

Mobile Business in Logistics

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Abstract: Mobile business is a successor of electronic business and is defined as exchange of goods, services and information with the help of mobile devices. In the paper we investigate potentials of wireless technology for logistics and develop criteria of suitability of logistics processes for mobile business. Furthermore, we investigate core logistics tasks and consider possible applications of mobile technology to logistics activities.

1 Introduction

Mobile business is a successor of electronic business and is often defined as a subset of it [Li03], [Wi01]. Usually, under mobile business authors mean any business operations that alternatively to a desktop computer can be also performed via wireless network. Mobile technology, however, offers additional possibilities that are unique to the wireless world and cannot be performed via fixed networks [Bu02], [ZYA03]. For example, localization, personalization and location-based services cannot be realized with a fixed Internet connection. Therefore, part of mobile business goes beyond the scope of e-business, bringing with it unique chances, possibilities but also problems. Summarizing several researches, we define mobile business as the exchange of goods, services and information using mobile devices ([Bu02], [Pa01], [Zo01] etc.).

Wireless technology has a big potential to enhance the performance of logistics division in a firm. Integrating mobile business into logistics is more than just replacing existing processes based on wired information systems through wireless ones. Through wireless data entry and instantaneous real time access to new data, mobile technology opens additional possibilities for logistics operations. However, it requires developing of new processes and workflows that would fully deploy the potentials of wireless technology.

Mobile applications allow better information exchange, facilitate communication, and enhance collaboration among different units in a company. They increase transparency and are especially crucial for time sensitive business processes, where real time and accurate data exchange is vital for the efficient operations. Wireless solutions can be

deployed to virtually all spheres of logistics. In mobile warehouse management systems wireless technologies can be used to identify goods and monitor their movement in the warehouse. Mobile solutions can also be deployed for wireless data entry, improvement of picking and put-away functions as well as for implementation such cost-reducing strategy as cross-docking. Furthermore, mobile inventory management can be optimized by providing the real-time inventory control and visibility through the whole supply chain. In mobile transportation, wireless applications can be deployed to track vehicles, optimize their routes and notify customers when their orders are due. In order processing, handheld devices can assist in reacting to customers' needs and order status updates (cf. [Sa05], [SMW04]).

In the paper we investigate potentials of mobile business for logistics and develop five criteria of suitability of logistics processes for m-business. We explore core logistics tasks and consider how wireless technologies can be applied to them. Furthermore, we describe possible applications of mobile technology to logistics activities and examine what benefits and improvements can be achieved, when integrating wireless data transmission and mobile access to the central databank into everyday business operations.

2 Logistics processes in m-business

Logistics encompasses variety of different activities and processes inside and outside a company and not all of them are equally suitable for mobile business. Our aim is to find out, what workflows can be significantly improved and optimized with the help of mobile applications. To determine the suitability of logistics processes for mobile business, we have developed five criteria. They encompass such aspects, like the necessity to transport goods from one location to another, the need to perform an activity on site, possibility for wireless data capture and so on. The more criteria are relevant for some logistics activity, the more benefits can be achieved when implementing a mobile solution for it. Below, the criteria are discussed in more details.

Necessity to transport goods. If goods or assets (for example, a truck) have to be moved from one location to another, there arises the necessity to transmit new data about current location or status of shipment to all involved parties. Mobile technology helps to keep contact with a vehicle and to determine its exact location.

Necessity to perform task on site. In case, when a task should be performed on site, the field force or sales force may need to contact the company back-end system to obtain new or additional information or to submit the status of the performed task. In many cases, wireless connection can be the only possibility to get in touch with the central office.

Necessity of the real-time access to new data. When somewhere in a supply chain new data is created, it may be very important for other parties to get access to this information in timely and accurate manner. This is especially relevant for updates in order processing or for notifications about new goods delivery.

Necessity of wireless data entry. Wireless data entry plays the crucial role in warehouse management systems and for distribution. By scanning the identification number of an item, it can be quickly, easily and unambiguously assigned to the right place, process or customer. Thereby, RFID (Radio Frequency Identification) technology or barcode scanners increase the accuracy and efficiency of the corresponding processes.

