Mobile Communication in Newspaper Distribution and Transport

Olli Kuusisto[1], M.Sc. and Asta Bäck[1], M.Sc. and Janne Pajukanta[1], M.Sc.

Keywords: Newspaper distribution, transport, mobile communication, mobile information technology, real-time control and tracking

Abstract: Newspaper distribution and transport are time critical operations where a large number of people are needed to work in a coordinated way. Even though the process is, in principle, repeated in a similar way every night, different kind of disturbances and problems occur during the night. By utilising mobile communication, people working in different locations can be reached, and problems solved. Mobile communication technology can also be utilised for communication between newspaper deliverers who operate as a team, where each member may adapt his or her work according to up-to-the-minute information of the whole production process. Mobile information technology can also be utilised in giving deliverers information of valid subscriptions by transferring the information in electronic form to electronic devices. With the help of realtime control and tracking, the entire delivery process can be optimised and the quality of the process improved.

This paper presents the pilot systems and solutions developed to enable work related communication in a newspaper distribution organisation, and the experiencies gained in practical field tests. The tests showed what kind of benefits can be gained with these new tools, and also, how the currently available technology is able to meet the challenges of professional usage in real environment.

1. INTRODUCTION

The production chain for a newspaper from producing the contents up to a printed and delivered copy to the subscriber is long and has many elements. Newspaper distribution is a significant part of this production chain; the process is not fully ready until the paper reaches the reader. Distribution and transport costs contribute to a notable share of the total production costs of a newspaper.

[1] VTT Information Technology, P.O.Box 1204, FIN-02044 VTT, Finland. email: firstname.lastname@vtt.fi; fax +358 9 455 2839.

The cumulative costs of production delays can add up to major amounts depending on the production stage where the delay happens. Accurate and cost effective distribution is an important factor in maintaining the competitive edge of the newspaper.

Newspaper publishers, the distribution companies they own, Finland Post and the Finnish Newspapers Association have been cooperating closely since the 1970s to develop distribution and transport systems. They have developed a joint early-morning distribution system, which means that a single organisation delivers all of the newspapers in any given area. All in all, there are 15 companies providing this service in various parts of Finland. [Hänninen & Kurunmäki, 2001]

Early-morning distribution networks are estimated to cover about 80 percent of Finnish households. They handle a total of some 586 million copies each year, which is about 78 percent of the total volume of newspapers bought on subscription. In Greater Helsinki and the densely-populated Uusimaa and Varsinais-Suomi regions the networks cover nearly all households. Naturally, the proportion of households which the networks serve declines in more sparsely-populated parts of the country. The early-morning distribution networks employ about 7,000 delivery personnel. [Hänninen & Kurunmäki, 2001]

An absolute prerequisite for successful early-morning delivery services is close cooperation between publishers, printers and distribution companies to ensure that the newspapers' subscription-handling systems are compatible with the printers' and distribution companies' production- and operation-control systems and always function flawlessly. The system functions in real-time so that deliverers receive with their newspaper bundles computer printouts showing any changes in delivery plans and mark these in their most important tool, their distribution book. Thus there is no need to print subscribers' addresses on papers. [Hänninen & Kurunmäki, 2001]

