blockbox insights

blockchain for anonymous, verified and secure retail insights

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Executive Summary

Ecommerce platforms are becoming increasingly reliant on using consumer personalization to survive in today's market. If online retailers fail to maximize user engagement, satisfaction, and ease of purchase, it becomes too easy for users to move on to different platforms due to the vast amount of options available online. The largest online platforms in the world such as Netflix, Facebook, Amazon, Youtube, and Spotify thrive in terms of revenue and active users because of their ability to personalize the user experience more than any other platform in their respective markets. These companies have gone on to become the world's best at search personalization, item recommendations, and targeted ads. How did they do it? They collected and analyzed data. A lot of it.

As companies collect more and more data for generating better consumer insights, users become increasingly concerned about their privacy. In the end, modern day consumers end up treating any personal information to websites as compromised, often using false information or using false login accounts, and this negatively affects the quality and quantity of data that online ecommerce platforms collect. Furthermore, in many markets there are strict privacy laws which prevent companies from collecting user data, and this puts them far behind their competitors. The fear that users have of their data being leaked, stolen, or sold is placing a limit on the amount of insights companies can generate from user data and even harming their ability to start or grow in today's market. That's where Blockbox Insights makes a difference.

Blockbox Insights is a product for online ecommerce platforms to use for generating proveable user insights without exposing any personal user information. While leveraging cryptography and blockchain, Blockbox allows for the secure storage of user data and generation of business insights using zero-knowledge methods. For example, Blockbox makes it possible to prove to an online retailer that a user would be interested in certain items without exposing the user's online interactions, ratings, or purchases to the retailer. This way, online retailers do not even need to be responsible for their own data storage or collection. Divided into three core products: Blockbox Components, the Blockbox API, and the Blockbox Insights Dashboard, Blockbox is an easily integratable, secure, and verifiable product that can be used for empowering online retailers with the user insights and retail personalization they need while ensuring user privacy at all times.

Problem Area

In today's age it is essential for online retailers to collect and store large amounts of personal data to be able to gain useful business insights, generate personalized, curated content for users and, as a result, maximize sales. However, users fear that this data is always at risk of being leaked, stolen, or sold. This leads to companies asking for less information from users and users providing companies with false information which negatively impacts data driven insights. Ultimately, this prevents companies from taking advantage of these insights to drive their business. This problem space presents opportunity to relieve the frustrations of both online customers and online retailers.

Companies collect tons of data about their customers for the purposes of generating targeted advertisements, conducting analytics, discovering trends, optimizing prices, and putting recommended items in front of online customers. *Customers are frustrated* that there is no guarantee that their personal information is kept safely and securely. They do not know how their data will be used and who will be able to see it and, if given the choice, 87% of consumers would ask brands to remove their personal information[1]. For these reasons, users are reluctant to make accounts and voluntarily give information. Because users often choose to not give companies their data or will input false data due to their privacy concerns, online retailers become frustrated because inaccurate data skews the insights generated from the data. This makes it much harder for companies to customize shopping experiences and curated content, and this negatively impacts their sales.

Smaller online retailers also choose not to collect user data due to privacy laws or because they are in the early stages (startups etc.) and/or lack the infrastructure to provide custom content for their users. Even when companies have the resources to collect data, they often make a compromise with the information they gather: they collect less than ideal data regarding location, demographics, interests and other details about their users because if they did not, then users users would not use their platform because of the request for information. Ultimately, this decreases an online retailers ability to provide users with custom content and receive insight. Another problem that faces online retailers are the financial risks associated with mass data collection: data breaches could cost several millions of dollars or lead to lawsuits. In fact, the average cost of a data breach is $3.86 million[2]. This financial risk is what a lot of young companies are not ready to take on.

Overall, online retailers have a lack of users willing to give personal shopping data because they are concerned about their privacy. This keeps online retailers from generating insights and personalizing their platform for customers, which ultimately harms their sales.

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[1] Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019.
[2] Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019.

Users

Overview

The key to making customer's the happiest, is by thinking precisely about their needs and desires. Through the creation of Blockbox Insights customer personas, the company is able to clearly identify the user's goals, areas of interest, hopes and frustrations throughout the process of looking for the best product recommendation and user analytics platforms. The personas that will be highlighted include Bowen, a Lead UX Engineer from a small online retailer, Sukhi, a long-term employee at a large company, and Karen, a young, avid online shopper.

Customer Personas

Primary User Personas are defined as employees at small or large retail companies. For detailed personas, please refer to **Figure 1** and **Figure 2** in **Appendix A**.

Secondary User Personas are individual online consumers who are familiar with ecommerce-shopping platforms and processes. These users are looking for data security and personalized shopping experiences. For a detailed persona, please refer to **Figure 3** in **Appendix A**.

User Stories

The three main personas presented include an employee at a small company, a senior employee at a large company, and an individual end-user who uses online shopping platforms. All of their motivations and goals lead to very distinct flows in becoming prospects of Blockbox's product. The user stories below will highlight a general scenario for the types of users and will lead to show how Blockbox is meeting the needs of our primary and secondary customers.

First Timers

As an employee at a small to mid-sized online retail company, I am hoping to introduce a way to easily receive product recommendations for our online shoppers, as well as insights to use internally about user interactions on our website. The company has not provided shoppers with any personalizations to date due to a lack of infrastructure and resources. However, due to productive growth the company now has a budget allocated for experience improvements. The company does not have the time nor human resources to build an internal insights and analytics tool, so is looking externally for software as a service (Saas) providers. The site has over 4000 user profiles currently stores account information in a private database. My goals as part of this small company is to find an affordable, easy to adopt and scalable technology to give our company the insights it needs and provide users with basic personalizations. This is to provide customer retention and to engage them further in our online shopping experience.

Transitioners

As a senior employee at a large company, I am working in the online retailing sector and am looking for opportunities to improve the experience of online shoppers. Currently, we have all of the infrastructure set up and use an internally developed product recommendations engine customized to our needs. I am experiencing frustrations with online shoppers who are choosing to enter false data or no data at all, but are hoping for custom feeds and tailored content. I want a solution that can help to prevent this problem so we are better able to provide the services our shoppers want, without causing them fear or frustration with the platform and its requests of them. The solution I will adopt must also be able to handle hundreds of thousands of user profiles and continue to allow our company to access the insights and information we want and desire.

Online Shoppers

As an online shopper, I am hoping for a custom experience to make my online shopping faster and easier, allowing me to use my time on a site most effectively only looking at curated content custom to my interests, needs and wants. I do not want to enter any personal data that will make me uncomfortable such as date of birth, age, contact information, addresses or financial information. I want to experience a personalized shopping experience without feeling like my data is being compromised or is at risk of being leaked, stolen or sold to a third party without my knowledge or consent. I want to know my data is safe and secure and not accessible by the thousands of employees at the company I am shopping at. Overall, my priority is the safety of my personal information while creating user profiles and entering shopping preferences.

Solution Space

Solution Statement

Blockbox Insights will be a SaaS product for storing all personal user information in the blockchain using completely anonymous cryptographic codes, and will also be able to apply zero-knowledge cryptographic methods to provide online retailers with verifiable user insights such as recommended items for users without having to reveal the user data used to generate them. Blockbox Insights has a goal to enable online retailers to receive accurate, verifiable insights that can be used for making targeted ads, personalized curated content, analytics, trends, sales insights and more without having the need to store their own data or even read data. Blockbox also has the goal of relieving existing user frustrations related to unwarranted personal data collection while improving sales for retailers by personalizing user experiences to the degree to which they never have before.

Why Blockchain?

Blockchain is an immutable, highly secure and decentralized data tracking platform which provides a public ledger of data[3]. As opposed to any other secure data network, a blockchain provides a flexible capacity by enabling many parties to write new entries into a system such as several teams responsible for tracking ecommerce platform insights. Additionally, all of the incoming data from retail consumers is dynamic and changes very frequently. Having an auditable record of consumer usage history is necessary in providing tailored recommendations and user-based insights to retailers. Above all, having the anonymity that blockchain provides and being able to collect information previously unattainable or falsified, this system will gain user's trust in data collection on ecommerce platforms and allow for more customized content while shopping. Also, insights generated from raw user data will be proved and verified to retailers using zero-knowledge proofs which are a sequence of calculations that can prove the validity of insights to online retailers without needed to reveal the user data that was used to generate them. Finally, cryptographic data stored using blockchain eliminates the idea of data breaches, which normally pose a big threat to users and retailers alike.

[3] "Why Use a Blockchain?" *CoinDesk*, www.coindesk.com/information/why-use-a-blockchain.

Value Proposition

The value proposed by Blockbox revolves around two strong pillars, both which will increase the success of online retailers. The first is an improved possibility for retail personalizations and the second is the introduction of highly secure and safe user data storage.

Today, 64% of online retail consumers think retailers do not truly know them[4], despite all of the content recommendation software and algorithms which currently exist. Retail personalizations using Blockbox will surpass any product recommendation software currently, simple due to the increased accuracy it will provide. Previously falsified or nonexistent data will become accessible due to user trust in an encrypted blockchain product to keep their data safe. Through the use of encryption, user data will be highly secure and anonymous to companies, therefore removing the possibility of breaching and leaks. For retailers, the user insights are still accessible using 1 to 1 mapping of user IDs to existing user accounts on the retailers platform. The user insights will include product recommendations, areas of interest, most clicked web component colours, favourites, demographic information about their site (percentage of users) and much more. Retailers can access insights via an API and dashboard app. Both of them show will show the exact same insights and can be queried. Given that 48% of shoppers have left a brand's website and made a purchase from a competitor because of a poorly personalized experience[5], providing these insights is essential.

