The Value of Monitoring in Supply Chains

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Summary: This thesis focused on how logistics companies should leverage real-time sensors to generate the most business value for their customers. By interviewing current users of real-time monitoring devices, we were able to understand how customers perceive the value added by this technology. We found that customers are unwilling to analyze this newly-collected data themselves, but instead want their logistics provider to interpret it to provide value-added services. Therefore, logistics providers should leverage all of the data they collect, instead of simply creating value when shipments become exceptions. We proposed using smart contracts on a permissioned blockchain to automate business processes and to reduce frictions within the shipping parties and other intermediaries.

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KEY INSIGHTS

1. Real-time monitoring customers do not do extensive financial decision-making when they choose to purchase this type of service. Instead, it is more of an emotional sale, similar to buying insurance.
2. Logistics providers should expand their service offering to add value not only when things go wrong. One such way is by using blockchain enabled smart contracts to automate business processes.
3. System dynamics modeling summarizes that three important endogenous variables affect customer adoption of a real-time monitoring device: the ability to intervene when a shipment has an issue, appeal of the product, and awareness amongst target customers. Therefore, logistics providers should focus on these variables to drive quick adoption.

Introduction

Monitoring in today's world is ubiquitous, but as supply chains become more and more global with longer transit times, the condition of shipments is sometimes unknown. Traditionally, companies have used passive tracking devices which record the information collected by the sensors in their packages. Recent advances in technology have enabled our thesis sponsor company (a global logistics provider) to develop a sensor device that reports data in real-time. However, how should logistics providers leverage this technology to greatly add value to their customers?

Approach

We approached this problem from an empirical point of view and interviewed customers of our sponsor company in order to understand how real-time monitoring devices are currently being used. We also interviewed potential customers of a real-time monitoring device to understand their inhibitions to

adopt such a technology. Furthermore, we focused on how businesses currently use the monitoring technology to solve their supply chain problems. Finally, we outlined customers' largest concerns with real-time tracking of their shipments.

Operational Context

Many interviewees confirmed that real-time monitoring of shipments is crucial in supporting niche business operations for any company. Performance is primarily judged by on-time delivery, however customers are increasingly interested in knowing, for example, if their shipment suffered excess vibration or was exposed to too much light. However, as shown in Figure 1, current customers expressed many concerns about these new devices.

Managing the Devices

- Who will interpret the data and generate insights?
- Who will manage the reverse logistics and ensure that devices are fully charged?
- Who will ensure that device inventory is balanced throughout their network?

Security and Trust

- What data is collected about their shipment?
- Who is this data shared with?
- How secure and reliable is this data?
- Should they be afraid of hacking?

Device Interoperability

- Can this device connect to their existing systems?
- Can these trackers connect to other IoT devices

Figure 1 - Summary of customer concerns

Additionally, today's pharmaceutical environment has become increasingly complex, with more specialty products being shipped than ever – which in turn raises the stakes, and the costs, of mishandling. There is a greater need for more sophisticated and personalized temperature control solutions, and one solution will not fit all distribution models. Better temperature control and the right packaging is essential to keeping product integrity intact.

Method, Data and Preliminary Findings

After surveying all of the sponsor company's customers (N = 69) who use real-time tracking devices, it appeared that not every feature is being used by every customer. Figure 2 describes which

features are used by current customers. The most important feature to customers is location (GPS), which suggests an interesting opportunity to offer a device with only real-time GPS tracking capabilities in order to serve the majority of the customer base. The next most important features are temperature, geo-fence (a subset of GPS) and exposure to light.

% of Customers Using Feature

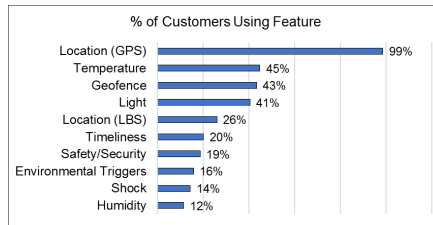| Feature	%
Location (GPS)	99%
Temperature	45%
Geofence	43%
Light	41%
Location (LBS)	26%
Timeliness	20%
Safety/Security	19%
Environmental Triggers	16%
Shock	14%
Humidity	12%

Figure 2 - Feature usage

Moreover, we identified five general categories where real-time sensors are being used:

1. Critical spare part (37%)
2. Cold-chain shipment (34%)
3. Security (14%)
4. High value (9%)
5. Sensitive document (6%)

Working alongside the real-time tracking device sales representatives, we were able to identify how often each customer uses real-time tracking for each of the categories we defined. Therefore, given that the two largest categories account for 71% of total usage, it reinforces the importance of the location and temperature sensors, which are key elements of the critical spare part and cold-chain shipment categories.