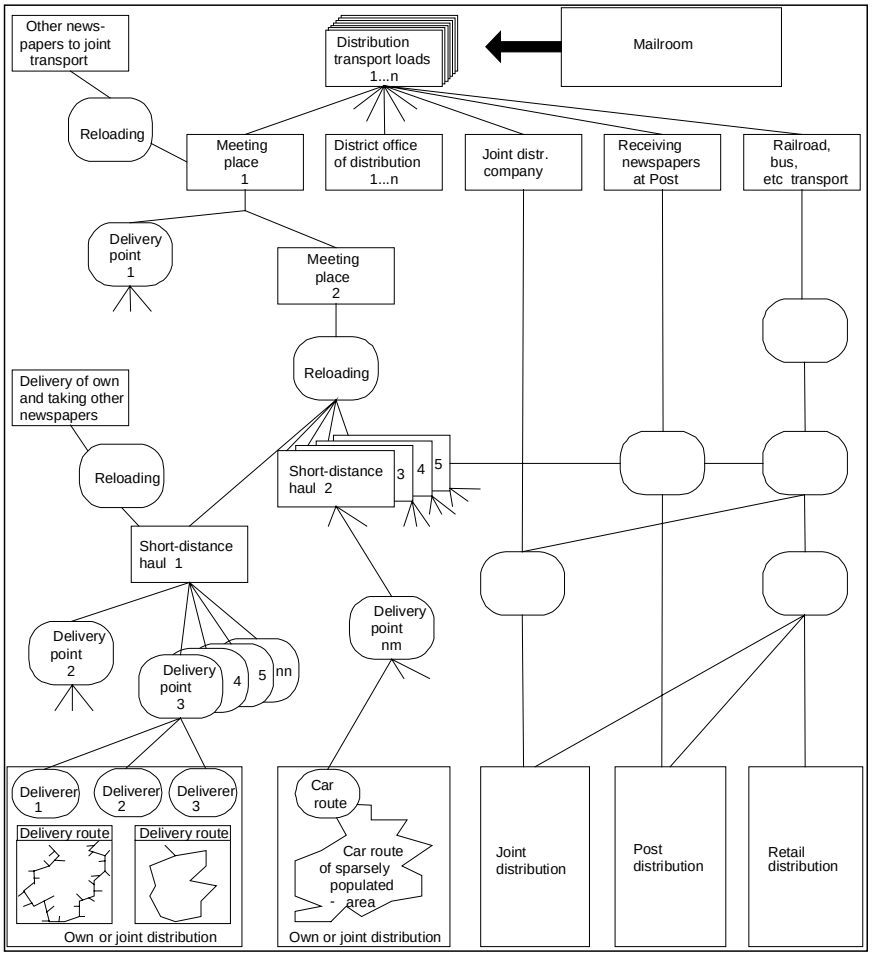

Figure 1. The transport and distribution network of newspapers in Finland [Monni, 1988]

2. OBJECTIVE

Tailoring of newspapers, new subscription alternatives, new products and predicted shortage on newspaper deliverers will increase the challenges for accurate and reliable distribution [Bäck, 1996]. The practical distribution evolves and is predicted to function more and more as teamwork, where the teams will be autonomous and the need for supervision decreases. These challenges form a demand for new systems of communication and transmission of data.

The objective of three-year reserch project, which started in the beginning of 2001 and will end in the beginning of 2004, was to to define a control and tracking system for mobile workers and several other parties and to pilot the sections that are critical and have innovative value. The planned pilot areas were an electronic delivery book and Internet-based communication and review of the process data.

Electronic delivery book in this case means an electronic device which is easy to carry and has the subscribers' address information of various newspapers to be delivered. It should also include the route guidance needed for the new or provisional deliverers, such as electronic maps and/or voice control. Data communication is needed for the upkeep of the delivery book and the transfer of the on-time data. The delivery book should also include features that improve the safety of the deliverers, e.g. easy way of transmitting request for help. All characteristics need not be joined in one and same device in the field pilots. Electronic delivery book shall be interpreted here as a selection of characteristics which can be implemented in a combination of one or several devices and solutions.

Hence, the objective is not direct product development but to examine, through field pilots, the functionality needed for the geographically and organisationally outspread control and tracking of distribution. The project will produce input for the development of an electronic delivery book and help distribution organisations take a major new technology into use to improve their operation. The distribution systems have traditionally been very static, but with new information technology the process can be made more flexible.

The approach to electronic delivery book as well as the field pilots has been assessed from two directions: mobile communication and delivery book information.

3. IMPLEMENTATION OF THE PROJECT

3.1 PLANNING

Interviews and open discussion were held with together over 30 persons from deliverers and drivers to the management of the distribution organisations to establish the present operations mode and already made pilots on mobile communication. A seminar was held with people from the management and operative personnel from different stages of newspaper production in order to create a common view of the status and information needs of the data related to the different production stages including the boundary conditions and objectives to be taken into account for developing the solutions of data transmission. The needs and solutions of other branches of industry were also examined.