Gaining the trust of user's is what Blockbox believes is the key to driving sales and interest in any online retailers platform. However, due to an increasing number of data breaches and scandals, users are losing this trust in online sites. This is also due to current industry conditions for data protection; more so the lack of. 88 percent of companies with more than 1 million folders have 100,000 folders accessible by every employee[6]. This data is commonly sold to other companies, leaked or misused all of which makes users uncomfortable, scared and frustrated. It is clear that an increased amount of access about users will lead to more personalized experiences. For example, 87% of mobile marketers say using location targeting has led to higher engagement and better customer insights[7] However, this data is currently not willingly provided by users for purposes of security and safety. Blockbox is providing a solution to alleviate user concerns regarding data governance and safekeeping through introduction of encrypting personal data storage. The

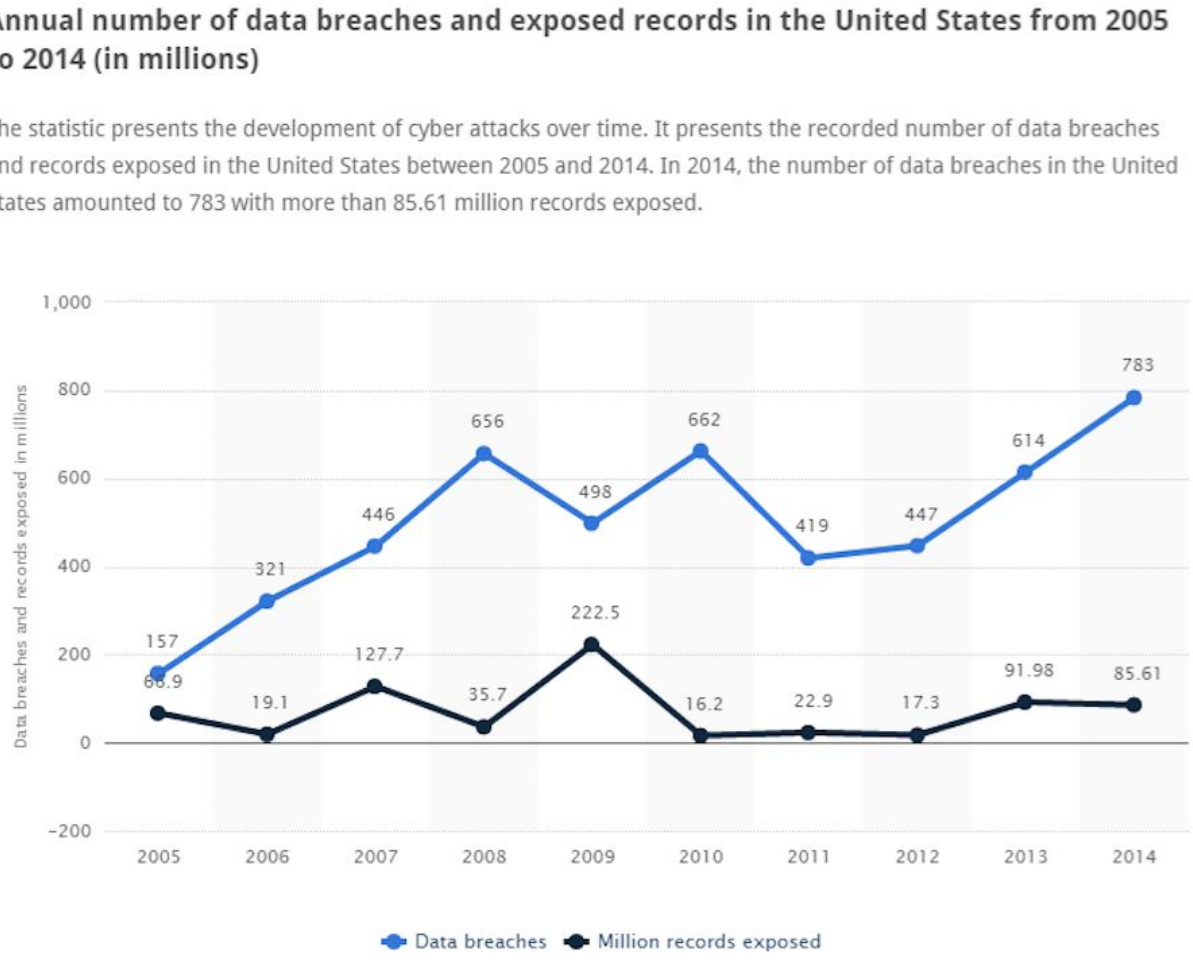
[4]Morgan, Blake. "50 Retail Innovation Stats That Prove The Power Of Customer Experience." *Forbes*, Forbes Magazine, 21 May 2019.
[5]Morgan, Blake. "50 Retail Innovation Stats That Prove The Power Of Customer Experience." *Forbes*, Forbes Magazine, 21 May 2019.
[6]Sobers, Rob. "56 Must Know Data Breach Statistics for 2019." *Inside Out Security*, 10 Apr. 2019.
[7]Morgan, Blake. "50 Retail Innovation Stats That Prove The Power Of Customer Experience." *Forbes*, Forbes Magazine, 21 May 2019.

content will still be used to customize their experiences while shopping, but keep their personal identification anonymous.

Why now?

Data security is an increasingly prominent issue and becoming more of a concern to the general public as e-commerce begins to increase in popularity. This increase can be seen in the prediction that over 2.14 billion people worldwide are expected to buy goods and services online in 2022 - an increase from 1.66 billion global digital buyers in 2016[8]. Worth noting is also the number of increases in data breaches, for example, between 2005 and 2014 was approximately 500% going from 157 million breaches to 783 million breaches (**Figure 4**). With nearly 1 billion data breaches to date, it is valid for online shoppers and users in general to be concerned about their data and its availability to corporations around the globe.

Figure 4: Chart from Digital Guardian showing data breach increases in the past 9 years[9]



[8] "Digital Buyers Worldwide 2021 | Statistic." *Statista*.
[9] "The History of Data Breaches." *Digital Guardian*, 3 Jan. 2019

Currently, attempts are being made by some online retail websites such as H&M USA (**Figure 5**) who display and connect users to their privacy policy as the landing page for their website. This prompts users to, if wanting to, look into exactly what data will be provided and what it is used for. However, this data still has no guarantee to be secure despite the use of existing privatized databases (**Figure 6**).

Figure 5: H&M Landing Page pop-up regarding privacy policy and data protection

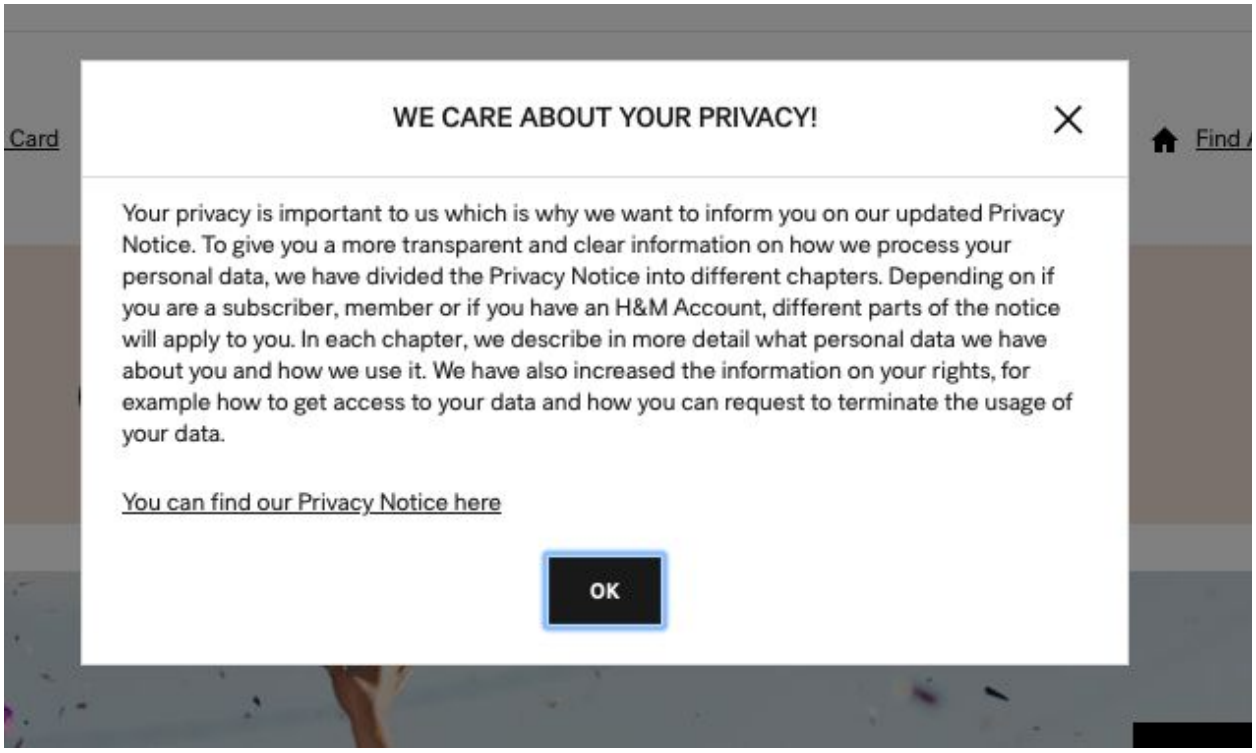
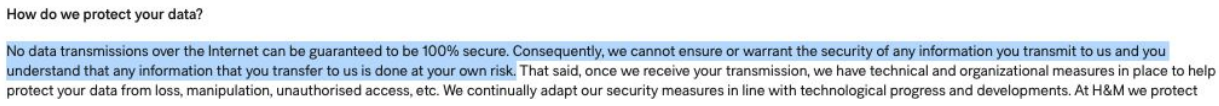


Figure 6: H&M privacy policy specifications on data protection and no guarantee



How do we protect your data?