Results – Adding Value

We identified four ways to add business value using a real-time monitoring device. First, this newly-collected data allows insurers to perform risk assessments based on actual characteristics of the shipment rather than proxy data. The ability to better detect and model risks due to theft or damage could move the pricing of insurance products from an actuarial exercise, to one that better assesses risks and losses in real-time. Second, knowing about a shipment delay ahead of time allows companies to react sooner, rather than later. This increases peace of mind by enabling companies to plan mitigating

processes accordingly. Third, logistics providers can use analytical tools to optimize shipments and operations, both internally and externally. Finally, with real-time tracking of the location and the condition of the package, opportunities open up for automating operations and reducing business frictions.

Moreover, a real-time monitoring device allows a logistics provider to offer its customers the ability to tap rules-based intelligence to perform business functions. Recent technological advances have enabled the creation of intelligent, embedded and trusted program code, letting participants build terms and other logic into contracts and transactions. It allows business partners to automatically monitor prices and delivery times to negotiate and complete transactions in real-time. It also opens the door for machine-to-machine transactions across the Internet-of-Things. These capabilities enable the transformation of a traditional supply chain, where transaction documents and contracts must be maintained separately by each partner. Indeed, with a new groundbreaking technology called blockchain, all transactional elements are stored on decentralized computing nodes by various partners. Blockchain is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way.

Results – System Dynamics Approach

Finally, to capture the dynamics of customer adoption of a real-time monitoring device, we used a system dynamics model, as seen in Figure 3. This approach allowed us to capture how different components interact with each other and to identify key components which affect the success or failure of the whole system. Based on customer interviews, we concluded that Appeal, Awareness and 'Support infrastructure for intervention' are the three most important factors which affect the outcome of the adoption model. 'Support infrastructure for
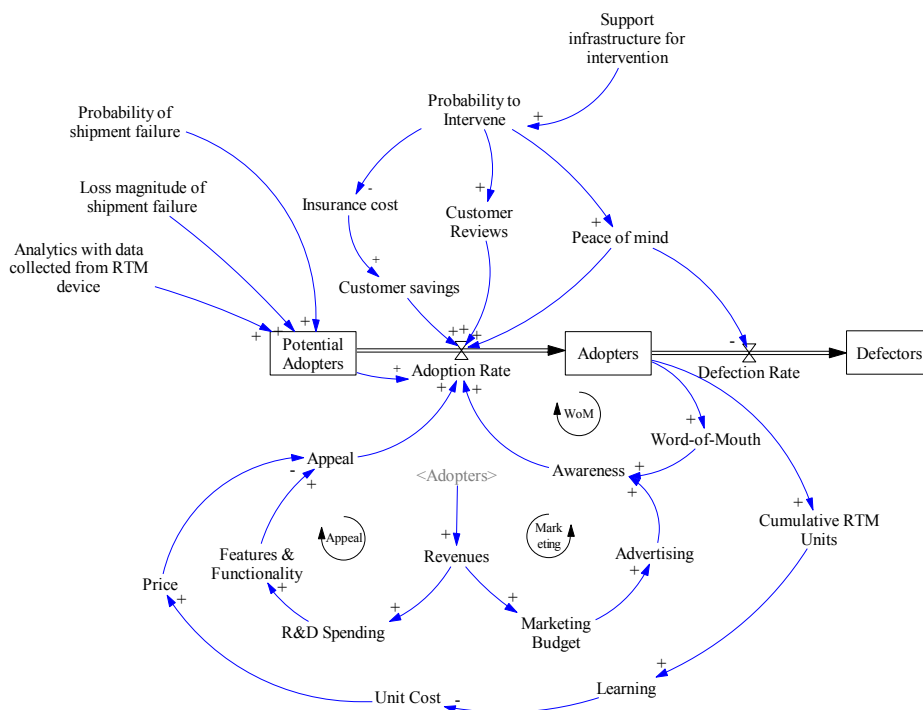
Figure 3 - System dynamics model of the customer adoption process

intervention' is the backend process which helps customers intervene after they identify any type of failure with their shipment. Investment in the infrastructure to ensure that logistics providers can actually intervene will make the device much more valuable to customers. Finally, there is enormous potential to drastically increase the appeal to customers by creating new business models with data collected by a real-time monitoring device.

Conclusions

Ultimately, every shipment in every industry is a potential market for real-time tracking devices. The most critical element that hinders or aids in adoption is, eventually, cost. Potential customers need to justify the investment from a financial perspective. Therefore, the price has to be right for them and they need to understand the potential added value that can be created by these devices. As these real-time monitoring devices become more ubiquitous, it will be critical for logistics providers to ensure that they are differentiating themselves with the services they offer, not with these physical sensor devices. Logistics providers' core business and expertise is moving product efficiently, not designing and launching state-of-the-art pieces of technology. As with the Internet itself, smart connected products reflect a whole new set of technological possibilities, but global logistics providers' ability to leverage their own core strengths will be the key to taking advantage of this emerging technology.