home when the delivery man arrived to deliver the products (during the working time) (Ding, 2013). 50- 60 percent is a wide gap of no one at home to receive the parcels. To resolve this issue of unattended deliveries a motivational and innovative idea appeared in the logistic management which will be discussed in the analysis part later.

Figure 1 below shows the results of a research conducted in China. The reports show the logistic costs that incurred in different processes per parcel logistics cost per parcel. The data collection shows that the cost of last mile logistics occupied more than half of overall logistics service. The general population of China are usually resident in capacity of tenants, this reflects that the complication in distribution of parcels may not be fully due to inefficiency in the logistic processes, It may be due to the customers unavailability of the customers , so if any logistics company could access this part of the issue and can generate an innovative idea to avoid the absence of customers when employee go to deliver the products, then the company can save a lot of costs during the final mile delivery. For Example if logistic company can get in touch with customer and inquire the availability of the customers it may prevent them from repeating last mile for same packages, hence the cost will be saved . In China, logistics cost in final distribution is much higher than in line haul as the picture showed.

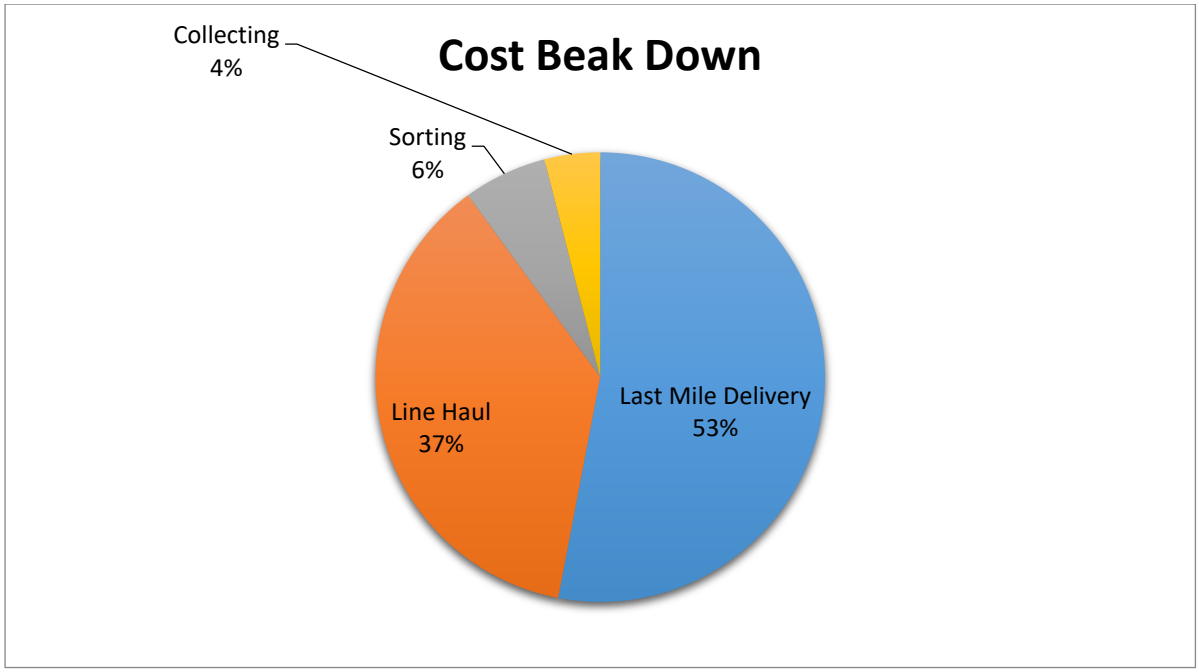

Figure 3: Cost breakdown of entire logistic cost (Goh et. al. 2011).

The figure 3 illustrates the cost break down of the logistic cost . The logistics cost in final distribution is much higher than in line haul as graph showed above