No data transmissions over the Internet can be guaranteed to be 100% secure. Consequently, we cannot ensure or warrant the security of any information you transmit to us and you understand that any information that you transfer to us is done at your own risk. That said, once we receive your transmission, we have technical and organizational measures in place to help protect your data from loss, manipulation, unauthorised access, etc. We continually adapt our security measures in line with technological progress and developments. At H&M we protect

Overall, there is a need for improved security and safety of personal user data but also room for innovation in the space of ecommerce and retail personalizations. The combinations of the two created an opportunity for a black-box, blockchain solution, which is unparalleled to product recommendation services created to date. Thus, there is a lot of opportunity for Blockbox Insights.

Competitors

Blockbox's goal is to provide highly accurate retail insights, focused on retail personalizations for consumers without compromising data security and accessibility. A competitor to this product, would be one that aligns with this goal or provides a similar service in lieu of products using identical technologies. Both direct and indirect competitors will be detailed, including examples of platform interfaces, usage, current client bases and other details if relevant.

Direct competitors

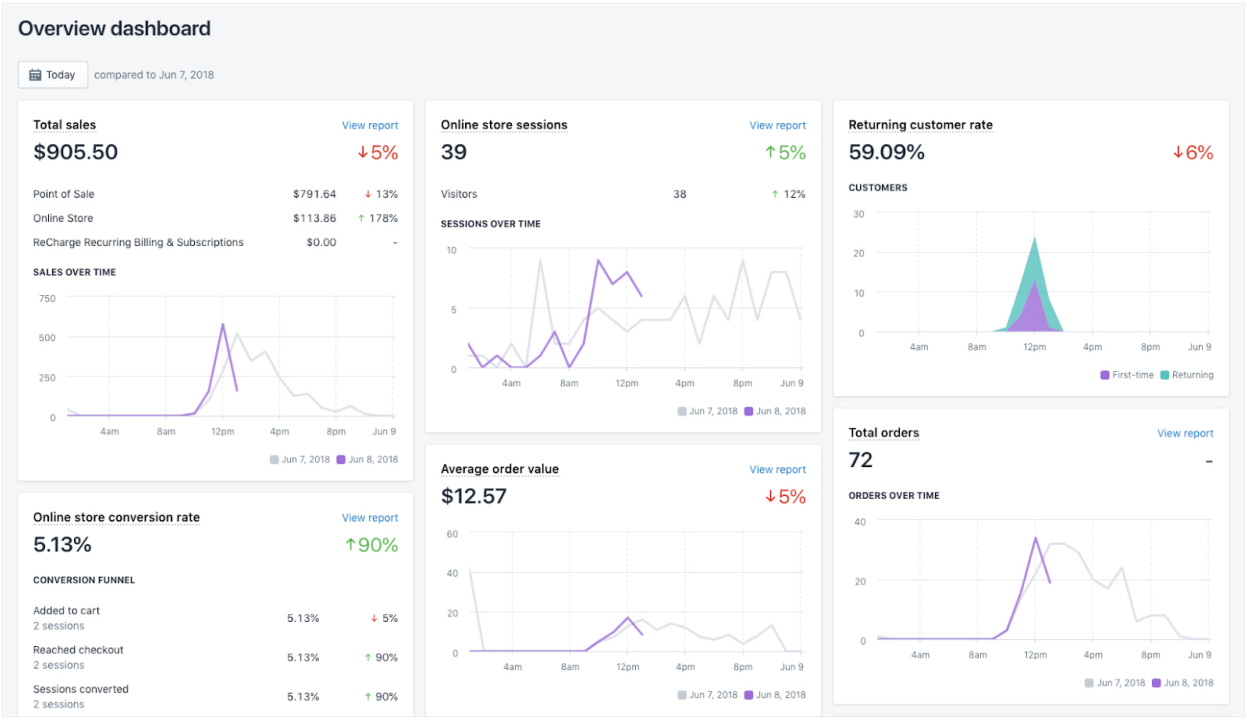
A direct competitor to Blockbox includes any internal or external SaaS platforms used by digital retailers to receive insights on their website's users. Some examples of direct competitors include Shopify analytics and Amazon Personalize.

Shopify's analytics and reports provides retailers a means to review recent activity, receive insights on site visitors' activity and analyze transactions. There are several levels for how many features are provided based on the package selected by Shopify's customer (**Figure 7**). For the purpose of maximizing feature comparisons, the "Shopify Plus" package will be detailed. Similar to Blockbox, Shopify Analytics provides an overview dashboard (**Figure 8**) including sales and site user data as well as general trends. Another relevant feature provided is the "Behaviour Report" which allows for retailers to view the way in which visitors interact with retailers' sites, and provide an in depth profile on these users as well. Shopify's analytics platform also provides its users an opportunity to customer reports. These reports includes data such as customer growth overtime, returning customer metrics, customers by country and one-time customers all of which provides insight into specifics on a retailers customer base. There is also the option of tailoring reports provided to a retailer by filtering information. In contrast with Blockbox, Shopify does not provide specific product recommendations or any form of extrapolated analysis of the data and, simply put, gives retailers a representation of the overall usage of their online platforms.

Figure 7. Shopify Analytics pricing levels and packages; features based on level[10]

Analytics and reports (for details, click the links)	Shopify Lite	Basic Shopify	Shopify	Advanced Shopify	Shopify Plus
Overview dashboard	✓	✓	✓	✓	✓
Finances reports (including taxes and payments)	✓	✓	✓	✓	✓
Live View	-	✓	✓	✓	✓
Acquisition reports	-	✓	✓	✓	✓
Behavior reports	-	✓ (5 of 6)	✓	✓	✓
Marketing reports	-	✓ (1 of 5)	✓	✓	✓
Sales reports	-	-	✓ (10 of 11)	✓ (10 of 11)	✓
Retail sales reports	-	-	✓	✓	✓
Profit reports	-	-	✓	✓	✓
Customers reports	-	-	✓ (5 of 7)	✓	✓
Custom reports	-	-	-	✓	✓

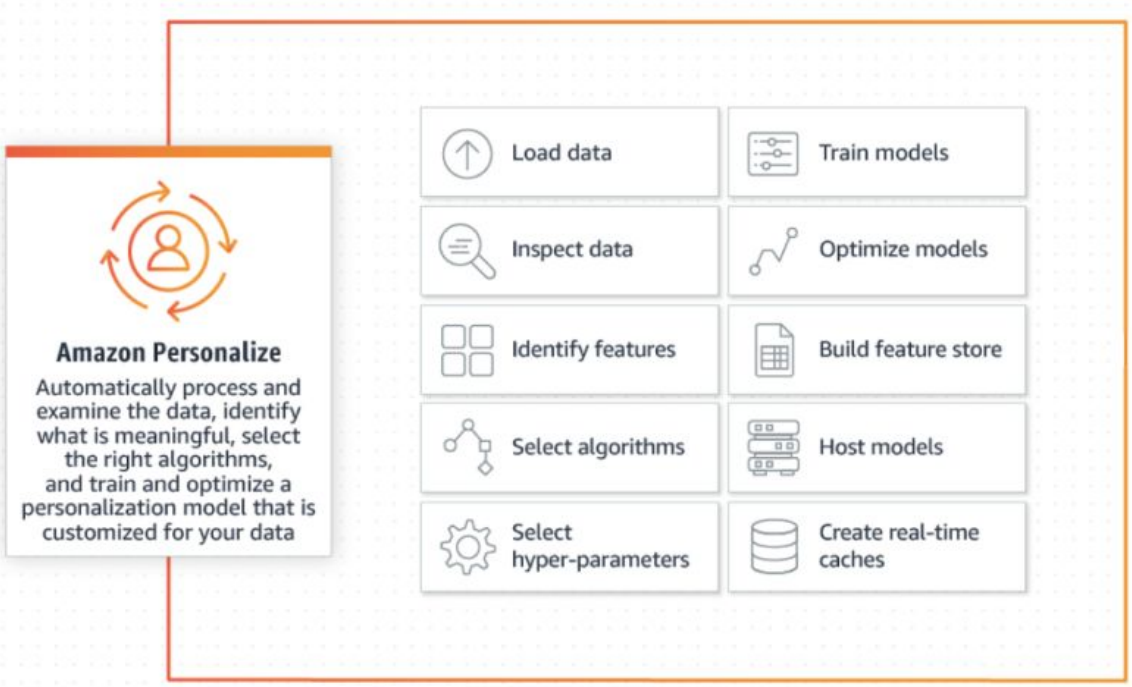
Figure 8. Shopify Analytics overview dashboard showing total sales, average order values, location-based visitor entry points and other trends over time[11]



[10] Shopify. "Shopify Analytics." *Shopify Help Center*.
[11] Shopify. "Shopify Analytics." *Shopify Help Center*.

Amazon Personalize is a machine learning (ML) service that makes it easy for developers to create recommendations for customers using their applications[12]. This product allows developers with no prior ML experience to build sophisticated personalization capabilities into their applications by providing an application activity stream- the process can be seen in **Figure 9**. One of the biggest plus points of the Amazon Personalize service is its speed and responsiveness. The software enables a retailer to receive real-time data about users interacting with their platforma nd immediately provide a recommendation. Additional personalization models can be developed within days as opposed to traditionally taking months to create and surface to the application. The Amazon Personalize provides a very appealing solution for companies looking to provide retail personalizations and is presented by a company which leads in the general Ecommerce industry. The tool promises to integrate easy with other tools, continuously learn and combine customer and contextual data to provide the best recommendations. In contract with other competitors, including Blockbox, this SaaS does not provide an interface for companies to view general dashboards, monitor overall health of sales and provide tracked metrics on different groups of users and personas. Overall, the platform provides convincing algorithms and technical solutions but may be missing the aspect of interactive content for retail administrators and moderators themselves.

Figure 9[13]



[12] "Real-Time Personalization and Recommendation | Amazon Personalize | AWS." *Amazon*, Amazon, aws.amazon.com/personalize/.

[13] "Real-Time Personalization and Recommendation | Amazon Personalize | AWS." *Amazon*, Amazon, aws.amazon.com/personalize/.

