Are HCI Issues a Big Factor in Supply Chain Mobile Apps?

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Abstract. A previous survey about the use of iPhone and/or iPad apps in supply chain operations learned that the use of such apps varies greatly among different individuals and different organizations, with many respondents using apps, but not for supply chain operations [1]. In product design, an aspect of growing importance is its usability. This raises the question that is the focus of the paper. Namely, are human-computer interaction (HCI) issues a factor being addressed in the mobile apps for supply chain management? It appears that addressing HCI issues for most any kind of commercial mobile app seems to have had little focus, even though some usability problems are well-known. Nielsen summarized this as "the user experience of mobile websites and apps has improved since our last research, but we still have far to go" [2].

1 Introduction

As a starting point, it is appropriate to distinguish between a browser-based mobile website and a mobile app. A mobile website application works as on a desktop. Webpages are developed in a language such as HTML, which interlinks text data, images, videos, and other files. A browser is used to download the pages from the Internet across a wireless network and renders them for the display on the phone or tablet. The primary difference for mobile websites is the pages are designed with the smaller screens in mind. However, the advantages of the mobile web application (or browser-based app) are mostly the same as for the desktop version. Webpages are device independent. It is only the browser, which normally comes with the phone or tablet, that depends on the underlying hardware. The web applications are instantly accessible, easily updatable, sharable, searchable and the like.

A mobile application (app) is an executable program that is downloaded and installed on the device such an iPhone or iPad. Once there, the Internet may no longer be needed, unless the application requires access to online data. Mobile apps can be highly interactive and capable of performing high-level calculations. They can generate personalized reports. They can work with the supporting platform to use native capabilities such as a camera. Of course, an application must be developed for and compiled on a particular platform. That is, an application may not be able to run on both an iPhone and an Android, for example.

A visit to the Apple apps store provides an overwhelming number of choices for mobile apps to add to one's iPad, iPhone, or similar device. Furthermore, the devices themselves have become almost ubiquitous, being everywhere you look. This means that employers can assume that an employee possibly has and or at least understands the iPhone and iPad. It follows that involving this technology in the execution of co-operative tasks should not present a challenging learning curve to overcome.

Of particular interest in this research is the application of mobile technology to the vastly complex notion of a supply chain. Fundamentally, a supply chain is the inter-linking collection of elements and actions required to fulfill a customer's order. It can begin with raw materials and the transportation of those raw materials to facilities for storage and/or manufacture. It incorporates distribution nodes and retail locations, ultimately placing the product in the customer's hands. Each unit involved in the chain may include functions such R&D, logistics, operations, marketing, sales, finance, and customer service. This is a vastly complex organism. Any efficiency found or optimization that occurs can save large amounts of money and resource. Hence, research into any means to improve supply chain operations is relevant and important.

Simple observation recognizes that mobile technology should be well-positioned to introduce efficiencies into the supply chain. For example, rather than making employees move to centralize computing locations, mobile technology allows them to bring the computing to them. Kalakota, et al., note a number of compelling reasons why mobile apps would be important to supply chain operations: fulfillment velocity, inventory visibility, supplier coordination, and versatility. They further note that customers expect real-time information about orders, information about location of product, and accurate delivery commitments [3]. However, others characterize the field as still in the early phases of providing competitive advantage [4].

One might wonder why so little is being done with mobile apps when they have so much promise for solving supply chain operation problems. There are issues that range from human behavior to complex IT demands. From the computing perspective, the integration of mobile apps across a supply chain is proposing changes to the underlying information system infrastructure. Studies have shown that over 49% of IS projects finish over-budget, late, and with fewer features than specified. Nearly 28% of all IS projects are cancelled [5]. This is quite daunting; yet corporations routinely carry the risk, provided the return on investment promises to be great enough. Estimating this ROI of mobile apps impact on IT infrastructure is not a focus of this research but does have promise for further work.