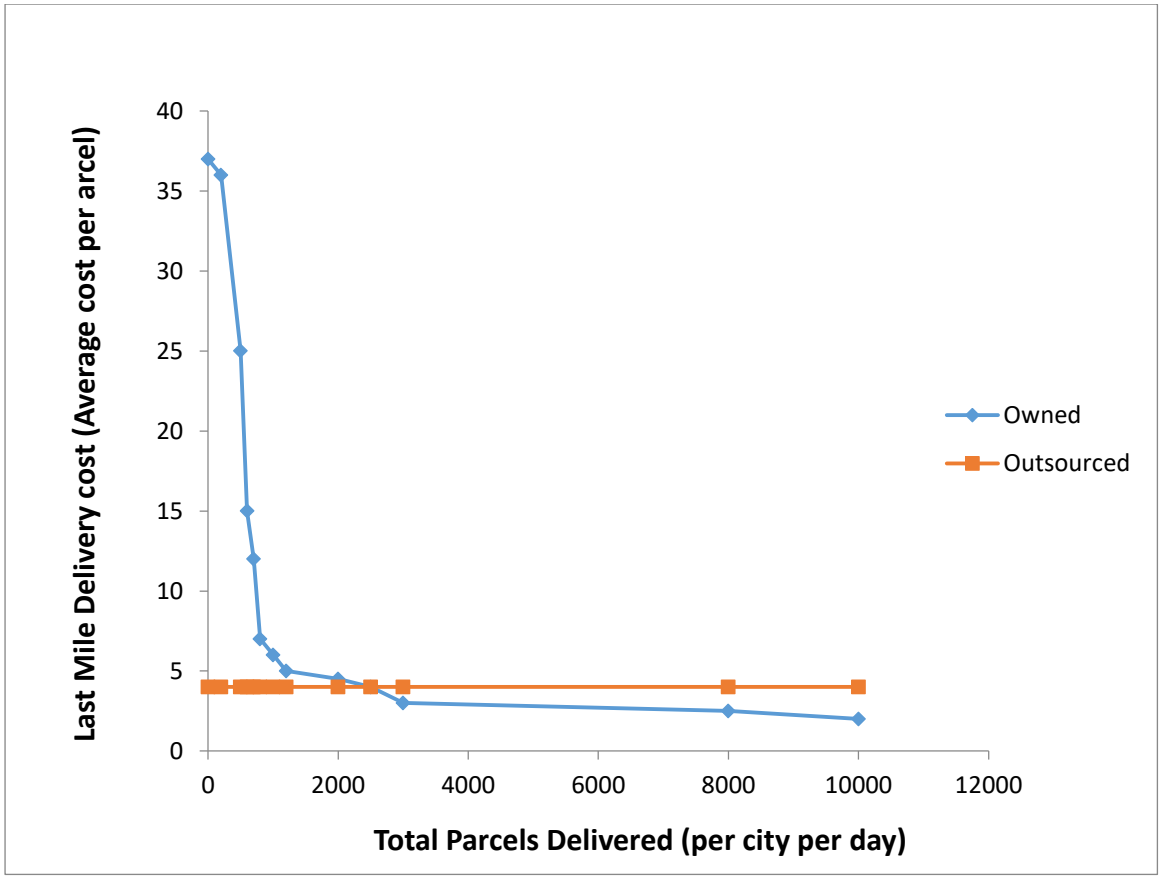

Figure 4: Last mile (intra-city) delivery economics (Goh et. al. 2011).

The Orange line in figure 4 represents the relation between average cost of each parcel and total amount of all parcels in self-owned logistics , and the blue line represents the same relation with outsourced logistics cost. Both results follow same standard that in one city and in one. In case of Out sourcing Logistic Services, the delivery cost is consistent thought out the activity level (the numbers of parcels delivered per day) but on contrary, in the owned logistic services the costs are very high at lower level of delivery activities and it reduces up to 2 Yuan's at maximum activity levels. Therefore, it can be predicted that a logistic company can achieve the low cost only in case of occupying a large customer base (i.e. higher number of deliveries per day).

Last Mile Delivery Options

The main role of the last mile delivery is to bridge e-commerce and customers. It has also discussed it as the final key step between on line businesses and online shoppers (Holdorf and Haasis ,2014)

LMD has become a significant factor for both online shoppers and online sellers due to the advanced technology. That motivates the online sellers to adjust and improve their current transport capacity. The delivery of the last mile is an inevitably crucial critical success factor now more than ever because of the increasing demand online buyers.

The traditional delivery services like UPS and FedEx are inefficient in all areas and the online retailers seek alternatives logistics to fulfill their customer's needs and want to expand their market share (Holdorf and Haasis, 2014). An alternative approach to conduct the business is provided by the fast paced IT driven environment. Therefore, retailers are adapting variety of software applications, which help them to provide easy and more targeted customers access to their products. (Lee and Yang, 2013).

There are two ways a LMD might fall into, which are attended delivery and un attended delivery.(Gevaers *et al*, 2011). The matter of unattended delivery arises when the online shoppers are not at home when the parcel arrived while the attended delivery means that the parcel was received by the person when it showed up on the door-step of customer.. Now the matter of unattended delivery is need to be dealt in such a way that it balances the costs, customer remarks and customer's privacy. There are certain ways to make sure that the products are safe and sounds when they are reached at the door of the customer and there is no one accept them.

A. Company may ask the permission to let the delivery man enter into home using home access system;
B. Company may ask permission to drop the order into reception/Locker box;

C. Send the parcel to the local reception ground to store and delivery it to the customer when he is available.

Home access system:

It is a system in which a telephone is connected remotely to an electronic key pad that can open or close a door (Iwan, Kijewska and Lemje, 2016).The password to home access can be changed after every delivery. When the door is closed after the delivery, keypad will generate and send a new code to confirm that the delivery is successfully made.

Reception boxes:

It is fixed box outside the house of customer which can controlled either by manual lock or electric lock. It is mainly used for receiving parcels and emails. Modern Reception boxes also have temperature controls so they can receive food deliveries as well. (Iwan, Kijewska and Lemje,2016).

Delivery boxes:

These boxes Distribution Company or retailer's property, The Company will correct the boxes which include empty box or return goods box on another collection round (Iwan, Kijewska and Lemje, 2016).