Indirect Competitors

Direct competitors include blockchain-based analytics companies with a goal of providing ecommerce insights for retailers through secure collection of user data, but potentially with a stronger user focus. An example of an indirect competitor is Shopin[14].

The goal of Shopin is to provide a universal shopper profile, allowing user data to be tracked across users online searches on various retailers. This data collected is then shared across the retailers and used to provide cross-retailer recommendations to the user. Retailers also benefit from this by seeing how their users interact with other retailers against their own, for which products and based on the various user types and personas entering their platforms. Although the platform does provide a very unique opportunity for retailers to see cross-platform interest from the user, there is a risk that other retailers receive more valuable information than another would. This tradeoff may or may not prove beneficial and could in some user cases, further disadvantage a retailer. The company uses a Retail Intelligence Data Engine (R.I.S.E) with Artificial Intelligence to provide the most accurate and relevant user insights both to companies across-retailers and also to users individually for a personalized experience. The company provides several smaller features for retail customers including: a visual AI tool to help users visually find items they are interested in (**Figure 10.3**), aggregate of items called a “global” wishlists and many more customer-focused features. The portal and interface is therefore for both customers of retail platforms (**Figures 10.1-10.3)** and retailers themselves. This solution is aimed on creating an entirely new shopping experience for users.

[14] “Making Shopping Personal for next-Gen Retail.” *Shopin*.

Image 10.1 - 10.3 Screenshots of Shopin's interface for users who are retail consumers[15]

Image 10.1

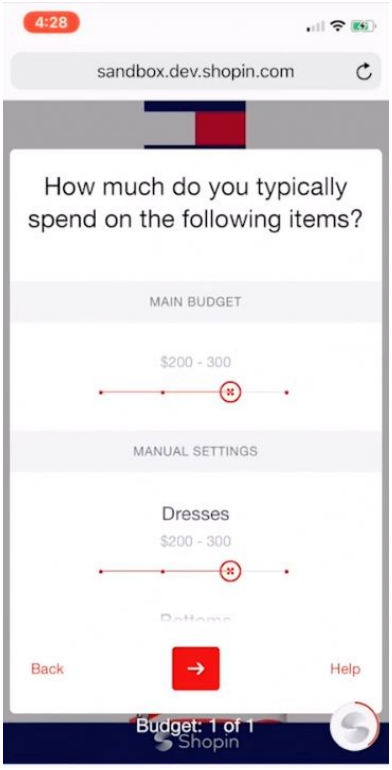


Image 10.2

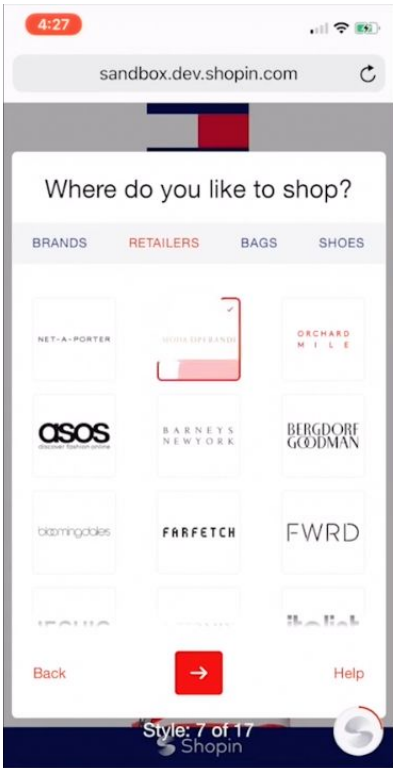
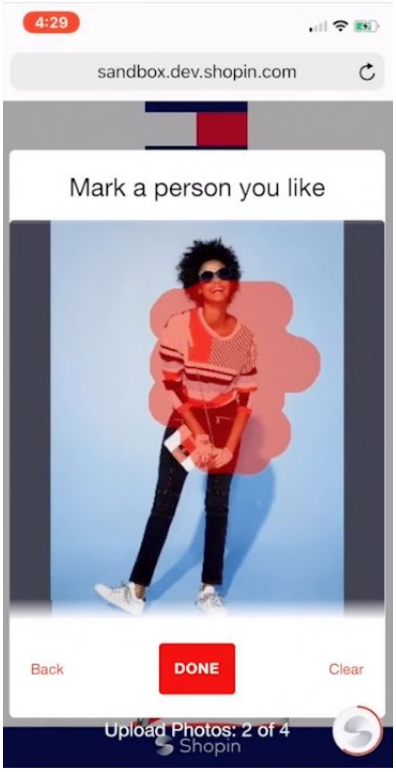


Image 10.3



[15] "Videos, Interviews and Talks." *Shopin*.

Market

How big is the opportunity?

From large enterprise provided services to internally developed solutions, gathering and analyzing digital customer insights is a top priority for companies across the ecommerce industry. From larger online retailers like Amazon, to smaller online marketplaces like clothing retailers, all online retailers are hoping to give their customers a highly personalized shopping experience. Global retail ecommerce sales will reach roughly $3.563 trillion this year[16]. Larger retailers, classified by emarketer using export volume and growth, currently account for 85% of this market[17]. These companies often have their own and open sourced, proprietary solutions tailored specifically to their needs and for smaller retailers to adopt. The remaining 15% of the market belongs to companies either smaller or not as prominent in the e-commerce industry. For smaller companies, not providing custom experiences could be due to the lack of infrastructure or resources available to them. Often with smaller budgets, small companies are in search for basic hosting platforms and general analytics to get the job done. More significantly though, companies in their early stages will often choose not to collect user information due to fear of breaking privacy laws. This is a very specific group to which a product like Blockbox would be very appealing and helpful to. Additionally, medium to large retailers, who are starting to launch ecommerce platforms, are hoping for specific and personal customer data, but face the issues of users opting out of providing or choosing to falsify information that they provide. All of these companies are searching the market for a solution that can alleviate their issues.

Product recommendation solutions are limited and many are very similar - where majority do not provide unique value or focus on appealing at all to retailer consumers. Blockbox is starting from the foundation of any successful Ecommerce platform - its users, and making sure that they are the most satisfied and feel secure with the solution being provided.

[16] Koch, Lucy. “What's Driving the Top Five Retail Ecommerce Markets?” *EMarketer*, EMarketer, 2 Apr. 2019.
[17] Koch, Lucy. “What's Driving the Top Five Retail Ecommerce Markets?” *EMarketer*, EMarketer, 2 Apr. 2019.

Why now?

Growth in the U.S. will be driven by high-performing retail ecommerce categories like consumer electronics and apparel. This year consumer electronics will reach $130.29 billion in retail ecommerce sales and account for 21.7% of total retail ecommerce sales. The category of apparel is estimated to reach $122.76 billion and accounts for 20.4%. Other categories and predicted ecommerce sales within eMarketer's forecast period can be seen in **Figure 11.** These predictions are generated from simply considering the current purchases of goods done virtually. Increasing the amount of customized data shown to users could further drive sales in this category, providing the right users with the best products tailored to their needs.

Figure 11. eMarketer's chart showing predicted sales by product category for the year 2022 [18]

Market Opportunity

The opportunity to enter the ecommerce insights market is not an uncommon idea; however, using a blockchain-based, decentralized and highly secure system to provide those insights while considering retail consumers is unique. There are currently no blockchain-based solutions that are able to provide the same level of trust, insight and storage capabilities while maintaining the anonymity of users. Blockbox will be able to provide a solution and disrupt the ecom-insights market and the general safety of data given by all online retail consumers, globally.

[18] Koch, Lucy. "What's Driving the Top Five Retail Ecommerce Markets?" *EMarketer*, EMarketer, 2 Apr. 2019.

Product

Overview

The purpose of Blockbox is to provide companies with the ability to receive insights and analytics data without storing personal information. Our solution is to ship Blockbox as SaaS which consists of the following:

Blockbox Components

Blockbox Components serve as a way for online retailers to stream data into the Blockbox platform. These components are fully embeddable javascript elements that can be integrated into any web-based e-commerce platform for online retailers to use freely. These modules will include user signup/login forms, modules for users to enter ratings, advertisement plugins, and more. Additionally, Blockbox will also provide embeddable code for tracking operations such as page loads.

Blockbox Dashboard

Blockbox Dashboard is an online dashboard for online retailers to view business insights and sales insights. The dashboard will also allow online retailers to query, filter, or sort their insights however they please. Of course, these insights would be generated using zero-knowledge methods, so no personal data will be revealed. Some of the valuable analytical information that can be found here would include recommendations for unique retail customers based on unique IDs, product sales grouped by geographical regions, and retail customer personas created by grouping similar users based on their product ratings. Custom insights may be provided to retailers by creating a feature requests which will all be reviewed and implemented frequently, considering relevance and appropriateness of the request.

Blockbox API

The Blockbox API powers Components and Dashboard. Not only will Blockbox Components stream data into our blockchain network through the API, but online retailers will have write access to their network of data through the API for the purposes of streaming existing personal retail customer data they already have collected into our network. Furthermore, Blockbox Dashboard will read business insights and sales insights data using the Blockbox API. This will also be open to online retailers for development purposes so there is a way to get insights information without going through the dashboard.

Data and Insights

Types of Data Collected

Blockbox Components will collect a variety of information from online consumers. Some of this information includes, personal demographic information, user-item ratings information, advertisement interactions, user geographical information, and website interactions information.

Types of Insights Available

Blockbox Dashboard will provide a variety of business insights and sales analytics information to online retailers. These insights include top recommendations for unique retail customers, trending items or topics, product sales grouped by geographical regions, advertisement performance indicators, retail customer personas (grouped users and their similarities), trending items or topics, product performance and interactions insights, and other custom insights developed as features as a result of requests from clients.

