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A Case Analysis on Amazon Delivery Drones Taking over Traditional Delivery Method

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Abstract: In a world where most businesses are innovating or digitally transitioning, neglecting to experiment puts businesses at a disadvantage by making them increasingly irrelevant to the consumers, resistant to change, and unable to compete with larger and more efficient rivals. According to a survey by McKinsey, 84% of professionals feel that future success is dependent on continuous innovation in order to gain competitive advantage in the industry and respond to the competition. On June 13, 2022, Amazon announced its plans to make its first drone deliveries in Lockeford, California. The idea of delivery with the help of drones represents a true innovation in the e-commerce business, fastening the delivery service in a way that was almost unimaginable a few years back. However, the company faces diverse challenges endangering its project, including ever changing regulations, skepticism from the customers, and safety concerns. All of this leads to a launch that has been postponed for years, questioning the viability of the project. Indeed, Amazon has the potential to be a huge success once it finally launches its operations as it can develop a strong competitive advantage. This case analysis aims at discussing the factors involved in the implementation of the Amazon Prime Air project to investigate whether delivery drones can possibly be a disruptive technology. This case analysis is intended to be a helpful source for class discussions as well.

Keywords: Amazon, Technology Innovation, Disruptive Technology, Drones, Delivery Drones

1. Introduction

With numerous new businesses entering the market, the drone delivery industry is tremendously fragmented. North America holds the most market in this industry as the key players include Amazon.com. Inc, Google and some others who provide delivery drone systems in this region. The major players in the overall industry are DJI, United Parcel Service of America Inc. (UPS), Zipline, Deutsche Post AG, Flytrex and Amazon.com. Inc. [1].

The global delivery drone market size was valued at USD $234.4 million in 2021, with an expected reach of $3119.3 million in 2028 [2]. Rapidly growing, the market is predicted to experience a growth rate of 53.94% from 2022-2028 [2]. Currently, North America is dominating the delivery drone market. For the past years, delivery drone makers have been facing increasing competition, as actors in the logistics, healthcare, and food delivery sectors have also started to enter the drone industry. Amazon is an American technology company founded in 1994 by Jeff Bezos. Guided by clear

values and principles, its brand culture is very strong: the customer is at the core of everything. The brand advocates "customer obsession rather than competitive focus", with the goal of being "Earth's most customer-centric company". Adopting a "Day 1" mentality, the brand is constantly inventing, developing and renewing itself in pursuit of innovation and excellence, to offer the best possible experience to its customers.

Currently, drones manufactured by Amazon can carry 2 kilograms which accounts for 90% of the products they sell. The idea of delivery with the help of drones is to make it faster and cut down fuel emissions from the delivery vehicles. However, there is a negative side as people have found that drone deliveries are not suitable for sensitive products, often found broken while getting delivered. There are many concerns from the people regarding this new concept of delivery such as the fact that drones might drop items on people, or regarding the impact of weather on the delivery

service. For instance, when it's very hot outside, the air density decreases, which has an impact on the drone's lifting capacity and similar is the case when it is extremely cold. Likewise, there are multiple concerns from tiny queries such as how drones get inside the apartments for delivery, what if people shoot them down, the impact on the job of delivery drivers to major privacy concerns related to drones [3]. In order for the delivery system to function, businesses must perform precise calculations. They may also decide to modify the packaging design to make it more aerodynamic and weather-resistant.

Amazon stands to gain a significant competitive edge over both online and physical competitors. The rapid delivery and novelty of drone deliveries should boost e-commerce. Delivery drones have the potential to give Amazon an advantage over other competing companies in logistics if the company can successfully launch its delivery drone services by the end of 2022.

As the world's largest retailer, Amazon has enormous potential to take over the delivery drone market and even become the market leader eventually. The group knows what exactly needs to be done to add roadblocks to others who want to successfully enter the market, which therefore, promises a potential competitive edge if Amazon can surpass them. This case study analysis is conducted for the purpose of identifying and discussing the factors involved during the implementation process of the technology.

Thus, if Amazon succeeds in its launch of delivery drones at the end of 2022 in California, this tech giant will most certainly have a strong competitive advantage over its competitors.