On the other hand, the interest in this research is on the human side. Will people be willing to accept the new technology? The adoption of information technology is a heavily studied problem, since the technology acceptance model (TAM) was proposed [6]. It is not the intention of this work at this time to provide an in-depth analysis of mobile apps technology in supply chain operations in the light of the TAM. Rather the two main external variables in the model, perceived usefulness and perceived ease of use motivate some of the discussion to follow.

Once a company decides to put a new technology into operation, there is the possibility it will fail because of the employee's reception of it. According to a simple view of the TAM model, if the employees do not perceive it as a useful technology or perceive it as not easy to use, then they may not accept it. This raises the question that is the focus of the paper. Namely, are usability issues a factor being addressed in the development of mobile apps for supply chain management?

This research will look further at the use of mobile apps to aid supply chain operations, then consider aspects of human-computer interaction that are important, especially for mobile apps. Next, anecdotal information relative to recent searches specifically for mobile apps applied to supply chain will be considered, followed by conclusions, especially with respect to whether HCI aspects are presently important for mobile apps in the supply chain area, and then thoughts about likely future scenarios.

2   Mobile Applications in Supply Chain

Given the complexity of supply chains already discussed, a common theme that emerges from looking at published literature about supply chains is that the flow of information is critical. It is here that mobile apps have the potential to accelerate that flow and improve its accuracy. Figure 1, Siau and Shen [7], illustrates the broad scope of the information flow in dealing with supply chain operations, stretching from supplier relationship systems to customer relationship systems, and flowing in both directions. Facilitating this flow of information can provide a much needed efficiency. Examples of this follow.
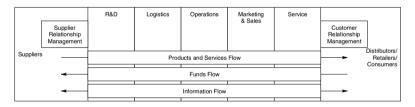

Fig. 1. Extended Supply Chain and Supply Chain Flow (Source: Siau and Shen [7])

Some supply chain areas are actively moving toward mobile apps. Transportation and logistics is one of these, Rowe reports, for functions like route planning, carrier and price selection, tendering, load board visibility, and updates of shipping location status. There are still concerns, though, especially around security, and the drawback of less screen real estate is also recognized [8].

With such a broad scope present in a supply chain, it is not surprising that there are many different mobile applications possible. Doolin and Ali, for example, prepared an extensive review of three companies in New Zealand who implemented aspects of mobile technology in supply chain: a food company who used mobile sales force automation (sales force information downloads, updated product information, customer information, sales promotion, territory management, stock levels, and replenishment dates) to speed up input ordering and invoicing information; a freight

company, who used mobile freight tracking systems; and a power company, who used mobile service support to send information about faults to field crew PDAs, including information on the job status, fault location, work required, and billing [9]. This type of case-by-case analysis will likely increase as researchers attempt to understand the return on investment of mobile app technology in supply chain operations.

As developers seek appropriate uses of mobile apps, one might wonder what characteristic and requirements will offer a perceived usefulness to the mobile app. Siau, et al., tried to identify characteristics of a "killer app" for mobile-commerce: it should provide service directly relevant to mobile needs as well as benefit users in immediacy and efficiency. The inherent characteristics of mobile-commerce (ubiquity, personalization, flexibility, and dissemination) provided reason to believe such apps could be developed. However, perhaps presaging the next section in this presentation, some of the limitations of the devices, including impeded user-friendly interfaces, were a concern [10].

3 Human-Computer Interaction and Its Applicability to Mobile Apps

One of the goals of HCI is to address the perceived ease of use of a technology, or said in another way, its usability. This then, as mentioned, addresses one of the factors behind technology acceptance. The general principles of usability can be drawn from Nielsen as:

- Ease of learning: How fast can a novice user learn the interface sufficiently well to perform basic tasks?
- Efficiency of use: Once an experienced user has learned to use the system, how fast can he or she accomplish tasks?
- Memorability: Can a past user remember enough to use the system more effectively the next time?
- Error frequency and severity: How often do users make errors, how serious are these errors, and how easy is it to recover from an error?
- Subjective satisfaction: How much does the user *like* using the system? [11]

It seems addressing issues of usability connected with mobile apps can be improved, although many shortcomings are known and documented. There is a long history of accessing and improving usability of websites. Similar effort toward increasing usability of mobile apps is being made. Nielsen summarized this as "The user experience of mobile websites and apps has improved since our last research, but we still have far to go" [2].