Local agency:

They are local collection grounds acts as intermediary between final distributor center and customer in case of unattended delivery. This company helps their customer to receive order but also deliver to customer's home when it is convenient with them. When a parcel reaches at the local agency they notify their customers by mobile phone or email. (Iwan, Kijewska and Lemje, 2016).

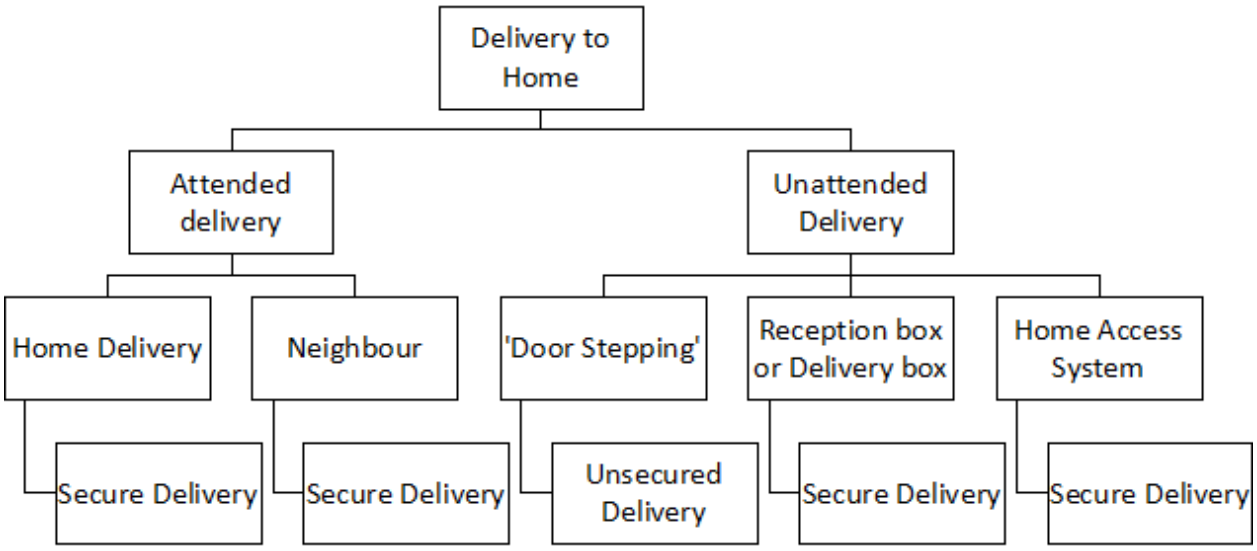

Figure 5: Classifications of Delivery Option to Home (Frenie and Spark (2014))

Based on the solution of unattended delivery above, the parcels can also be placed in the collection point and then acknowledge the customers by any means available to collect their parcel (Iwan, Kijewska and Lemje, 2016).

According to Interactive Media in Retail Group (IMRG) report 2016, Four options available to the online shoppers which are mentioned below:

1. In-store click and collect: Buyers book their orders online on a website and collect them from retailer on their own.

2. In-store reserve and collect: Buyer books the orders and requests the retailers to keep their orders until the payment is cleared. After the clearing of payment buyer collect the order from retailer.

3. Parcel Store: Buyer pay and check out website and select a convenience store to pick goods from

4. Lockers: Buyer pay and check out the website and request retailer to send their goods to private lockers or MRT Stations and then customer picks up the parcel using Pin code or QR code.

Figure 6: Click and Collect Options (IMRG Report (2016))

According to Cullinane (2009), customers are required to reduce the delivery time, preferably an hour, but as the distribution company, the wider of the delivery, the lower cost of the delivery. The density from 3 hours reduce to 1.5 hours will lead the cost increase 17-24%, and ignore the delivery window altogether result will lead to saving 27-37%. DTI (2009) make a survey based on 317 online shoppers and the result shows that the 34% of respondents indicate the best delivery time is on 6pm until 8pm. A huge delivery demand generate in this short period, and lead the delivery motorcade move at low capacity for 80% of the day (Xu, Ferrand and Roberts, 2008).

Comparing the Last Mile Delivery Method

From the literature review above, each delivery method have different advantages and disadvantages. Table below compares and explains each delivery methods as below.

	Attended delivery	Reception/ Delivery box	Controlled Access system	Locker Bank	Collection point
Last mile	Delivery company	Delivery company	Delivery Company	Customer	Customer
Customer available	Yes	No	No	No	No
Product types	Any	Packages, Grocery	Packages, Grocery	Packages, Grocery	Packages
Failed deliveries	High	Virtually none	Virtually none	Virtually none	Virtually none
Delivery hours	Fixed delivery hours	Delivery company operating hours	Delivery company operating hours	Delivery company operating hours	CP Opening times
Collection time	Not appropriate	24 hours	2 hours	24 hours	CP Opening times
Retrieval time for customers	None	Very short	Very short	Short-Long	Short-Long
Drop off Time	Long	Short	Short	Very short	Very short
Initial Investment	Low	High/Medium	Medium	Medium	Low/ Medium
Delivery Cost	High	Low	Low	Lowest	Lowest
Possible	High Failed	Large number of	Safety concerns	Customer has to	Customer has to