2. Amazon Prime Air and Technological Innovation

2.1. Prime Air Technology Strategy

While UPS's Flight Forward and Alphabet's (the parent company of Google) fully owned drone delivery firm Wing Aviation have both previously obtained the approval, Amazon is the third company to reach the milestone from the Federal Aviation Administration (FAA) [4]. Amazon's long anticipated approval sets the pace with a business model that may effortlessly integrate into current logistics processes, in order to increase the usage of its autonomous air delivery system to connect rural communities and shorten delivery times.

Drones are getting quite popular these days and we can find varieties of drones on the market today. However, when the use of drones was mainly for photography and videography, Amazon decided to adopt an "innovative" innovation strategy by utilizing the existing drone technology for the delivery of products. By doing so, Amazon has tried to update the existing technology, work on its flaws and then create a new innovation as per its needs. In the delivery service, it is also a new innovation that will help bring a drastic change in the e-commerce industry.

2.2. Amazon Delivery Drones

Amazon drones will have big chances to benefit from network externalities, which means that the quality of the service will not be the only element impacting its value. Indeed, a direct network effect is very likely to happen here, as the more customers will adopt and use this technology, the more other users will want to try and adopt it themselves. Especially if the project proves to be successful and safe, the more users of delivery drones, the newer members there will be.

Even though it is difficult to say for the moment, we believe that Amazon Prime Air's drone can be a dominant design. As early as 2013, Amazon unveiled its first delivery drone prototype, nicknamed "octocopters", in reference to its appearance. A few years later, a quick look at the few drones currently available in the market and the prototype design the competitors offer, we can observe similar helicopter-like shapes and structures. While some designs stand out from the crowd, a majority of the companies seem to have adopted Amazon's design for their delivery drones.

Prime Air can benefit from developing a dominant design, as it will come with increasing returns to adoption, since the more a technology is adopted, the more valuable it becomes to the users. Indeed, people are not willing to accept a technology that might be abandoned, as there is a high risk involved. As we can observe, the constant failure of drones in delivery services has made people a bit reluctant to adopt this technology. Likewise, the more the technology is being used, the more the company invests in its improvement and betterment. That way it becomes more valuable to its users too. In the case of Prime Air's drone delivery service, they have made their investment for continuous improvement, and new designs are continuously being introduced in the market with technological advancements.

2.2.1. Drone Delivery: A Market Pull or Technology Push Innovation

Amazon has implemented both "market pull" and "technology push" approaches to come up with the idea of delivery drones [5].

On the one hand, the top priority for Amazon is to satisfy customers and offer an outstanding delivery experience. Nowadays, customers want everything even faster and more convenient, and are ready to pay more for it if they have to. Time and speed are among the main factors leading to the idea of delivery drones in Amazon's services. Moreover, the use of drones is progressively implemented in other fields, such as in military, movies, agriculture and even sports. Why not in delivery? Drones are extremely useful tools, especially considering the pace of technology improvement. Thus, the idea could have come up by observing the market and trying to find a use of these technologies in the e-commerce business.

On the other hand, the idea could also have come up as a way to increase profitability. Indeed, less delivery people would have to be employed, more deliveries would be possible in less time, more customers could be attracted to this new service and higher prices could be charged for it. All this

resulting in a reduction of operational costs or an increase in revenues, Amazon would make more profits. This would also lead to an improvement of supply chain efficiency, granted by more flexibility, that could even potentially allow for 24/7 and 365d/year delivery. Moreover, one main value of Amazon is innovation. With the rising power of AI and development of automated technologies, the group may have simply wanted to push robotization and development of machines even further. Some, like Sam Phipps, business and marketing enthusiast, even argue that it could be "the biggest development in logistics since the emergence of the internet".

Besides being adapted to consumers' needs, which is in alignment with Amazon's values, implementing this innovation opened a new market, as Amazon was the first company to publicly express its plan for delivery drones in 2013. At that time, there was no competition, giving a competitive advantage to the group with its differentiation strategy. However, as the years passed, competition has slowly started to rise, notably with Alphabet's Wing Aviation and UPS' Flight Forward drone delivery services, which both already received FAA's certification as well. Amazon should make the move, and quickly, if it wants to keep its first mover advantage.