Today, most the technological solutions available for supply chains are still browser-based web apps designed to run on desktop browsers and not on smaller devices. Nielsen found that, "empirically, websites see very little traffic from feature phones, partly because people rarely go on the Web when their experience is so bad." As is typical in usability analysis, Nielsen's tests involved seeing if users could successfully carry out specific tasks. The average success rate was only 62%. However, he notes,

this is about the same as the rate for desktop Web use in 1999. That low success rate for use of smart phones led to the recommendation to design a separate site for mobile phone users, but the research also found that iPad users fared reasonably well using a standard website. However, designing a specific app worked even better: 76%. This suggests moving in the direction of mobile web apps for areas such as supply chains wherein accurate and timely flow of information is critical.

Some of the usability issues for websites are the same as those as those for apps, yet some difference remain. For example, providing clear text on a contrasting background and using "real estate" effectively are true for both platforms, but websites usability reviews usually lead to strong guidelines to avoid horizontal scrolling, while app users expect to use horizontal swiping as a normal action. Further, the selection process for a mouse on a website is similar to the use of a finger touch on a mobile device, but a finger can't be used to select as precisely (sometimes called the "fat finger" problem), so usability suffers if selection points are too small on a mobile device [2]. The use of a stylus can overcome the "fat finger" problem, to a large degree, but a stylus is easier to "carry along" on an iPad than it is on an iPhone, so it is likely to continue to be a problem. Of course, zooming is relatively easy on a mobile device, but it requires additional effort and distracts from the task at hand.

Also it is not surprising that there are usability issues specific to tablets. After several years of testing by the Nielsen Norman Group, it found consistent usability issues for iPads:

- Read-tap asymmetry when using browser-based sites, with content that was large.
- In general, touchable areas too small or too close together.
- Accidental activation due to unintended touches.
- Low discoverability, with active areas that didn't look touchable.
- Difficulty with entering information (typing was disliked on the touchscreen).
- Further, some apps featured too much navigation [12]

Dealing with the global issue, in another report, Nielsen reinforced the need for separate and distinctly different user interfaces for websites and mobile devices. "Most complex tasks have vastly better user experience on the desktop and thus will be performed there," he states. Thus he urges implementation of multiple user interfaces [13].

Chan and Feng address practical concerns with the development of mobile apps. They point out that multiple form factors are constraints in terms of the amount and format of content presentation, navigation, and site structure. Further, they believe that developers will be challenged to adopt new methods and design guidelines that take into account contextual variations. And they also note that mobile-commerce users are likely to have experienced e-commerce technology and thus have heightened expectations [14].

The sum of these reports is to realize that there are a number of usability issues that tend to impede the success of mobile apps or of browser-based apps made available on tablets. The designers of mobile apps are not always the same people who have been designing websites, so some of the usability lessons will have to be learned anew; other lessons are more unique to mobile devices and will have to be addressed.

4   The Kinds of Mobile Apps That Dominate Supply Chain Today

A previous survey about the use of iPhone and/or iPad apps in supply chain operations learned that the use of such apps varies greatly among different individuals and different organizations. While most respondents to that survey indicated that they believed that apps would be of value in an organization's operations and supply chain, and over half were using apps in some form at the workplace, most were not using them for supply chain operations [1]. Recent queries of exhibitors at an APICS (The Association for Operations Management) conference provided a simple survey of mobile apps available in the marketplace. It indicated that little has changed in the last year or so -- only a few mobile apps were being used in supply chain applications, although a number of supply chain applications were available for browser-based usage, especially for iPads and equivalent devices. The vendors reported little to no user unhappiness with the use of browser-based applications. This might be due to the prior experience of most users, which was with desktops and laptops, and which apparently had a lower level of perceived ease of use than the mobile apps. Furthermore, the mobile apps that were in use tended to be in areas with longer histories of mobile use, such as logistics (tracking of shipments, for example) and in calculations related to quality (six sigma calculations, for example). Likewise, industries with specialized supply chains such as health care use mobile devices to manage financial information and product scanning.