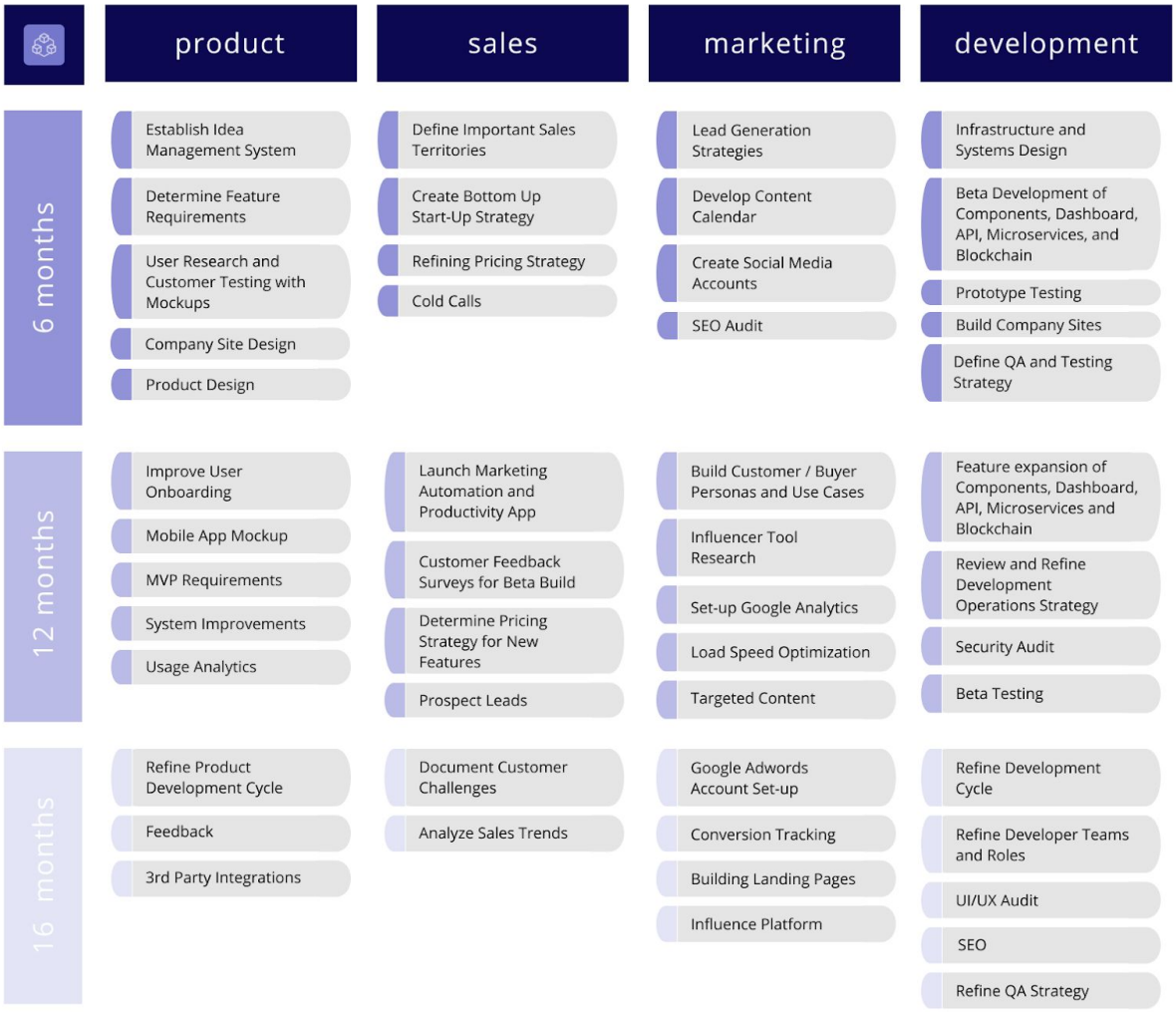
Clients and Feature Development

The target user demographic to establish Blockbox's initial client base will be organizations with little to no data collection infrastructure, data analytics, and/or sales optimizations in place. As discussed later in the Revenue Model section, there are strategic plans, the six month free trial and the small business pricing model, that would be suited for these businesses. These plans are not solely tailored towards the needs of businesses without data collection and insights infrastructure, but are also strategically constructed to transition into larger pricing plans as an online retailer's business grows and more BlockBox features are developed. Blockbox also has a pricing plan for enterprise level businesses with features that would be tailored towards them.

As the needs of online retailers expand, there is the option to submit feature requests to Blockbox which will be reviewed by the development team and later implemented.

Product Roadmap

Figure 12. Blockbox Insights Product Roadmap



Stakeholders

Primary users

The primary users will be online retailers. Bloxbox services can be used by all departments in the company for a variety of business operations such as engineering, product development, finance, and marketing. For example, the engineering team can use Blockbox Components components to collect user data and then use the Blockbox API to gain information about recommended products to display for particular users. On the other hand, a marketing team may use the Blockbox Dashboard to view insights to be used for market segmentation, which they can use for launching better advertising campaigns.

Other Users - Network nodes

Online customers who shop from Blockbox are significant stakeholders. The data provided by these users is what powers Blockbox products to provide insights to online retailers. For each online retailer in the Blockbox system, Blockbox will host a blockchain network for their users wherein the network nodes will represent user data.

Blockbox's Role

Blockbox will work closely with online retailers to ensure their transition to the Blockbox platform is as smooth as possible. More specifically, Blockbox will assist online retailers through the processes transition, integration, training, and adoption. Furthermore, because of the importance of online customers, Blockbox will tailor user-facing components towards creating good relations with online customers. For more information, please refer to the Operations section.

Technology

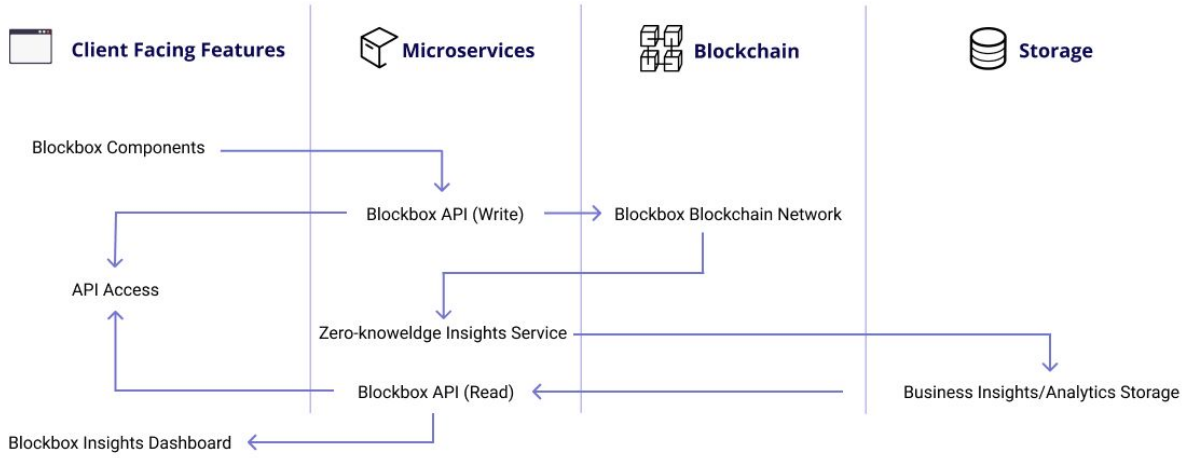
Overview

Blockbox has four distinct functionalities that will make it run:

a) User data is streamed to Blockbox
b) User data is stored securely using privatized blockchains or channels
c) Accurate insights are calculated from user data in a zero knowledge way
d) Insights are shared to the online retailers

To accomplish this, Blockbox will govern the a network of cloud services for each online retailer to use. A network for one specific retailer will follow the architecture shown in **Figure 13**.

Figure 13. Blockbox Systems Architecture Design



Features, Strengths, and Weaknesses

Blockchain

The blockchain that Blockbox uses will be a privatized, closed network made in Hyperledger. The nodes in the network represent online customers and their personal data which are controlled by Blockbox. Constructing a privatized blockchain from scratch will give Blockbox more control over network security and rules.

Since Blockbox will use blockchain will be used for decentralized data storage, data transactions and auditing information will be transacted among the nodes. This means that transactions will need to be processed and consensus will need to be reached. For rules regarding consensus and governance information, please see the Governance section.

The three most significant advantages of storing personal user information via blockchain is **decentralization**, **immutability**, and **security**[19].

- Immutability and consensus ensures fraud prevention or data structure mutation
- Cryptography is used to protect personal user information
- Data updates and transactions are extremely secure. Data can only be altered in a way that is verified by the consensus among nodes
- Data can always be recovered due to the decentralized nature of the blockchain
- All the data is time stamped and audited
- Rules can be controlled by Blockbox
- Security can be governed by Blockbox
- The network operates autonomously. Blockbox can focus on expanding features, maintaining security, and increasing efficiency rather than operating the network

One of the weaknesses of a privatized network is the cost of maintenance and hosting. This is discussed in depth in the Governance section.

Zero Knowledge Services

The zero knowledge insights service translates personal user data into usable business/sales insights for online retailers to use. The strength of this service is that it can prove the validity and accuracy of calculated insights while keeping personal data confidential. This way, our system become data driven instead of trust based because we can prove the validity of insights to online retailers.

One major weakness of this service is that it takes time to develop zero knowledge algorithms. Overall, this weakness is not significant because of Blockbox's plan for creating features according to the product roadmap. For example, more simple, beta features will be developed first and can serve as building blocks for larger features. For example, displaying a user's rated items in a zero-knowledge way is a relatively simple task that can be used as a building block to prove user similarity for generating recommended items or user profiles. Strategically choosing which insights to prioritize will optimize the time required to develop new zero knowledge insights.

[19] Patel, Ankit. "The Top Advantages Of Blockchain For Businesses." *SmartData Collective*, 16 May 2019.