Several wireless or non-wireless systems for delivery and/or transport personnel were either piloted or in use in distribution organisations in Finland. They were mainly based on SMS-messages, and included generally reporting of the start and stop times of transport or delivery and automatic communication of the data to the parties concerned. The information was used e.g. in calculating the delay costs to be paid and invoiced. There were also systems which informed the deliverers of the departure time of the transport with their papers on.

3.2 REQUIREMENTS SPECIFICATIONS FOR THE DEVICES

Particular emphasis was put on the specifications for the devices to be used by the deliverers. The specifications were discussed with the delivery organisations, especially with the deliverers. Many of the requirements had contradictory interrelations, and in practice one had to make compromises. However, the technology involved is under strong development, including transmission, display and battery technologies not forgetting the improvements in usability.

The following list of wanted characteristics was made in the beginning:

- mobile two-way communication
- possibility to run third party applications
- small and light
- big screen, that can be read also in dark
- shock-resistant
- water-resistant
- frost-resistant
- resistant for sudden changes in temperature
- easy-to-use, usage with one hand
- clear and appropriate user interface
- reliable in use
- moderate costs for purchase and usage

The vital demand of the users was usability: if the device and the system are not easy-to-use, they won't be used. The authentic statements from deliverers were: "no system errors" and "the battery must last long enough". The use of the device should not slow down the actual delivery work. The device should be possible to attach so that the both hands of the deliverer can be free.

It was obvious that at the time there were no such devices in the market. In fact, the original plan was to pilot the existing devices in order to specify the requirements in practical work. Cell phones, PDAs (Personal Digital Assistant) and bar code readers were analysed, and the potential ones investigated with the deliverers. Cell phone solutions had already been tested in Finland and since they lacked many of the requirements, they were dropped from the further tests. Although the bar code readers had most of the needed features, the

specifications ranking order turned into devices with colour display and efficient backlight after interviews and device presentations with the deliverers. The search turned then to newest PDA-devices, most of which were to be introduced to the market. It should be noted, though, that during the pilot period it became harder and harder to distinguish the PDA-devices and cell phones from each other. Vehicle-bound devices were also examined, but at the time they were too heavy to carry with.

Following devices were chosen for the pilots with bluetooth-connection, apart from Siemens SX45, which had a built-in GPRS-cell phone:

- Siemens SX45 GPRS-PDA
- HP Jornada 568 and GPRS-cell phone
- Compaq iPaq 3850 and GPRS-cell phone
- Compaq iPaq 3870 and GPRS-cell phone
- Fujitsu-Siemens Pocket Loox 600 and GPRS-cell phone
- Nokia 7650

3.3 THE PILOTS ON MOBILE COMMUNICATION

The objective of pilots was to plan and implement mobile control and tracking system which also enables communication between and among foremen and deliverers. The goal was to get empirical information of the suitability of the system and the devices for distribution. The pilot system included following functions:

1. On-time- and deviation reporting to the distribution organisation.
2. Messaging to deliverers.
3. Communication between and among the foreman and the deliverers.

The preliminary requirements specification was made by interviewing deliverers and their foremen, van drivers and management from several different distribution companies, the potential end users of the system. Especially opinions concerning portable devices and features of the system were gathered. Also typical working methods and needs for bilateral communication were examined. At the pilot stage the operation of the pilot system was presented to the pilot companies and deliverers and feedback was gathered accordingly.

The most essential functional requirements were communication between the supervision and the deliverers, the follow-up of the progress of the distribution and deliverers' mutual communication. All information should be real-time, or at least almost real-time. The communication should not decrease the efficiency of the distribution. Hence, menus with ready-made messages were used as much as possible. There was always the possibility to make or add ones' own message by typing it, too.