In a study by Barlow, it was noted by one respondent that, "There's a significant amount of supply chain related business activities, such as product evaluation or purchase negotiations that occur outside of the typical office environment, such as trade shows, dinners and/or site visits. Mobile apps allow instant access to information, which can significantly impact the outcome of the activity" [15]. This suggests the value of information collected from mobile apps, which ties in well with the information flow view of supply chains, as was illustrated in Figure 1. However, it also highlights the continued scarcity of mobile apps designed specifically for supply chain activities.

5   Conclusions

For mobile apps in general and supply chain apps in particular, it seems clear that HCI issues have not yet become a big factor in development. The usage of true mobile apps in supply chains is small, although growing in some specific areas. It appears that the predominant use of mobile devices for supply chains operations favors the iPad using browser-based mobile websites. Usability of iPads has been studied; the question remains as to whether developers for supply chain apps will put increased usability into practice.

The evolution of web development shows websites that put usability principles into practice are more successful with users. This, then, raises the expectation of users when surfing, thereby driving other websites to improve usability to survive. The

authors expect and anticipate that the use of mobile apps will follow the same course, with mobile apps increasing in usability over time. The ones generally most popular will show the way. As Minda Zetlin put it, "today's enterprise apps must be as user-friendly and inviting as those found in a mobile app store in order to entice users who, increasingly, can choose whether or not to bother with them" [16].

References

1. Elrod, C.C., et al.: iPhone and iPad Applications: Perceptions of Use in an Organization's Supply Chain. Issues in Information Systems XII(1), 170–180 (2011)
2. Nielsen, J.: Mobile Usability Update, Alertbox (September 2011)
3. Kalakota, R., Robinson, M., Gundepudi, P.: Mobile Applications for Adaptive Supply Chains: A Landscape Analysis. In: Lim, E.-P., Siau, K. (eds.) Advances in Mobile Commerce Technologies. Idea Group Publishing (2003)
4. Eng, T.: Mobile Supply Chain Management: Challenges for Implementation. Technovation 26, 682–686 (2006)
5. Legrisa, P., Inghamb, J., Collerettec, P.: Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model. Information & Management 40, 191–204 (2003)
6. Davis, F.D.: Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technologies. MIS Quarterly 13(3), 319–340 (1989)
7. Siau, K., Shen, Z.: Mobile Commerce Applications in Supply Chain Management. Journal of Internet Commerce 1(3) (2002)
8. Rowe, D.: Mobile Tech and the Supply Chain. Transport Topics 3975 (December 5, 2011)
9. Doolin, B., Al Haj Ali, E.: Adoption of Mobile Technology in the Supply Chain: An Exploratory Cross-Case Analysis. International Journal of E-Business Research 4(4) (2008)
10. Siau, K., Lim, E., Shen, Z.: Mobile Commerce: Current States and Future Trends. In: Lim, E.-P., Siau, K. (eds.) Advances in Mobile Commerce Technologies. Idea Group Publishing (2003)
11. Nielsen, J.: What is Usability? (2001), http://www.zdnet.com/devhead/stories/articles/0,4413,2137671,00.html
12. Nielsen, J.: Pad Usability: Year One. Alertbox (May 2011)
13. Nielsen, J.: Design for the 3 Screens (Make That 5), Alertbox (August 2011)
14. Chan, S., Fang, X.: Mobile Commerce and Usability. In: Lim, E.-P., Siau, K. (eds.) Advances in Mobile Commerce Technologies. Idea Group Publishing (2003)
15. Barlow, R.: What's Your apptitude? Healthcare Purchasing News, 36.2 34, 36–37 (2012)
16. Zetlin, M.: The New Rules for Enterprise Apps. Computerworld, 46.2, 18–19, 14–16 (2012)