Microservices Architecture

The microservices architecture defines software that is broken down into multiple components as services. Each service can be deployed and updated independently of the others. This has a variety of strengths including but not limited to the following[20]:

- Fault Isolation: If one service breaks, the others will continue to work
- Limits technical debt since individual components are easy to keep up to date or refactor
- Compliments continuous delivery and integration
- Easy to develop: the architecture is easier for developers to understand, and tasks for different components can be divided among development teams and completed asynchronously
- Easy to integrate with 3rd party software
- Highly scalable since components can be individually load balanced
- Complement cloud activities
- Isolated security monitoring: If there is a security fault in one component, the integrity of the others may not be compromised

API Access

When handling large amounts of data, it is most efficient to do it programmatically. For this reason, API access is important for online retailers to build their own services that use Blockbox. Furthermore, API access allows Bloxbox insights to be easily integrated directly into their applications instead of having to read insights via the Blockbox dashboard. If online retailers have existing data, the API allows them to port it into the Blockbox blockchain. As Blockbox grows, an SDK can be developed for different frameworks so that making API calls and accessing the Blockbox platform can be made easier.

Components

Components will be javascript modules that can be integrated into online retail platforms. This components will stream data into the Blockbox network in real time. The major strength to this approach is that these components can be customized by the online retailer and integrated into their site in the way that they chose. Similarly to Google Analytics, these embeddable components can also track metadata such as clicks and other interactions[21]. As Blockbox expands, the company can release a platform for making custom components (private or public) so companies and individuals can customize the way their applications interface with Blockbox.

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[20] Novoseltseva, Ekaterina. “Benefits of Microservices Architecture Implementation - DZone Microservices.” *Dzone.com*, 20 Dec. 2017.

[21] “How Does Google Analytics Work (A Complete Guide for Beginners).” *MonsterInsights*, 2 Jan. 2019.

The major weakness of this is that the component based approach requires a small amount of development work by the online retailer. Making the components customizable and pre-built makes the integration and development process as easy as possible for online retailers, but they still have to take steps to include our code in their online platforms.

Dashboard

The Dashboard is an interface for companies to view their business insights and trends. This will primarily be made using several javascript libraries for data visualization.

The largest weakness of this is that all the insights are presented visually; however, API access is available for companies that want to stream their data. Furthermore, due to the monolithic nature of this app and the number of libraries it requires, it is susceptible to technical debt. One solution to this is to make the app component/interface based (React, Typescript architecture) so that the individual components can be updated and maintained over time.

Governance

Blockbox blockchain networks will exist as individual privatized, permissioned networks for each online retailer using the product. The nodes in the network represent users and their personal data which are controlled by Blockbox.

Consensus

Consensus will be achieved through **open governance** as a result of a **representative democratic decision** of specific nodes in a network. Initially, a specific percentage of nodes in the privatized network will be responsible for computing how to update the ledger. These nodes will be specialized in terms of computing power and privileges to be able to compute how to update the leger efficiently. This method has advantages over a direct democracy because it is more cost effective than if every single node is required to compute how to update the ledger. Because all the nodes are managed by Blockbox and the network is privatized, there are no weaknesses regarding misrepresentation, bias, or misplaced trust that openly governed, public networks may have.

The long term solution to this is to eventually make Blockbox networks public for mining purposes only. Logic can be added to the network using smart contracts to compensate these publicly owned nodes for solving the ledger. These public nodes will have restricted privileges, but should still be able to update the ledger if their solution is approved by the other nodes. Ideally, the cost saved in computing power is greater than the cost of financing miners; thus, there is potential to generate an autonomous revenue stream here.

Governance

Blockbox blockchain networks will be governed by a combination of **on-chain governance** and governance by the Blockbox Engineering team. Since the network should operate autonomously, data transactions and additions will be handled by programmed logic within the network. For features, the core engineering team with work with the Blockbox product team and customer relations team to determine the features that need to be improved or added to the Blockbox API, Dashboard, and/or Components, which directly translate to functions occurring within the blockchain network or zero-knowledge insights service. For example, if online retailers in the trading market want to track insights regarding online consumer trades in their platform, this would translate to a transaction between users in the Blockbox blockchain network. Because of the open channels of communication between online retailers and the engineering team, the online retailers have some control over features, but the engineering team remains the topmost authority for determining the functions of the blockchain.

Operations

Summary of Roles and Teams

Engineering: The core engineering team will be responsible for application development, devops, and security.

Sales: The sales team will be responsible for forming business relationships with online retailers who are interested in using Blockbox.

Marketing: The marketing team will be responsible for public relations and advertising. User awareness of how Blockbox preserves the privacy of personal information is essential to improving Blockbox's market share.

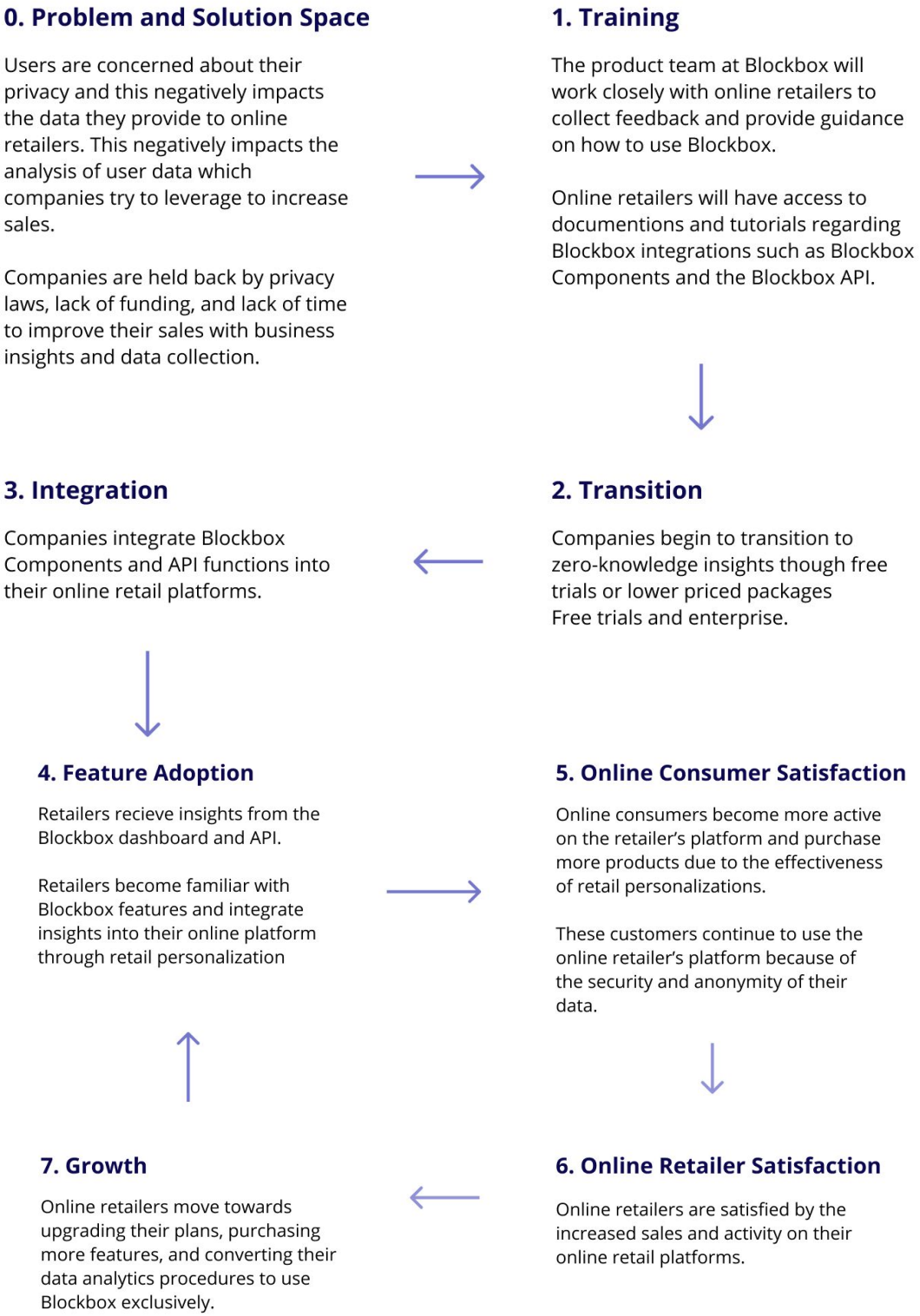
Product: The product team will work closely with customers and leads to determine the features and improvements that need to me made for Blockbox. They will also collect feedback and perform user research regarding features.

Finance: The finance team will decide on pricing strategies and opportunities. Furthermore, they will accounting for the company and customers.

Administration: The administration team will be responsible for company operations and management.

Product Rollout and Growth

Figure 14. Blockbox Product Roadmap



Security

Cryptography

Zero-knowledge proofs are an aspect of cryptography wherein a certain output can be verified without revealing the input. For example, considering product recommendations for users, using a zero knowledge method can allow Blockbox to prove that a user will be interested in certain items without revealing the user's shopping habits or history. Using zero-knowledge methods will allow all retail insights that Blockbox generates to be validated without revealing any of the personal online shopper data used to calculate those insights. Using this cryptographic method also ensures that user data cannot be reverse engineered or calculated from insights data.

Furthermore, sensitive data will be encrypted before being added to blockchain networks. For example, this may include the names, birthdates, or geographic locations.

Protocols

API protocols will be set in place to ensure data security. Firstly, there will be no read access to the online shopper data in the network; it will be write only. Read access will only be given to insights, which exist in a separate database than the user data. APIs will also be authenticated for security purposes. Furthermore, Blockbox components, the user-facing elements of Blockbox, will be constructed to only send encrypted data across networks.

Governance

Transactions and exchanges will be heavily audited and handled programmatically by the rules of the Blockchain that are written by Blockbox. Because the data will be privatized and transactions will be autonomous, it is extremely secure. Furthermore, none of the network nodes will be controlled by people directly, but they will be handled directly using a set of write only APIs, which are goverened by the protocols specified in the above section.