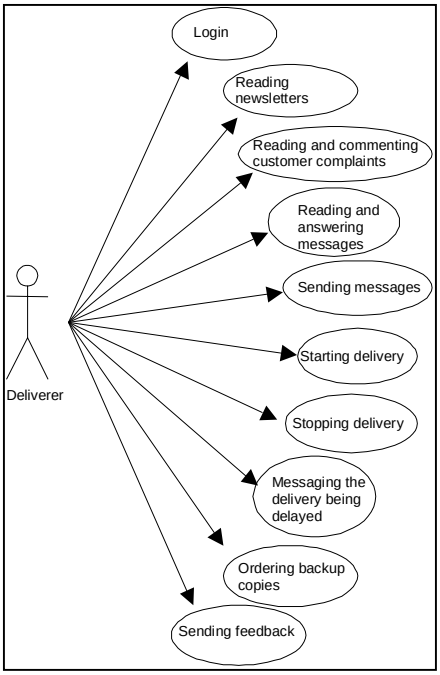

Figure 2. Use case diagram of the deliverer's user interface

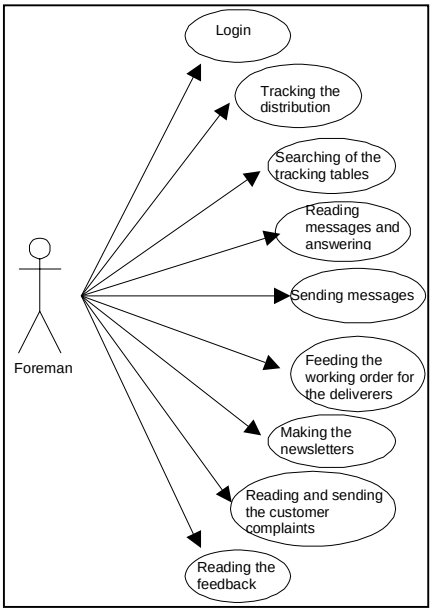

Figure 3. Use case diagram of the foreman's user interface

The objective was to implement a working pilot system as soon as possible in order to get feedback of it's function from real users at field environment. There the terminals of the deliverers created the frame conditions. PDA-devices operating with Microsoft Pocket PC operating system were chosen for mobile workers participating in the pilots. GPRS-connection was chosen, as the PDAs should be constantly connected to the system, and GPRS-connection was the most economic way to do it without building a separate application program to the devices. The foremen used an internet-application on standard PC. All data was stored in the database for analyzes.

Web application architecture was chosen since the individual applications to different terminals would have been troublesome, and especially the control of the state of the application difficult with not so (at the time) reliable GPRS-connection. Thus the application can be run on any general web browser. The typical layers in such architecture are client application, www-server and database. Web browsers served as client application at the different terminals. HTML-pages were created dynamically with help of Java Servlet -technology based on the database. The communication was implemented on web-page with automatic updating. The database management system and the web server with Java Servlet -engine were physically situated in the same server.