Possibility for paperless workflow. It is known that paperwork is full of mistakes, lost and inaccurate data. Moreover, it is often connected with changes from one medium to another. Let us consider a sales agent, who receives new tasks per phone, makes his notes on paper, and faxes it to the office where an office assistant transforms them into an electronic form. In contrast to all these inefficiencies and change in format, mobile technology serves as a unique and reliable means of communication and data transfer.

To work out the list of criteria and decide which criterion is relevant for which logistics activity, we have analyzed ca. 80 case studies from the Internet and literature about the successful deployment of mobile technologies to logistics. The processed case studies cover the wide range of companies starting from logistics giants like DHL and Dachser and to the smallest service provider. The companies originate from Europe and North America. The described case studies consider deployment of wireless technology to various logistics processes from mobile sales order entry to wireless capture of client’s signature upon goods delivery.

In Table 1 core logistics activities are considered with regard to the described criteria of suitability. The mark “x” means that the criterion applies to the corresponding process. The more such marks exist for some process, the more benefits can be achieved with the launching of a mobile solution. In the table we listed only fundamental processes of logistics. They should be further broken down into many smaller processes and for every such process its suitability for m-business should be determined. For example, order processing, amongst others, can be subdivided into picking and packing. Picking can benefit greatly if mobile solutions are deployed to it. Wearable mobile terminals with wireless data entry and automatic verification of picked items facilitate picking. In contrast, packing cannot be optimized much with the introduction of a mobile solution. Whatever wireless application for packing we try to develop; goods still have to be physically wrapped and packaged. Of course, it makes sense to look for potentials of mobile technologies only for these logistics processes that are suitable for m-business.

Process	Criteria				
	Goods transportation	Work on site	Real-time access	Wireless data entry	Paperless workflow
Procurement			x		x
Inventory management, warehousing			x	x	x
Order processing		x	x	x	x
Distribution	x	x	x	x	x
Fleet management	x		x		

Table 1: Suitability of logistics processes for m-business

2.1 Procurement

The emergence of wireless telecommunication technology has led to the appearance of mobile procurement. M-procurement is a solution that supports purchasing of goods and services with the help of mobile networks. It is not an extension or substitution of electronic procurement; rather it is a supplement to it. In general, mobile procurement reinforces benefits of an e-procurement solution by further reducing time and costs needed to procure an item.

Procurement by field workers. Mobile handheld devices can be used by field service technicians to increase their productivity [HLÖ05]. Therefore, the company can achieve the shorter reaction times, better service quality and thus more satisfied customers. Via mobile device field workers can quickly order the needed component while being at the customer's place, or react correspondingly in case, when such component cannot be delivered within an acceptable period of time.

Track & trace capabilities. The wireless data transmission can be widely used for tracking the movements of goods. Thanks to GPS (Global Positioning System), a job shop manager can, for example, be informed about products or raw materials that arrive first, and thus prepare and start the corresponding production task. By analogy, in just in time production systems the workers can trace the delivery of ordered components and in case of a failure take preventive actions. The track and trace capabilities of mobile technology can be also implemented in merge-in-transit systems and in operations where consolidated deliveries are used.

Notifications and authorizing. In organizations, purchasing managers are often not at their desks and it may be difficult to locate them quickly. Mobile technology contributes to the procurement process by notifying the approving managers about pending orders. Especially, it is useful for urgent orders or for those orders that require only formal approval. Thus, the whole purchasing process could be even further accelerated, cycle times reduced and productivity increased [GHS03].

2.2 Inventory and warehouse management systems

The aim of warehouse and inventory management systems is to ensure the receipt, storage and issue of handled items in an accurate and timely manner. Mobile solutions in warehousing provide location independent data capture, further reduce errors and increase efficiency of warehouse management systems. There are many applications of wireless handheld and vehicle-mounted devices to warehouse operations.

Wireless data entry. Mobile devices give the possibility to capture any information about handled materials inside a warehouse. Be it goods receipt in a loading dock, goods movement inside a warehouse or goods issue in a shipping area, data about it is immediately captured through a wireless reader and saved in an inventory management system. In case, when received containers or goods are not provided with special labels, they can be immediately generated by a mobile device, printed by an attached mobile printer and affixed to the containers.