However, the customers might not be ready for such a delivery revolution yet. According to Statista's Global Consumer Survey conducted in 2021, the level of readiness for delivery drones is quite low and depends significantly on the countries studied. Will the company be able to cross the chasm and reach the mainstream market? While there is little doubt that tech-savvy customers (innovators and early adopters) will ask for this service, the challenge will be to make more lambda customers (early and late majority, laggards) adopt this technology, by reassuring them regarding the viability and complete value proposition of the project.

2.2.2. Technological Protection

The Amazon drone delivery device is just in the introduction stage of the product life cycle. It is observed that several other companies such as Alphabet, Domino's Pizza, Flytrex, Rakuten, and many more have begun their drone delivery service. With the popularity of drones in the market, it seems that the delivery drones will also soon take over the market with various competitors. It shows that the applicability of drone delivery is quite low as various e-commerce companies have started testing drones for their deliveries.

In April 2016, Amazon was awarded US Patent No. 9,305,280 for this idea. But Amazon is not acting alone in its search. Project Wing is a comparable initiative being worked on by Alphabet. Additionally, the US Postal Service, FedEx, UPS, and others are also working on this technology. In the upcoming years, drone air service appears to be unavoidable in one way or another, in some form, and in at least some regions [2, 13].

Considering all the opportunities it provides, it is important to protect this technological innovation. With the growing competition in e-commerce platforms, every company is trying to update itself with improvements in the existing process and new technological advancements. In the world of technology, delivery drones seem to have a brighter future if they are able to overcome all the recent challenges. People are really looking forward to using drones for the delivery service, as we have noticed that drones are already getting popular for various activities and have proven to be very successful. So, we can perhaps have the same expectation from the delivery drones as well. The success of delivery drones is going to bring a great outcome in the overall e-commerce market as well. If Prime Air is able to launch its service in 2022, it will be a success for the business that had to take on the nearly impossible challenge of being the first mover in a brand-new industry. Therefore, technological protection of Amazon delivery drones is suggested instead of diffusion of this technology.

3. Prime Air's Collaboration Strategy & Project Management

3.1. Collaboration Strategy: An Adventure in Solo

In 2020, Amazon tried to outsource the manufacturing of its drones, by launching a call for third parties to make drone parts and provide their help for the R&D process of its Prime Air program. In fact, discussions and tentative agreements with external partners have been reported (including Austria's FACC Aerospace and Spain's Aernnova Aerospace) for external companies to manufacture drone components. Amazon also sent several requests for proposal (RFP) to companies in the drone industry. However, nothing -or at least nothing officially reported- was conclusive. For the moment, Amazon keeps conducting R&D by itself, running multiple development centers in the US, the UK, France, Austria, and Israel.

In fact, Amazon builds and develops its own drones and hardware. The idea is to try and certify their delivery devices internally, to allow for quicker evolution and innovation processes. The company also develops its own connective technologies, which will permit the type of changes in devices it requires, ensure flowing development processes and rapid evolution to meet its needs.

However, it is risky, as Amazon will be the only one bearing the consequences in case of failure, and it is more costly than hiring a third-party provider to run the experiments. Moreover, it does not allow for alternative development or management points of view, nor does it offer the "positive" pressure regarding a potential deadline or limited budget that a partnership would have created.

Even though there is no clear collaboration with external parties for the development of drone pieces, Amazon Web Services (AWS) and Siemens announced an exchange of the two companies' services in 2020. This answered the need of Prime Air to design and create a drone for pilotless deliveries.

With this partnership, Prime Air could develop a working version of the drone by running simulations using Siemens's STAR-CCM+ Simcenter with high performance computing

(HPC) on AWS [6]. Siemens's software helped Prime Air simplify its engineering streams, resulting in more efficiency. The variety of HPC solutions available on AWS also allowed for faster simulations and provided the flexibility to meet tight deadlines. In exchange, Siemens Smart Infrastructure, specialized in energy distribution and intelligent buildings, now uses AWS instead of its previous SAP infrastructure [6, 7].