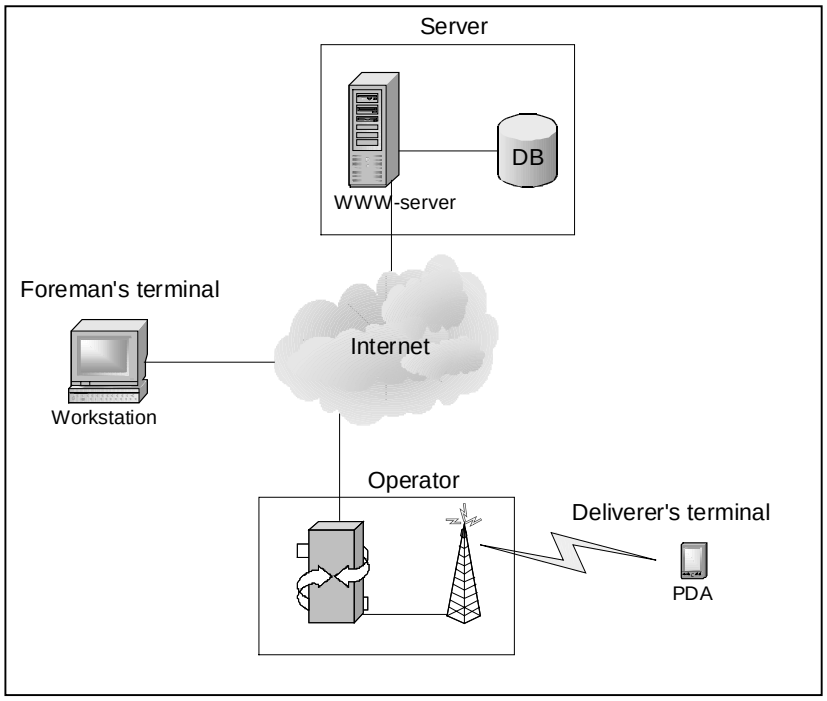

Figure 4. The system architecture of the communication pilots

3.4 THE RESULTS OF PILOTS ON MOBILE COMMUNICATION

The pilots on mobile communication took place in April, October and December 2002. The pilot system made the information flow and the communication easier to manage between deliverers and their foremen as well as inside the team of deliverers. It is presumable that schedules of entire delivery process could be optimized and quality of the process would be improved by the aid of realtime control and tracking.

The main experiences from the pilots are presented in the following tables.

Table 1. The experiences from using the PDAs.

Duration	First pilot: 9 nights, 2 deliverers, night foreman, day foreman Second, extended pilot: 18 nights, 4 deliverers, night & day foreman, van driver, backup driver, transport management, production Third pilot: 14 nights, 6 deliverers, night & day foreman
The use of PDAs	The batteries were sufficient for the whole night. The devices functioned properly in -10 ºC. The backup drivers battery was almost finished after 7 hours. This can be easily avoided by cigarette lighter battery chargers. There were differences in the duration of the batteries between different devices. Most of the devices had a depot battery and a battery change possibility. The backlight was good, the information was very well visible in dark stairway - it was even adequate as a flashlight in a stairway with lights down. In some occasions, the GPRS-connection got cut off, but came back as retried. Potential sources for that are dead regions in the lower floors and in metal-structured elevators, as the drivers didn't experience from cut-offs. The night foreman would need also a mobile device, because he or she is on the move. Writing the messages needs concentration and is relatively slow. (In normal conditions they are not needed) Difficult to take photographs in the dark. The pictures about the bundles are mainly recognizable, though.

Table 2. The experiences from using the pilot system

The use of the pilot system (deliverers)	The pilot system was easy to use and navigate. The two-hour training for the device and the system was adequate. The instruction manual was good, especially the part action in problem situations. The manual was not used/needed in most cases. The ready-made messages were good, since you didn't need to write them. The information of the production stage at the printing house was useful and helped to plan the work. The ordering of backup copies when needed was useful. Communication system was useful. There is quite a lot of communication between the deliverers already, which now is handled by cell phones and could be handled easier with PDAs, which leave a trail.
The use of the pilot system (foremen)	The pilot system was easy to use and navigate. The two-hour training for the system was adequate. The instruction manual was good. The manual was not needed in most cases. Seeing the start and stop times route-specific helps to control the distribution and to react when needed. Seeing the logged-in users would further improve the system, and is relatively easy to accomplish. Relaying the information from deliverers helps in studying the sources of the feedback. There is not too much need for messaging during a normal night, but when there is, the amount of data can easily grow to be too large to handle. On the other hand, in such situations the night foreman can send a group message to all people concerned.

3.5 THE PILOTS ON ELECTRONIC DELIVERY BOOK

Early distribution in Finland is carried out by utilizing lists, delivery books, which include information of subscriber names and addresses. Traditional delivery books are hand written on A5 sized papers, and each page is put inside a plastic cover in order to protect it from dirt and moisture. Because, in most areas, the distribution is joint distribution, there are several newspaper titles that are delivered, which adds more information to the delivery book. Usually also

some route information is included in them to help the deliverer to find all the addresses and letterboxes. Particularly in old city centers and in areas with small houses it may be quite a challenge to find the correct route.