Materials and assets tracking. Without mobile technology the exact tracking of handled goods inside a warehouse would be hardly possible. Thanks to it the highest data accuracy, reliability and consistency can be achieved, and more informed decision making can be ensured. Wireless devices can monitor not only material flows, but also material handling equipment like forklift, optimizing their routes and utilization.

Locating goods, assets, etc. Mobile technology has unique capabilities in locating goods, assets or even people. On the one side, the system can automatically locate the nearest vehicle or person who is not occupied with other tasks and assign and transmit a new work order to it. On the other hand, if an employee has difficulties, the system can estimate his position in a warehouse or at a factory premises and direct him to the right location.

2.3 Order processing

Order processing is a link between clients, producers, service providers and retailers. Various areas of a company, like production, logistics and sales departments, are connected through order fulfillment. To meet increasing client requirements for high logistics performance, premium quality and immediate product availability, it is very important to achieve the seamless order processing [St04]. Mobile technology helps to implement and coordinate all steps of the order processing, starting from order assignment, through order picking and order tracking, to order invoicing.

Order assignment. The majority of mobile work force that receives and executes external orders is acting mobile. So, it takes a lot of additional time and resources to locate a free worker, to assign him a task, to transmit him the order details and to integrate the report about the completed work into the back-end system. Mobile technologies can significantly reduce efforts and resources involved in order allocation process. They are very efficient in locating field workers and communicating with them. Because of the direct data transfer and high quality of data, deployment of wireless technology reduces paper work, eliminates rework of an office assistant and improves process workflow.

Order picking. The process of order picking requires the highest concentration of an employee, in order not to make mistakes. To increase the quality of order fulfillment, mobile technology can be applied. When entering data about selected goods wirelessly, a mobile device automatically forwards this information further to the back-end system and the electronic comparison of the ordered and picked items is taking place. In case, when ordered and picked lists differ, the system automatically generates an alarm signal. In addition, pick-by-voice technology and wearable mobile terminals free hands of a warehouse worker and thus increase his productivity.

Order tracking. Not only in order allocation, but also for order tracking mobile technology can be very helpful. Thanks to it, mobile workers accept new orders and synchronize their tasks with each other in real time. Any information about the order status is immediately transmitted via wireless networks to the back-end system. So, the central office always has the full information and can react correspondingly in case of

problems. A mobile terminal can be also used instead of paper forms to record the performed work while on site, to capture client signatures, as well as to prepare reports about the visited client and completed task.

Order details access/update. Not always mobile workers can foresee and prepare all data that may be required when performing a task on site. On the other hand, it is very expensive in terms of time and resources to request all potentially relevant information beforehand. In such cases mobile devices can be a good compromise. They can contain a huge amount of data, like catalogues of spare parts, technical instructions, details of maintenance agreements and reports about earlier performed work. Besides, via mobile device it is possible to connect to the back-end system of the company and check goods and components availability, prices, discounts and delivery conditions. Thus, wireless technology reduces office work, improves the process workflow and increases the data quality.

2.4 Distribution and fleet management

The process of distribution encompasses transportation of goods from producers to consumers. Unfortunately, trucks on the road are often not fully integrated into information flows among manufacturers, distributors and clients. To meet the growing requirements of clients, however, distributors have to be able to provide exact and timely information about shipment location and due dates. Mobile technology plays the central role in supporting all involved parties with tracking and delivery data.

Localization. The deployment of Global Positioning System (GPS) provides functions for mobile fleet localization. Knowledge of a vehicle exact position helps by real time track and trace operations of both vehicle and transported cargo. It allows route control and optimization as well as significantly simplifies re-routing in case of unpredicted events, like an unexpected order or a traffic jam. While being en route, the driver might receive via wireless networks some additional information that assists him in choosing the optimal road. This can be, for instance, location of accidents, travel times on alternative routes, weather conditions, delays at terminals and port facilities, etc. [GR05].