Operational Problems	Deliveries. Poor use of vehicles	boxes required. Collection of boxes		travel to collect	travel to collect
Reduction in vehicle activities		Some reduction	Some reduction	Greatest reduction	Greatest reduction

Table 1: Comparing the Different Method of Last Mile Delivery (**Iwan, Kijewska and Lemke (2016).**

How Automated Parcel Station solves the last mile delivery problem

Automated Parcel Stations Changes the concept of delivery. Contrary to home delivery the items are bundled and dropped off at the automated locker by the external courier. After a successful delivery to unmanned pick-up point the recipient is notified by either SMS or email with a code to collect the parcel themselves. These lockers are accessible every moment of the day, the customer usually has 3 days to collect the parcel, if he/she fails to do so which only happens in (1% of the cases) the item will be taken back to the hub by the courier. Another option is also available, in case of a failed home delivery the courier could also leave the parcel at the automated parcel station for the customer to pick up afterwards instead of making a second or third redelivery which commonly is at the cost of the consumer (Giuffrida et al., 2012; Somers 2014).

It is no coincidence that logistics providers place their automated lockers in busy areas. This is part of a main strategy to minimize the distance travelled by the courier and the recipient who must personally collect the parcel. Parcel lockers are carefully positioned near residential areas such as post offices, universities, shopping centres, station etc. This in turn enables simple access often linking the trip to the APS with other activities (e.g. waiting for

the train, shopping, refueling the car) also referred to as trip chaining. (Giuffrida et al., 2012; Iwan et al., 2016a).

In addition to the delivery and pick-up of parcel the automated locker can also be used as a tool for reverse logistics. Making the machines able to receive and send parcels (often at a lower cost than from post offices) A customer can enjoy the extra service by sending the packages or if the parcel is damaged the APS can be used to return the good to the retailer, reducing the deadhead trips by the courier. Logistic operators also added supplementary services to their automated lockers. The APS is equipped with a payment service so customers can be for either mailing or delivery of their parcel. A printer inside the machine makes it possible to print receipts or self-adhesive postage (Somers, 2014; Iwan et al., 2016a).

Hence Value chain and architecture of APS may be shown as below:

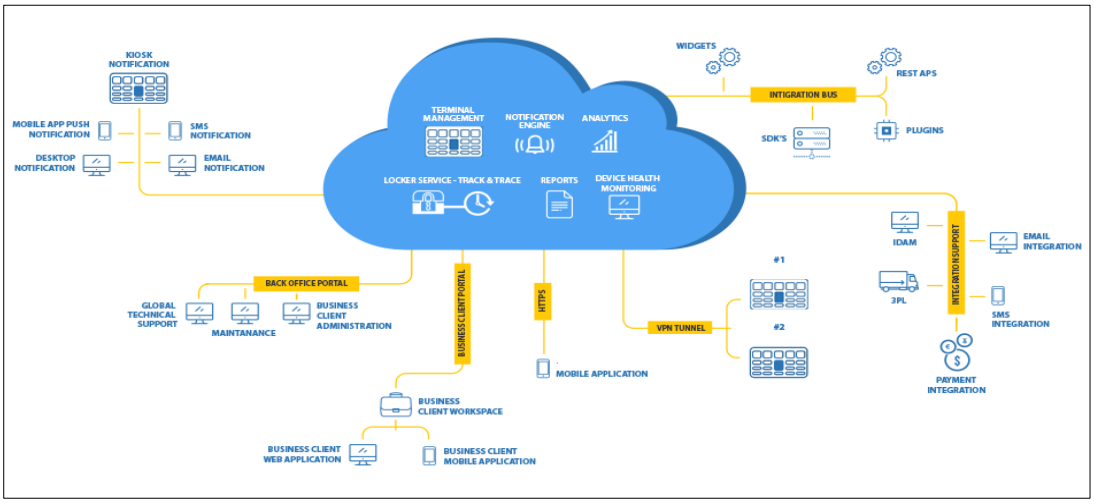

Figure 7: value chain and technical architecture of an APS (Source : Smart box Webpage)

The above schematic indicates that any APS system is integrated in terms of technical architecture and data management but highly decentralized in terms of delivery. The process would be further explained in detail while considering the example of PopBox in subsequent section. Hence, APS helps in solving the last mile delivery problem in following way:

- Reduction in missing the delivery: There are two ways by which there is reduction in missing the delivery. First, it gives a large window of 3 or even more days to consumers to collect their consignment from automated parcel stations. Second, these parcel stations are generally at crowded places where consumers can go while commuting for work. This means, consumers need not to plan specifically for picking up their consignment.
- Reduction in wait time of the customers: Consumers need not to coordinate with delivery executives and wait at deliver point for extended period of time. This improves not only consumers satisfaction but also saves a lot of time.
- Reduction in delivery cost: Since delivery executive need not make multiple attempts of delivery, therefore delivery cost will be decreased by using automated parcel stations. Also time to serve also improves as delivery executives need not to search specific addresses for every delivery.
- Ensuring privacy: At times consumers gets forced to receive their packets either at their work place or in home when guests are around. This hampers the privacy of consumers. Automated parcel systems gives enough flexibility to consumers so that they can pick their parcel when they are comfortable.
- Reduction in cycle time of reverse logistics: As mentioned above, automated parcel stations can also be used as receiving stations for any return an thus reduces the reduction time of returns, exchange or refunds (Somers, 2014; Iwan et al., 2016a) .