Legal and Compliance

Regulations and Ethics

The General Data Protection Regulation (GDPR) enforced by the European Union is an excellent ethical and legal guideline for Blockbox to follow while executing the company's mission.

Blockbox operates in complete compliance with the General Data Protection Regulation (GDPR) enforced by the European Union. The core principle of the GDPR is 'to protect all EU citizens from privacy and data breaches in today's data-driven world[22]. This core principle is aligns exactly with Blockbox's mission to protect user privacy in a world where it is essential to collect data and generate data-driven insights.

Some of the core principles of the GDPR that will be implemented into all Blockbox products including the following:

Privacy by Design:	By far, this is the most significant principle that Blockbox follows. The company will encrypt all of the personal data related to online consumers and ensure that the personal information of users can never be compromised.. Furthermore, generating insights using zero knowledge methods ensures that user data can never be read or copied.
User Consent:	All retail consumers must provide consent for Blockbox to collect data. Requests for consent will be provided in accessible forms, and the ability to withdraw consent will be available as well.
Breach Notifications:	Users will be kept up to date with security related events that transpire which may potentially put their data at risk.
Right to Access:	Not only will uses be able to see the information which Blockbox has collected about them, but Blockbox will be transparent about the purpose and storage details about their data.

[22] "GDPR Key Changes." *EUGDPR*.

Data Protection Officers:	Blockbox will appoint data protection officers who are experts in the field of data security based on their prior experience and skills. These officers will report to a high level of management in Blockbox and will have the sole responsibility of ensuring data protection.

Compliance Agreements with Clients

A fundamental requirement for Blockbox to ensure privacy is that online retailers must comply not to store user data and to reply completely on the Blockbox platform for data collection and analytics. To use Blockbox, online retailers must comply to these terms to ensure data protection.

Distribution and Scaling

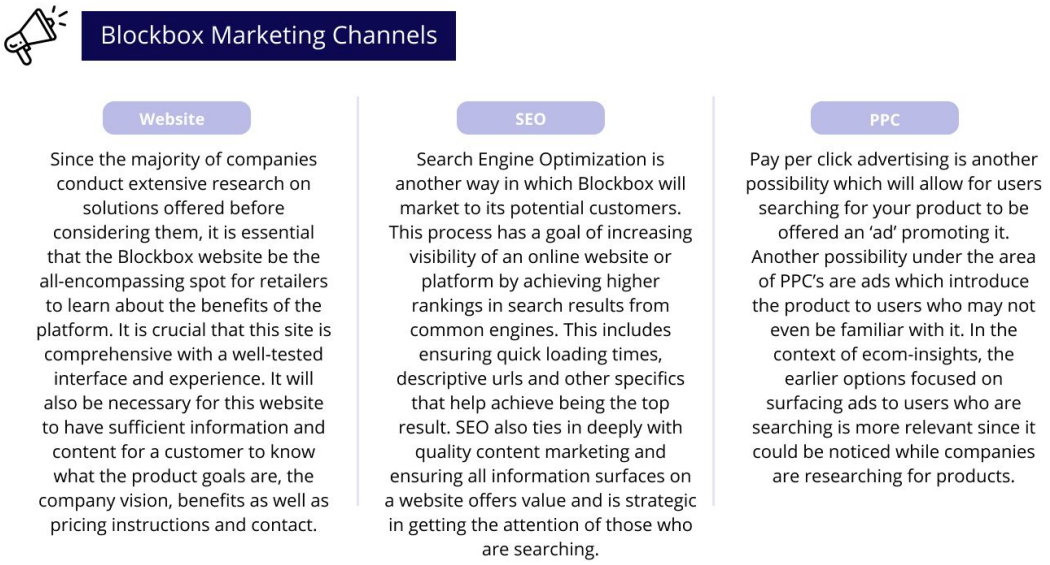
Distribution

In order to ensure the adoption of Blockbox's technologies, it is crucial to consider marketing and vision sharing strategies as well as create detailed distribution plans and budget projections. The company will grow by investing budget, time and worker resources into areas of research and business infrastructure to make Blockbox the go-to place for safe, secure and highly personalized business insights. The following sections will detail the plans and strategies that will be put in place to ensure this project's growth and success.

Marketing and Vision Sharing

In a world booming with social media outlets, thousands of marketing technologies and tools, and an increase in general connectivity between individuals - finding the correct channels to market a product in can be very overwhelming. Since the main users of Blockbox are existing retailers or ecommerce platforms, it is important to learn how these companies would be most interested in learning about a insights-providing software solution. Based on several articles, studies and results the use of websites as the main channel of marketing has proved to be the most beneficial in today's day and age, as well as specifically in this industry[23]. **Figure 15** shows the marketing channels and strategies that will be used to reach the customers for Blockbox.

Figure 15. Details on marketing strategy and techniques in order to promote product



[23] "The 6 Marketing Channels You Should Prioritize in 2019." *Disruptive Advertising*, 26 Sept. 2018, www.disruptiveadvertising.com/marketing/marketing-channels/.

Distribution Plan

The distribution plan consists of considerations about the physical way in which the product will be given to the users, and the channels through which customers can be reached out throughout the distribution process.

1. Physical Distribution

Blockbox will use the method of direct selling which will give the company the ability to choose customers and control the price and selling points for solutions being provided. It also helps Blockbox in better controlling revenue, but may require additional resources to man since product quality should not be sacrificed by providing this service.

2. Outreach channels

The product will be purchased primarily online and occasionally via calls, emails or other methods of communication with internal staff in cases with required personalizations and setup assistance. The financial structure as shown in **Figure 15** will be used to decide on which version of the product the consumer is hoping to purchase. Along the process of purchasing, customers will be reached out to by or can proactively contact Blockbox customer service representatives. These teams will serve as a continuous link as the first point of contact with the customer all the way through to the order being installed and implemented into the customers system.

Scaling

The primary way in which Blockbox is planning on expanding and increasing the scale of the company is by investing back into the company. Specifically in research and development and business infrastructure to tackle technical and other company challenges and risks.

Although initial funding will be required, most likely obtained from VC firms or private investors, the funds following this initial phase will directly go into improving the company's functionality. To tackle business challenges, part of the budget will go towards business infrastructure. This includes considering overhead costs for office real estate, employee salary, culture, tools and internally needed software and infrastructure as well as any other costs that may be required to set up the infrastructure to better monitor all processes within the company. Business challenges around promotion and marketing will be improved by investing in customer retention strategies, since it is very expensive to onboard new customers due to advertising, salesperson time, processing transactions and contract creation.

Technical challenges will be addressed and minimized by continually investing in research and development, and working in fast-paced team structures. The goal in initial stages will be to make safe decisions that will ensure that Blockbox is meeting the most basic goals of the company; security, safety and strong analytics all to provide the best personal e-commerce insights. By investing further into research and development, the company will stay on top of keeping the company's software solution up to date with modern standards.

Revenue Model

Free Trial

The free trial allows an organization to experience all the features and services that Blockbox has to offer. 6 months will allow the business to accumulate users and understand the analytics that Blockbox can provide. Free trial participants will have access to all the features to better understand everything that Blockbox has to offer. Furthermore, if the trial consumer has the opportunity to use all the features and integrate them into their systems, they will be more inclined to upgrade to the small business or enterprise plans to continue the progress they have and to ensure that their user insights are not lost.

Small Business

The small business package is meant for businesses that may not have a vastly large amount of users or infrastructure in place to support business insights and analytics. Providing access to Blockbox Components will allow the organization to quickly integrate Blockbox into their online retail platform and Blockbox Dashboard will allow the online retailer to immediately see sales insights through their personal dashboard. Since businesses on the small business plan is likely to not have a large amount of user data or infrastructure already, they do not require advanced analytics or API access for development purposes; however, they will be inclined to upgrade to the enterprise plan once their business and technical infrastructure grow over time and they accumulate more users.

Enterprise

The enterprise package provides full access to all the features. Since enterprises may already have certain analytics, the price is flexible to allow enterprises to select their optimal price based on choosing they analytics features that they require. Additionally, keeping the price flexible allows Blockbox to scale prices based on the number of retail customers that different enterprises have. Including Blockbox API access in the enterprise plan will allow the enterprise to stream any existing user data into the Blockbox platform and it would allow them to use our services to create their own applications of Blockbox technology. Finally, once new analytics features are developed, the flexible pricing plan facilitates contract upgrades and extensions for existing retailers who are on the enterprise plan.

Figure 16. General Pricing Model Guideline based on from Amazon Personalize[24]

	Free Trial	Small Business	Enterprise
Flat Fee	FREE for 6 months	$149/year	Contact prices vary by advanced insights feature
Boxbox Components	✓	✓	✓
Boxbox API Access	✓	✗	✓
Boxbox Insights Dashboard	✓	✓	✓
Boxbox Starter Insights	✓	✓	✓
Boxbox Advanced Insights	✓	✗	✓
Customer Support Docs	✓	✓	✓
Customer Support Help	✓	✗	✓
Per GB of Storage	$0.03	$0.04	$0.05
Per Training/Computing Hour	$0.10	$0.15	$0.20
Per 100,000 Insights API Requests	$5.00	$6.25	$7.50

[24] "Amazon Personalize Pricing - Amazon Web Services." *Amazon*, Amazon.

Financial Projection

Predicting the costs and overall finances of Blockbox includes cost comparisons for other companies as well as traditional expenses that most startups will incur. This financial projection will include an expense budgeting and sales forecast based on existing trends in product adoption into a market of large scale.

Expenses Budgeting

Year 1

Based on the market size as well as public perception of blockchain technologies, it can be assumed that year 1 sales will mostly be from smaller companies without existing insights and analytics infrastructure. Additionally, the following non-recurring costs will most likely be made in year 1: Hardware, Servers (blockchain service), telecommunication equipment, software (packaged or custom), project and organization tools and frameworks, infrastructure, development, business process owners, management, employee training and onboarding, transition costs and post-implementation reviews. All these costs are fixed in the scope of the first few years and, therefore, are only needed to be done in this year.