AREA 1 DELIVERY BOOK Page 1

Route			Toimipaikka **12345 KAUPUNKI**	Newspaper					
House	Stair	Flat	STREET/Subscriber	HS	SS	TS	ETSA	KALE	ÖB
			DISTRIBUTION STREET						
1	A		Suomalainen		SS	TS			
2	C		Ruotsalainen	HS					
2	D		Saksalainen		SS				
1	B		Jaakkola		SS				
3	A		Pekkala	(HS)			ETSA		
3	B		Koivisto	(HS)		(TS)			
4	A		Kerman		SS				
4	B		Norjalainen				ETSA		
4	C		Tanskalainen		SS				
4	D		Untamala	HS		TS			
5			Korhonen		SS				ÖB
7	B		Mikkola						
7	A		Kainonen	HS	SS			KALE	
6			Vienonen	HS					
8			Takkunen		SS				
10			Turunen		SS				
11			Mättö	(HS)					

Figure 5. An example of a page in a traditional delivery book

The tests with a Windows CE based PDA as a delivery book was made utilizing programs that are included in the basic software for the device, namely the browser and a spreadsheet program (Excel). The browser is a good choice also because we can assume that most mobile, handheld devices will include a browser, and this way the HTML based electronic delivery book can be used with different devices. The delivery books were created and updated manually in

order to get the pilots quickly under way. The main purpose of these tests was to see how the deliverers could work with PDA in real circumstances.

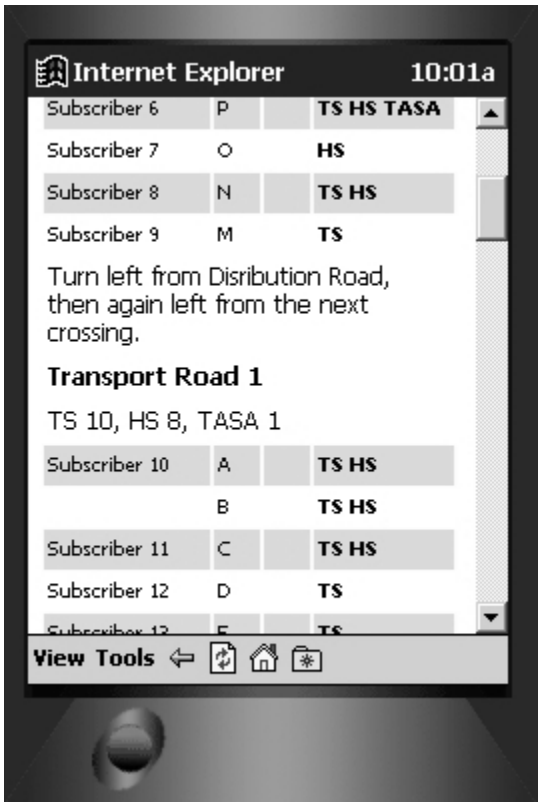

Figure 6. A version of electronic delivery book

3.6 THE RESULTS OF PILOTS ON ELECTRONIC DELIVERY BOOK

The first test was made during five nights with a deliverer with two routes. The other of her routes was an urban city route mostly with blocks of flats; the other was to a large extent industrial area, where giving route guidance was very important. The second test was made with Excel version in another city with three routes that consisted of blocks of flats. The duration of the latter test was 15 nights. The deliverers were interviewed after the tests. Table 3 summarizes the main features of the trials.

The deliverers had somewhat differing views on working with the electronic device. One found it slower to use the electronic device than the traditional

delivery book, whereas the other did not experience any big difference between the electronic and traditional delivery book. In the latter trial with better results, the deliverer made many trials on how to best carry the device and she managed to find a good way to handle the device and newspapers at the same time. Also the length of the trial contributed to better results, because then the deliverer became well accustomed to using the device.

The biggest challenge in utilizing these devices as a delivery book is to find a way to present all the necessary information in such a way that it is easy to see and understand without too much browsing and jumping back and forth. The information must be structured in the same way that the deliverer does it when going though the route. This is not so much a problem in blocks of flats, but other types of areas are more challenging. There, more information is needed on how to proceed. When the deliverer looks for the next stop in the route, he or she would like to what to expect, e.g. is it a single letterbox, or a group of letterboxes. This is information that is important for the deliverer for quick proceeding in his or her work.

Table 3. The main features and findings of two field tests with a PDA as delivery book (separate test deliverers).