Advantage APS

Automated Parcel stations also helps in solving other critical aspect of last mile delivery such as cost advantage, single day delivery and accommodating increasing demand.

Cost Advantage of APS

Research has shown (Gevaers et al., 2014) that when the route distance remains the same and and the number of parcels drops could increase the price per parcel is set to drop. Thus, the density of an area is correlated positively with the number of drops a driver can execute during his route. If a consignee for example lives in an area with a density of 0-50 inhabitants (€7.75) the number of possible drops that a courier can perform will be lower thus tripling the cost (€2.75) of delivery compared to an inhabitant living in anurban area with a density higher than 1500 inhabitants (Gevaers et al.,2014).

Density/km²	Last mile costs/unit	Density/km²	Last mile costs/unit
0 – 50	€ 7.75	601 - 800	€ 2.96
51 - 200	€ 4.17	801 - 1000	€ 2.87
201-333 (Belgium)	€ 3.87	1001 - 1200	€ 2.81
334 - 400	€ 3.55	1201 - 1500	€ 2.79
401 - 600	€ 3.12	> 1500	€ 2.75

Table 2 : Cost Comparison of conventional delivery model (Gevaers et.al. 2014)

However the costs of B2C home deliveries are high, this is due to the many inefficiencies within the last mile combined with a poor environmental performance (Gevaers et al., 2009). It should be pointed out that these last mile costs are displayed as the last mile cost per unit delivered. It refers to the cost of ownership. These costs are sometimes passed on to the shipper or to the recipient. The costs are calculated from the moment the parcel has left the depot of the logistics provider until the delivery at the customer's house or at another location (Gevaers et al., 2014). A set of researchers have estimated the average cost of home delivery which is shown in table below:

AUTHOR / STUDY	COST OF HOME DELIVERY PER PARCEL
K. Boyer et al., 2009	€5.59 - €7.95
Giuffrida et al., 2012	€2.02 - €4.85[27]
Gevaerts, 2013; Gevaers et al., 2014	€3.87[28]
Iwan et al., 2016a	€2.57 - €3.39[29]

Table 3 : Cost Comparison of APS based delivery model (Gevaers et.al. 2014)

Similarly, cost of B2C parcel delivery via Automated Parcel Station is also examined by few researchers which is tabulated below:

AUTHOR / STUDY	COST OF DELIVERY VIA CDP PER PARCEL
Giuffrida et al., 2012	€0.24 – €2.3 - €0.36 - € 5.35[49]
Gevaers et al., 2014	€1.16 - €2.91[50]
Iwan et al., 2016a	€2.18[51]

Table 4 : Cost Comparison of various research (Maere, 2017)

Clear it can be seen that Automatic Parcel Stations is cost efficient over traditional delivery. Compared to the high percentage of failed home deliveries, parcel lockers do not suffer from this issue it is assumed that the first time hit rate is 100% thus saving costs by not having to re-deliver and redistribute the parcel (International Post Corporation, 2010). By bundling goods and having them delivered at one location saves time and costs. Finally, due to not having the personally deliver the parcel at each recipients'' house it will lead to more optimized delivery routes. These factors lead to reduced operational costs (Gevaers et al., 2014).

Single day delivery

The Automatic Parcel Stations have converted delivery from B2C model to B2B model and therefore problems such as missed delivery, 'not at home problem' , high transit time of delivery executive, and inability to find the address gets solved. This not only increases the cost but also total time to delivery. On the contrary, Automated Parcel Stations logistic companies deliver the parcel at a set specified location which is generally at well-known locations. Therefore, the overall turnaround time of logistic companies gets decreases and therefore E-commerce as well as logistic companies can promise single day delivery with greater ease (Gevaers et al., 2014)..

Accommodating increasing demand

Automated Parcel Stations also flexible in catering increasing demand. This is primarily because of the fact that Automatic Parcel Stations are facilities which requires high initial investment and low operation expenditure. Also, the incremental cost of operations is not high. Therefore, even if demand increases the same facility may be used provided it is underutilized. However in case of traditional delivery model, every additional demand

requires additional delivery cost because the traditional delivery model is based on low capital expenditure and relatively higher on operational expenditure (Gevaers et al., 2014).

Based on above discussion a SWOT analysis of Automated Parcel Stations are shown below:

Strengths	Weaknesses
• Customers can Track their packages 24/7 • Low delivery cost • Reduction in use of vehicle makes it environmental friendly	• Public authorities have no information on impact on private parcel lockers • Customers have to collect the packages
Opportunities	**Threats**
• Efficient • Easy to relocate	• Rapid growth of e-commerce inviting new entrants in market which may impair the profitability of sector as a whole

Table 5: SWOT Analysis of APS (Torrentellé et al, 2012)

Key APS providers: Case of PopBox

As mentioned above that Automated Parcel Station has the ability to solve last mile delivery problem. Also, it has been understood that it will be an additional intermediary in entire value chain of E-commerce business.