Year 2

In year 2, there would have been an increased interest as well as knowledge of the platform as well as blockchain technologies and this will result in a higher demand and interest amongst customers. The costs for year 2 may include maintenance of any earlier fixed costs, such as blockchain services being used and employee trainings or salaries.

Year 3

Having seen the results of other companies adopting these technologies and a more established SEO, the product may receive more attention from its users. For that reason, the sales in year 3 should be more than previous years. Costs in this year would be similar to year 3, potentially less if more optimized methods of maintaining internal products and services is discovered.

Sales Forecast

After conducting an analysis across existing companies in the same market, the following prices show the averages of traditional product recommendation engines and insight-offering softwares:

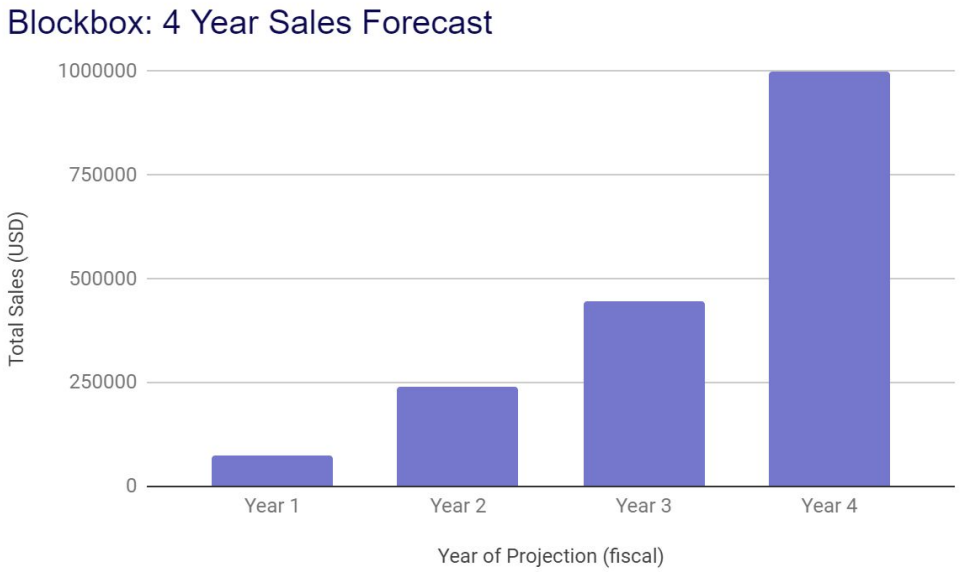
Small Company with between 1200 - 120,000 profiles → $500 / month
Medium to Large Company with between 130,000 - 1 million profiles → $2000 / month or custom price. [25]

The chart in **Figure 17** shows estimated yearly sales from small, medium and large companies.

Figure 17. Estimated yearly sales for Blockbox Insights

Company Size	Plan	Approximate Pricing per year
Small	Small Business	1-5k
Medium	Enterprise	5-20k
Large	Enterprise	20k+

Figure 18 Estimates for sales projections in a 3 year duration.



[25] "10 Examples of Recommendations Engines." *Wonder*.

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Appendix

Appendix A

Figure 1

Sukhi Gupta

Executive Engineering Director, Walmart USA

Sukhi has been a part of Walmart USA's Engineering team for the past 15 years of her career. Just last year, she was promoted to the role of Executive Engineering Director for the Online Retail sector, which makes her responsible for all purchases made on Walmart USA's website. Sukhi directly manages 50 technical program managers and has 850 engineering employees in her sector alone.

About

Education: Computer Engineering
Age: 47
Interests: Management, Data Analytics, Ecommerce Insights

Motives

Sukhi want to maintain Walmart's image of fast, secure and intuitive services. Her goal as Engineering Director is to uphold and improve the quality of online experience and for Walmart USA online shoppers.

Goals

After years of being a fulltime engineer in the Online Retail sector, Sukhi is very familiar with the processes and security policies currently being upheld. Given this information, Sukhi is a believer in innovation and emerging technologies, and is on a lookout for any insight-providing software solutions that may be better suited for Walmart's massive online platform. Her goals while looking for a product are primarily security and reliability in terms of scale. She will only suggest the adoption of a software that she finds will be an easy transition, including well documented training materials and sufficient technical customer support.

Keys: Security, Scalability and Best Practices

Figure 2


Karen Cuadros
Avid Online Shopper, Austin (Texas)
Karen is a recently university graduate and is on the search for a full time job. She currently pursues part time roles as a secretary and administration assistant for financial companies in a corporate district of town. Karen thouroughly enjoys shopping and is actively looking for deals and specific items. She returns home from a busy day at works and experiences frustrations when having to go through the process of finding the items to shop for.
About
Education: Economics
Age: 24
Interests: Business analysis, marketing and finance
Motives
Karen, above all, is hoping to find good deals in a short amount of time. Due to her personal and career comittments, when she spends time recreationally shopping she is hoping for a personalized experience.
Goals
Having recently graduated, Karen has taken many courses in school about technology and its increasingly important role in business management and economics. She is aware of ongiong data privacy and security issues and, for that reason, often falsifies or completely ignores any opportunity to provide personal information to online retailers and websites in general. She fears data breaches, personal information leaks and spam emails or calls from companies asking for more information. Her goal is to have a personalized shopping experinece without having to feel overexposed, vulnerable and unsafe
Keys: Privacy, Custom Content and Great Deals!

Figure 3

Appendix B

Company logo by JShrivastava and TMehta.

References

1. Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019, www.forbes.com/sites/blakemorgan/2019/05/21/50-retail-innovation-stats-power-customer-experience/#3b83edb6447e.

2. Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019, www.forbes.com/sites/blakemorgan/2019/05/21/50-retail-innovation-stats-power-customer-experience/#3b83edb6447e.

3. “Why Use a Blockchain?” *CoinDesk*, www.coindesk.com/information/why-use-a-blockchain.

4. Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019, www.forbes.com/sites/blakemorgan/2019/05/21/50-retail-innovation-stats-power-customer-experience/#3b83edb6447e.

5. Sobers, Rob. “56 Must Know Data Breach Statistics for 2019.” *Inside Out Security*, 10 Apr. 2019, www.varonis.com/blog/data-breach-statistics/.

6. Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019, www.forbes.com/sites/blakemorgan/2019/05/21/50-retail-innovation-stats-power-customer-experience/#3b83edb6447e.

7. Morgan, Blake. “50 Retail Innovation Stats That Prove The Power Of Customer Experience.” *Forbes*, Forbes Magazine, 21 May 2019, www.forbes.com/sites/blakemorgan/2019/05/21/50-retail-innovation-stats-power-customer-experience/#3b83edb6447e.

8. “Digital Buyers Worldwide 2021 | Statistic.” *Statista*, www.statista.com/statistics/251666/number-of-digital-buyers-worldwide/.

9. “The History of Data Breaches.” *Digital Guardian*, 3 Jan. 2019, www.digitalguardian.com/blog/history-data-breaches.

10. Shopify. “Shopify Analytics.” *Shopify Help Center*, help.shopify.com/en/manual/reports-and-analytics/shopify-reports.

11. Shopify. “Shopify Analytics.” *Shopify Help Center*, help.shopify.com/en/manual/reports-and-analytics/shopify-reports.

12. “Real-Time Personalization and Recommendation | Amazon Personalize | AWS.” *Amazon*, Amazon, aws.amazon.com/personalize/.

13. “Real-Time Personalization and Recommendation | Amazon Personalize | AWS.” *Amazon*, Amazon, aws.amazon.com/personalize/.

14. “Making Shopping Personal for next-Gen Retail.” *Shopin*, www.shopin.com/shopin-making-shopping-personal/.

15. “Videos, Interviews and Talks.” *Shopin*, www.shopin.com/videos/.

16. Koch, Lucy. “What's Driving the Top Five Retail Ecommerce Markets?” *EMarketer*, EMarketer, 2 Apr. 2019, www.emarketer.com/content/whats-driving-the-top-five-retail-ecommerce-markets-worldwide.

17. Koch, Lucy. “What's Driving the Top Five Retail Ecommerce Markets?” *EMarketer*, EMarketer, 2 Apr. 2019, www.emarketer.com/content/whats-driving-the-top-five-retail-ecommerce-markets-worldwide.

18. Koch, Lucy. “What's Driving the Top Five Retail Ecommerce Markets?” *EMarketer*, EMarketer, 2 Apr. 2019, www.emarketer.com/content/whats-driving-the-top-five-retail-ecommerce-markets-worldwide.

19. Patel, Ankit. “The Top Advantages Of Blockchain For Businesses.” *SmartData Collective*, 16 May 2019, www.smartdatacollective.com/top-advantages-blockchain-for-businesses/.

20. Novoseltseva, Ekaterina. “Benefits of Microservices Architecture Implementation - DZone Microservices.” *Dzone.com*, 20 Dec. 2017, dzone.com/articles/benefits-amp-examples-of-microservices-architectur.

21. “How Does Google Analytics Work (A Complete Guide for Beginners).” *MonsterInsights*, 2 Jan. 2019, www.monsterinsights.com/how-does-google-analytics-work-beginners-guide/.

22. “GDPR Key Changes.” *EUGDPR*, eugdpr.org/the-regulation/.

23. “The 6 Marketing Channels You Should Prioritize in 2019.” *Disruptive Advertising*, 26 Sept. 2018, www.disruptiveadvertising.com/marketing/marketing-channels/.

24. “Amazon Personalize Pricing - Amazon Web Services.” *Amazon*, Amazon, aws.amazon.com/personalize/pricing/.

25. “10 Examples of Recommendations Engines.” *Wonder*, askwonder.com/q/please-give-10-examples-of-pricing-for-recommendation-engines-577dd0d3e101a5340048bdef.