Amazon has always been known for its vertical integration strategy [8, 15]. Indeed, the company has always wanted to have control of the entire supply chain process, from the production to the delivery to the customer. When the company decided to launch its own delivery and logistics activities by insourcing, it became its own biggest shipper in 2019 [9].

However, a collaboration with other organizations would have enabled Amazon to reduce time and gather more resources. Even though financial resources might not be such a problem for the giant, not collaborating with external partners deprives the company of additional knowledge and skilled individuals, which could also have increased innovation.

3.2. Prime Air's New Product Development Project Performance

As a brand-new project, it has required the involvement of people coming from various backgrounds, displaying different skills and competencies in technology and innovation, delivery, and others [18]. For example, the areas of expertise needed include drone manufacturing, security architect, piloting, maintenance, legal expert, and so on., additionally to the more traditional positions in marketing, engineering, and other units.

The hiring and training process is long and costly, as the group needs to be sure that it hires the right people. In this case, where the safety of customers and the population is one of the most critical issues to which the clients attach great importance, it is even more necessary.

"We're hiring team members across a wide range of technical, operational, and support roles to help us bring Prime Air to our customers around the world", declares the Prime Air team on its Amazon. jobs website. According to the company itself, the team is gathered on common values: passion for innovation, state-of-the-art technologies, complex problems and having a meaningful impact on customers. Currently, about 1,000 people are working on the Prime Air project globally. [17].

To measure the performance of Prime Air's delivery drones project, we need to have a look at the three main criteria of NPD projects: the cost, time, and quality of the project.

Let's start with the time. At the first announcement of the project in 2013, it was initially planned to be launched within five years, according to Jeff Bezos. The company has subsequently stated on multiple occasions that the project will be initiated soon, and notably in 2019. However, here we are, in 2022, and no official date has been given yet, except the vague "later this year". Given Amazon Prime Air's incapacity to meet its own deadlines, we can see that the project has been significantly delayed.

Regarding costs, the project is said to have reached $2 billion in investment, according to Forbes. The initial budget has not been communicated, but since the project has experienced a considerable delay, it is easy to deduce that the costs and money invested in it are a lot higher than initially expected. Indeed, all the usual expenses (research, software, robotic devices, R&D centers, employees…) have had to be extended for several years more. This might have a negative impact on the price the company planned for the service, if they want to keep their profit margin [10-13].

Finally, the quality, representing how well the project meets customers' requirements, seems mixed. On the one hand, the fast delivery proposed by the drone service matches the customer's constant need for speed and instantaneity, but on the other hand, safety concerns remain, which makes customers more reluctant. Indeed, customers are worried about the reliability and safety of such delivery drones, especially considering the crashes that the company has faced in recent years [11, 13].

Overall, the performance of the project, based on cost, time and quality, is at stake considering the important delays and costs. But it is not surprising for such a project, and very common for big companies. Let us just hope the company will not increase the price to ensure its profitability.

3.3. Prime Air's Knowledge Management

Employing more than 1,600,000 employees throughout the world, Amazon is a huge company that needs to deal with the management of knowledge between all employees, departments, and countries. Amazon goodwill and intangible assets accounted for $20.229B at the end of the first quarter of 2022 (a 32.91% increase compared to Q1 2021), representing 4.9% of its total assets [14].

3.3.1. Amazon's Knowledge Management System

As knowledge-based industries rely intensely on their inputs of technology and human capital, it is essential to retain and enhance this knowledge. This does not only help improve processes, operations, and innovation, but also profitability. This can be done via knowledge management (KM), which represents the explicit and systematic management of vital knowledge in an organization [16].

Thus, to take advantage of this significant amount of knowledge, Amazon implemented an internal KM strategy, consisting of a 4-process SECI model. [17].

1) Socialization. Employees are encouraged to share tacit knowledge (representing the type of knowledge that can hardly be converted in written form) through practice, observation, imitation, and participation in informal and formal processes within the organization.
2) Externalization. Amazon employees need to express tacit knowledge through explicit concepts. This allows for easier and better management of all the information gathered.
3) Combination. The information is integrated into the company's knowledge system.
4) Internalization. The explicit knowledge (i.e., the

knowledge that can easily be articulated, codified, stored, and accessed) is converted into tacit knowledge.