Globally there are many automated parcel station providers. Some of the notable names are Locktec, Smartbox, PopBox, Kern Smart Terminal automated parcel lockers etc. For the

purpose of the research, the case study of PoPBox is examined. The process flow of PoPBox is outlined below:

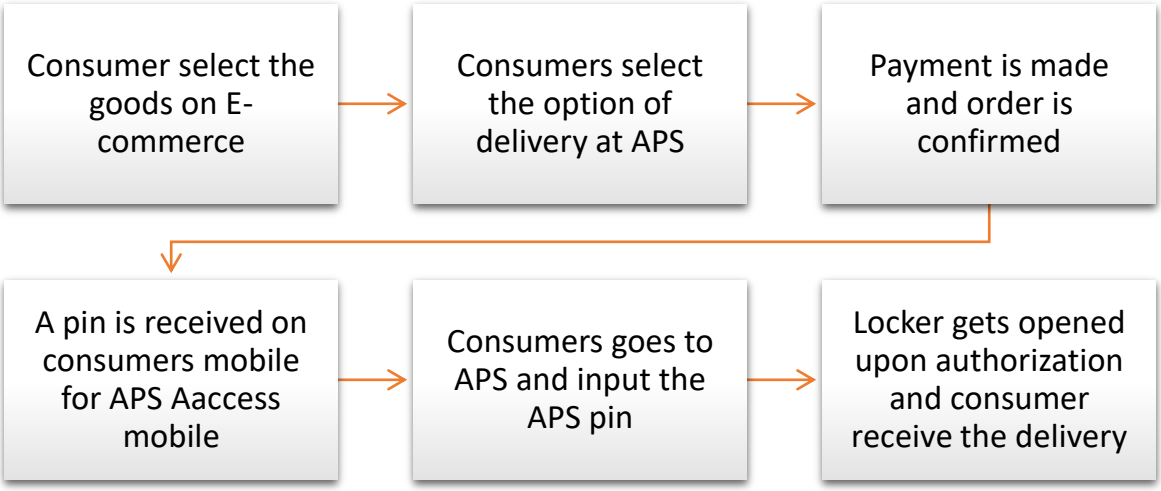

Figure 8: Process Flow of PopBox (PopBox, 2017)

As mentioned in figure above, the operation flow of PopBox is quite simple. The location of Automated Parcel stations are integrated with various E-Commerce Portals. Therefore the entire operation of PopBox may be explained below:

- Consumers log in to E-commerce portal and select the items of their choice
- After selecting the items, consumers may put those items into the basket for purchase.
- At the same time consumers select the option of PopBox APS for delivery.
- Post that, consumer re confirm the order and make the payment.
- Upon successful purchase of the order consumer gets a pin for accessing the locker at Automated Parcel Stations of PopBox.
- Once delivery of the goods at APS is confirmed by E-Commerce Company, consumer can go to APS any time, and use the password sent to her for accessing lockers.

- Upon successful entry of the password, the box containing gets opened and consumers obtain their basket.

In its advertisements also PopBox claims that it solves three fundamental problems of last mile delivery associated with any E-commerce business. These problems are longer wait time for delivery executive, missing the delivery owing to unavailability at work place, and compromising the privacy of customers. Therefore PopBox with its offering of automated parcel station could able to solve the problem of last mile delivery in E-Commerce value chain.

Other technological solutions

While numerous powers will impact which conveyance models will turn out to be generally embraced, unmistakably the business will keep on experiencing significant disturbance in the coming years. In this segment, we talk about how the fundamental mechanical developments of centre work; their potential focal points and restrictions that may hinder reception; and their potential application in the market (Stanford, 2016).

Algorithm and Analytics based Solution

A few programming advancements have been enhancing last-mile conveyance in the course of recent years and have opened the entryway for built up conveyance organizations and in addition new contestants to offer new or enhanced administrations that better location client desires. Specifically, the fundamental developments that permit conveyance organizations to offer redid conveyance (e.g., on-request or same-day) incorporate undertaking dispatch coordinating and dynamic steering calculations. In the accompanying pages we investigate these and a few different developments and their effect on last-mile conveyance (Stanford, 2016).

A few basic calculations and examination have empowered last-mile conveyance to wind up more productive and viable. Their working reasoning is demonstrated as follows:

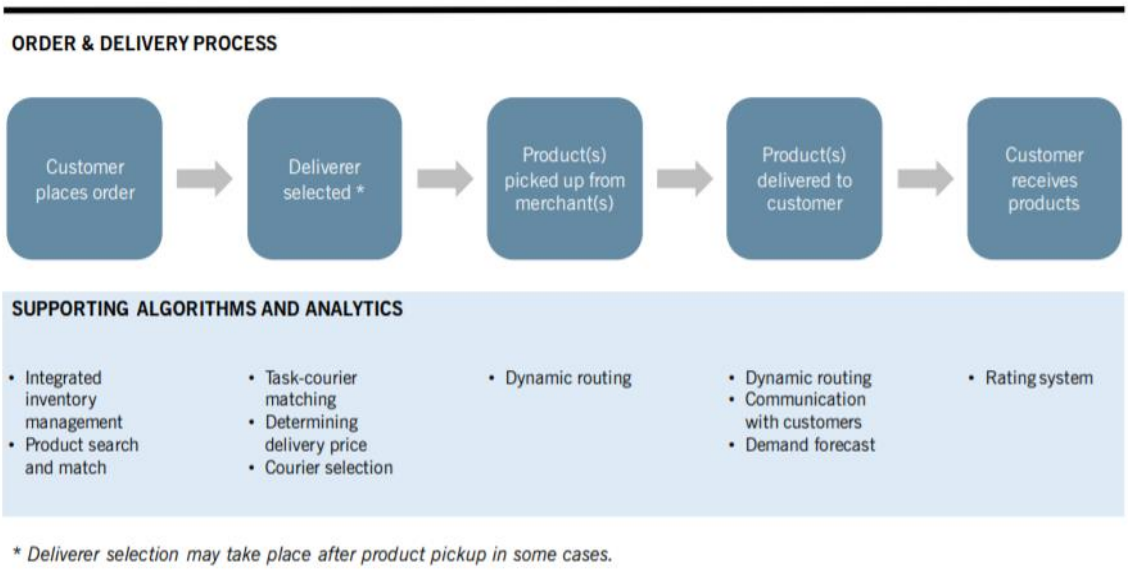

Figure 9: Order and delivery process (Stanford, 2016)

The calculations and examination talked about in this area are being connected by conventional firms and in addition new contestants. New contestants can get to the last-mile conveyance advertise rapidly utilizing these instruments, regularly with moderately low forthright venture and low working expenses. This is particularly valid for organizations that depend on group sourcing or subcontracted drivers, in this way maintaining a strategic distance from the need to work their own armada of conveyance vehicles and to utilize full-time drivers. Propelled calculations and investigation likewise make it simpler for new participants to offer on-request or same-day conveyance benefit, and in addition the alternative to search for products for clients. For instance, item hunt and-match apparatuses enable suppliers to enhance effectiveness, while errand messenger coordinating and steering advancement make it less demanding to give on-request or same-day conveyance benefit. These calculations likewise open the entryway for new procedures that detour customary conveyance organizations by and large, including,

A. Purchaser pickup: With cutting edge determining investigation, and more noteworthy perceivability to in-store inventories, retailers can all the more effortlessly offer clients the alternative to arrange things on the web and lift them up from an adjacent store. Frequently this choice will enable both retailer and client to save money on transportation expenses, and clients get arranges quicker. This is additionally an advantageous alternative for clients who favour their requests not to be transported to their home.

B. Group sourced conveyance: Distributed (P2P) and business-to-customer (B2C) organizations utilizing swarm sourcing give people a more adaptable and potentially less expensive option in contrast to conventional conveyance suppliers, for example, the U.S. Postal Administration, UPS, or FedEx (Stanford,2016) .

Drones

Once the mechanical impediments are settled, administrative limitations are loose, and open worries around well-being and protection are tended to and limited, automatons could significantly affect the scene of last-mile conveyance. Conventional conveyance organizations, new participants to the market, and dealers themselves could utilize automatons to offer same-day conveyance administrations, consequently fulfilling clients' craving for expedient conveyance in a naturally neighbourly way. So also, mediator organizations could spare expenses by having their workforce centre around looking for clients while utilizing rambles for the genuine conveyance, in any event for those requests inside the automaton's ability impediments. In the event that the expense to claim and work a very practical automaton turns out to be adequately low with the goal that distinctive individuals could possess rambles for individual item transport, clients could conceivably send their automaton to the store to get their requests. Despite the fact that the utilization of automatons will be constrained to a specific conveyance separation and bundle measure, the market potential is high; for instance, it is assessed that around 20 percent of Amazon's

internet business orders meet these criteria Moreover, retailer Walmart includes areas inside 5 miles of 70 percent of the U.S. populace, making genuine open doors for automaton conveyance (Layne, 2015). Automatons can likewise give a helpful answer for conveying direly required things to remote or difficult to-achieve areas. Automatons as of now have been utilized to convey little guide bundles after the Haitian seismic tremor in 2012, and Specialists Without Outskirts utilized them to transport sham TB test tests from a remote town to the huge waterfront city of Kerema in Papua New Guinea.

Conveyance Robots

Conveyance robots are ordinarily focused for generally princely and uncrowded rural regions, gated networks, helped living offices, and grounds. In these settings, they would have the capacity to go on walkways or bicycle paths, customized to go among people on foot, bicyclists, and cars. Robots would travel a short separation from a nearby centre point or retail outlet to a collector, inside 5 to 30 minutes. Customers would have the capacity to plan the conveyance utilizing an "Uber-like" application and may likewise utilize a real-time portable application to track the robot's area and open the merchandise upon entry (Stanford, 2016). The robot would come back to the conveyance centre point after every conveyance, or it could possibly convey different conveyances, each situated in a different bolted compartment. Robots utilize GPS, sensors, and cameras for route, halting for an impediment or walker in its way. A few models can go here and there checks and little stairs. While a human administrator would track a conveyance robot, it would drive self-governing 99 percent of the time in a painstakingly mapped neighbourhood. Robots commonly have mouthpieces for two-way correspondence. In the event that a hoodlum represented a risk, the human administrator at a control focus could drive the criminal off by means of a speaker and call the police (Stanford, 2016).