Technical data. Wireless data transmission and telemetry provide remote access to different types of technical data of vehicles in the field. The retrieval of technical data allows permanent monitoring of various parameters of a vehicle, which leads to the optimized preventive maintenance scheduling and improved technical condition of the fleet. The system can automatically record such parameters as door openings, entering or leaving of a particular area, vehicle motion and idle times, speed, etc. Mobile technology also increases the security through alarm signal generation by theft, accident or breakdown as well as through real-time notifications of emergency issues.

Dispatch handling. In the process of dispatch handling, wireless devices improve the control of outgoing goods. By scanning the codes of goods that should be delivered, the automatic comparison of ordered and picked items is performed. In case of mismatch an alarm signal is generated. Furthermore, mobile technology simplifies the preparation of delivery notes and lists and contributes significantly to paperless document flow.

3 Conclusions

Due to the nature of performed tasks, personnel engaged in logistics have to act mobile. Spending most of their time out of the offices, these employees are not really connected to each other and to the rest of the organization. Therefore, they usually cause numerous inefficiencies, errors and double work. Mobile technology has unique possibilities to provide mobile staff with a constant access to the central back-end system and seamlessly integrated it into the company business operations. Considering logistics processes one by one, we have found many possibilities for mobile solutions application, which will improve and optimize the underlying processes.

References

- [Bu02] Buse, S.: Der mobile Erfolg – Ergebnisse einer empirischen Untersuchung in ausgewählten Branchen. In (Keuper, F. Hrsg.) *Electronic-Business und Mobile-Business – Ansätze, Konzepte und Geschäftsmodelle*. Wiesbaden, 2002; p. 91–116.
- [GHS03] Gebauer, J.; Haacker, D.; Shaw, M.J.: Global non-production procurement at Motorola: managing the evolving enterprise infrastructure. In (Shaw, M.J. Ed.) *E-Business Management Integration of Web Technologies with Business Models*. Kluwer, 2003; p. 133–154.
- [GR05] Golob, T.F.; Regan, A.C.: Trucking industry preferences for travel information for drivers using wireless Internet-enabled devices. *Transportation Research Part C* 13, 2005; p. 235–250.
- [HLÖ05] Hanhart, D.; Legner, C.; Österle, H.: Anwendungsszenarien des Mobile und Ubiquitous Computing in der Instandhaltung. In (Hampe, J.F. et al. Hrsg.) *Mobile Business – Processes, Platforms, Payment. Proceedings zur 5. Konferenz Mobile Commerce Technologien und Anwendungen (MCTA 2005)*. Bonn, 2005; p. 45–58.
- [Li03] Link, J.: M-Commerce: Die stille Revolution hin zum Electronic Aided Acting. In (Link, J. Hrsg.) *Mobile Commerce: Gewinnpotenziale einer stillen Revolution*. Springer, 2003; p. 1–39.
- [Pa01] Paavilainen, J.: *Mobile Business Strategies: understanding the technologies and opportunities*. Addison Wesley, 2001.
- [Sa05] SAP: Mobile supply chain management with mySAP™ supply chain management. SAP Solution Brief, 2005. http://www.sap.com/solutions/business-suite/scm/pdf/SB_Mobile_SCM.pdf, accessed 12.07.06.
- [SMW04] Sattler, T.; Milling, P.; Weissman, S.: Potential of mobile supply chain management scenarios – an empirical analysis. In (Van Wassenhove, L.N. et al. Eds.) *Operations Management as a Change Agent*. Vol. I, Insead, 2004; p. 1117–1126.
- [St04] Straube, F.: *e-Logistik, Ganzheitliches Logistikmanagement*. Springer, 2004.
- [Wi01] Wirtz, B.W.: *Electronic Business*. Gabler, 2001.
- [ZYA03] Zhang, J.J.; Yuan, Y.; Archer, N.: Driving forces for m-commerce success. In (Shaw, M.J. Ed.) *E-Business Management: integration of web technologies with business models*. Kluwer, 2003; p. 51–76.
- [Zo01] Zobel, J.: *Mobile Business und M-Commerce*, Hanser Verlag, 2001.