As part of its KM system, Amazon emphasizes the importance of communication, both traditional and digital, as a great channel for knowledge sharing and better productivity [19, 22]. Additionally, the group uses a combination of both bottom-up and top-down approaches for its strategy implementation. The first implies that the information comes from low levels in the hierarchy to finally reach the top management. This approach is crucial as the issues can be better understood, expressed, and addressed by the employees who are the closest to the customers or to the operations. The top-down approach is also essential to make sure that operational objectives are achieved.

Another internal practice is the report of trials and tests that must follow a defined strategic framework, to ensure that the right information is provided, even -and especially- if the program has failed. Finally, a key element in its KM is the company's single interface, enabling it to gather all items and services at the same place and meet the needs of all its users [19].

Through its clearly defined and well-implemented KM model, Amazon has been able to process information and knowledge in a way that has increased its operations in the marketplace. This has been facilitated by the company's culture and "teaching-by-doing" mentality of the top management, who are required to show the example.

3.3.2. Prime Air's Knowledge Management Struggles

However, despite the group's great and effective KM, Prime Air has recently suffered massive layoffs in some of its main development centers. This poses a real threat for the entity as companies do lose critical knowledge whenever they lose employees, whether because they retire, leave for another company, move to another department, or are terminated due to downsizing or restructuring.

In fact, the Financial Times reported massive layoffs in the R&D and manufacturing staff of the program. The French Prime Air team has started to be reallocated to COVID-19-testing projects from 2020, while, according to a Wired article, a hundred of employees were laid off in the UK Prime Air research center last August and dozens were reassigned to other projects [10].

Facing a high turnover, an Amazon spokesperson declared that it was part of a transitional phase for the drone unit, "reorganizing one small team within our larger Prime Air organization" for the sake of meeting customers' and business needs better [12, 20] Former employees admitted that the project was "chaotic," allowing people who initially worked for other Amazon departments and had no technical knowledge of drones or AI to take on leadership positions. The constant departure of employees and managers gave no consistency or fluidity to the Prime Air team's operations. Currently, the Prime Air division is actively recruiting, as it has over 100 open positions.

The poor team management and the massive layoffs in UK and France R&D centers can explain the lack of efficiency,

high costs and deadlines not met [13, 15]. Indeed, Prime Air has not been able to create a positive and viable culture among the team, resulting in dissatisfaction and thus malfunction of the unit. Firing a huge number of employees might have big consequences on the delivery drones project, as crucial knowledge, that has been built, developed and transmitted for almost a decade, has been lost and will require time and cost to bring back.

4. Conclusion

To conclude, we can argue that the Amazon Prime Air delivery drone project can disrupt the market [21, 22]. However, this success will only be possible if the company overcomes diverse challenges. While Prime Air benefits from a first mover advantage, it still hasn't been able to unlock this advantage in the form of returns. The company faces a potential threat of technology abandonment due to the reluctance from customers in technology adoption. Additionally, Amazon's decision not to collaborate with other companies allows for a strong vertical integration strategy but can also be a reason for the project's poor performance. Finally, Prime Air has not been able to take advantage of the well-established KM model of Amazon, leading to the loss of critical knowledge.

The key takeaway for companies is that even the biggest innovations do not always succeed. It is crucial to have a strong implementation and technology strategy to preserve their first mover advantage. They need to make sure that the market is ready to adopt the project, as it is sometimes difficult to assess a future project with today's perspective. It is the challenge for companies to make them believe in it by offering them a true value proposition. Additionally, brand culture should not be underestimated. A non-united team can be a real weakness that might jeopardize the whole project even before it is launched. This analysis also shows the need for technology protection, and how it should not be determined by the current challenges. Finally, companies can learn from Amazon's determination on their project. Despite multiple failures, Amazon did not give up, even after 8 years, and still believes in the possibility of drone delivery in the near future.

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