Since conveyance robots are proposed for less thick regions, their relevance might be restricted. Dispatch's procedure, for instance, is at first focused on college grounds in California, bearing in mind the end goal to scale into other private regions. Starship likewise recognized that its framework is planned for uncrowded territories. In settings where conveyance robots are material, they can possibly be very fruitful. For instance, on college grounds understudies regularly don't have their very own vehicles and depend on bikes and open transportation. This can make shopping for food a test. Understudies are additionally more prone to have tight spending plans, so robot conveyance, or, in other words be moderately shoddy, will probably be more appealing than conveyance administrations, for example, Instacart. The innovation would present comparative advantages for seniors in helped living lodging. In the two settings, conveyance could be orchestrated by a market and completed by the store's very own armada of robots, or the store could re-appropriate to a robot conveyance organization. Another choice is for middle person organizations to offer shopping with conveyance through robot. Robots could likewise be utilized by retail locations or eateries to convey products requested online to adjacent clients. On the other hand, clients could be the ones to start the conveyance procedure, either through an outsider that offers robot conveyance administrations or without anyone else's input, if later on people possessed robots for individual utilize. Since the scope of conveyance robots is generally little for a long time to come, their utilization for direct conveyance will be more constrained than automatons (Stanford, 2016).

Driverless / Autonomous Cars

A considerable lot of the specialized difficulties related with driverless vehicles are simpler to address when the auto is relied upon to work in a constrained geographic territory, or, in other words of the primary developing business uses of driverless vehicles is as cabs or transports for neighbourhood transportation. A few urban areas are thinking about the utilization of

transports and prepares without drivers, which may enable them to extend travel courses and limit more expense successfully because of the normal noteworthy investment funds in labour costs. And Uber is right now constructing its very own driverless auto innovation, and anticipates that this innovation will enable the organization to bring down the cost of Uber rides (Stanford, 2016).

Last-mile conveyance is another normal application for driverless vehicles, as this industry shares a large number of the attributes of cabs and transport transports, including extended periods of driving and task in a constrained geographic region. Preliminaries kept running by U.K. government-subsidized research units will test how effectively driverless vehicles can be utilized to convey bundles and different merchandise in London. In the Assembled States, Google acquired a patent in February 2016 for a self-governing conveyance truck, which could conceivably convey anything from the undeniable bundles bought online to promoting fliers and even pizza (Stanford, 2016). Another potential utilization of driverless vehicles is as help vehicles for letter and bundle conveyance, as recommended by a 2014 DHL consider titled "Self-driving vehicles in coordination." This application could handle the wastefulness related with long-separate strolling at whatever point stopping isn't accessible near the beneficiary's post box or front entryway, or, in other words in thick urban territories. Under this model proposed by the examination, the conveyance individual will stroll to every conveyance area (expecting they are close by) with the conveyance vehicle following independently, so the conveyance individual could recover the bundles for every area when achieving the goal. At the point when the help vehicle is about void, a second one (stacked with more packages and letters) would arrive self-governing. As indicated by the examination, the greatest favourable position of this application is its capability to build the efficiency of every conveyance individual, making the activity simpler and in the meantime more attractive (Stanford, 2016).

A relative investigation of graph for mechanical advances done to take care of last mile delivery issue is demonstrated as follows:

	ADVANTAGES	LIMITATIONS	STAGE OF DEVELOPMENT
Algorithms and Analytics	• Fast / cheap / flexible delivery • Low capital cost; low barriers to entry • Open the door for new delivery models	• Some companies have yet to demonstrate a viable business case • Trust issues with crowdsourcing	Large-scale adoption
Delivery Drones	• Fast / flexible delivery • Environmentally friendly • Can reach remote / hard-to-reach locations more cheaply • Can bypass crowded / poor roads	• Strict regulatory restrictions • Safety and privacy issues • Capacity limitations • Delivery distance limitations • Remaining technological challenges	Pilots
Delivery Robots	• Fast / cheap / flexible delivery • Environmentally friendly • Fewer safety and privacy issues compared with drones • Higher capacity compared with drones	• Delivery distance and speed limitations • Cannot operate in crowded areas • Theft issues • Limited ability to overcome obstacles in their way	Pilots
Driverless / Autonomous Cars	• Fast / flexible delivery • Low operating cost • Environmentally friendly • Cost-efficient to reach remote locations	• Strict regulatory restrictions • High cost of driverless vehicles • Many technological challenges still exist	Experimental

Table 6: Comparative Analysis of Technology (Stanford, 2016)

Impact on Automated Parcel Stations

As it can be seen from the table above, the proposed technological solutions are either at pilot stage or yet to solve a critical problem of "Not at home". Though, the solutions discussed above seems promising, in near term it could not replace Automated Parcel station. Further, it should be noted that these solution is not as cost effective as Automated Parcel Station. Therefore the threat to Automated Parcel Stations from above solution is quite low in near term (Menge and Hebes, 2011) .

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