	Test 1	Test 2
Test device and program	HP Jornada, HTML	HP Jornada, Excel
Test routes	One urban route; one route in mostly industrial area. A lot of route information needed particularly in the latter one.	Three short routes all with blocks of flats. Little, if any route information needed.
Duration	Five nights	15 nights
Delivery speed	Slower than traditional delivery book.	Same delivery speed as with normal delivery book.
Experiences from handling the device	Display can only be read at a certain, relatively narrow viewing angle. No technical problems. Difficult to get good information of what to expect next. No overlap in HTML pages when browsing, which is an annoyance in some cases.	Quick to change from one route to the next one. Backlight improves the readability in dim conditions. It should be possible to lock the touch screen to prevent changing the focus in an unintended way. Scrolling line by line is sometimes too slow.

The application was made in a fashion to enable the navigation using the buttons on the device, because the electronic delivery book must be usable by one hand only. HTML and Excel have both some shortcomings in navigation with this device. In HTML the navigation is made either by scrolling or screen by screen, which can be annoying if the information that would be important to see at one time is divided on two pages. In Excel, the navigation is only one line at a time, which again is slow on some cases.

It depends on the deliverer which type of information is important for her or him. If the route is new for the deliverer, the route information is very important, whereas later, practically no information is needed of the route and only the subscriptions are important. This sets two kinds of challenges for future development: the information should be gathered and presented so that the deliverer sees only the information that is relevant to him or her.

Also, new ways in which information is presented must be sought compared to present ones, so that the navigability and comprehensibility of the information is at good level. The work is now continued to test new options that include maps, images and other options for navigation.

The objective in future is to produce the delivery books automatically. All information that is needed for them must be stored in electronic format and the data generation must be automatic. This means that all addresses must be in correct format in the databases, and that each subscription can be placed into the correct place along the correct route.

With traditional delivery books the deliverer has been able to place the subscription in the correct place, once the information comes, and it is enough to do it once. If and when the information for the delivery book is produced automatically for every night, each subscription must be automatically placed correctly. Or, the system must allow the deliverer to make his or her own changes.

At the same time, an electronic delivery book was introduced in Norway by Distribution Innovation AS. The concept is somewhat similar to what was used in the first pilots of VTTs electronic delivery book. The pilot project in Norway started in the end of April 2002 and includes 25 newspaper deliverers. The deliverers have replaced their paper based delivery guide with an electronic delivery guide (EDG). The results so far have been very positive. The technology is functioning and the EDG is well received amongst the deliverers. [Anon., 2003] This encourages also us to go forward to the concept of intelligent interactive delivery book.

4. CONCLUSIONS AND DISCUSSION

The electronic information flow at the present in the newspaper production ends at the post-press department. Tailoring of newspapers, new subscription alternatives, new products and predicted shortage on newspaper deliverers will increase the challenges for accurate and reliable distribution. The practical distribution evolves and is predicted to function more and more as teamwork, where the teams will be autonomous and the need for supervision decreases. These challenges form a demand for new systems of communication and transmission of data.

In such environment, the updating of traditional paper-based delivery book can become too laborious and prone to failures. This generates the need for electronic control system in distribution which, however, shall not disturb or slow down the efficiency of the distribution.

The first challenge was to find suitable portable devices for deliverers. The existing devices were quite expensive. The cost and other savings added to potential extra income must exceed the investment, operating and maintenance costs during the exploitation time. The cost savings can turn up from dimished need for supervision, better quality by decreasing the amount of spare newspaper copies and from the decreased delivery of missing newspapers. Also, an electronic control system enables the optimization of the daily schedules of distribution which brings savings in decreased waiting time costs.

Pilot-like real-time control and tracking gives accurate data on the sources of failures which enables fast reaction to them and increases quality. Reporting of the start and stop times of delivery gives the specific data to foremen and to customer service. If the deliverer has not registered the start time as scheduled he/she can be contacted without delay. Traditionally one either has to go and check the starting points of delivery or wait until the customers complain. Fast and accurate feedback can be given to the previous working phases, too. That improves the quality of the entire process. Registering of the extra copies needed by the deliverers enables better and more accurate control the edition and makes it easier to tackle the causes for ordering extra copies.

The pilots on electronic delivery book confirmed the pretension of the functionality of such aid and have created new development ideas for further research. A few versions of maps and photos have been tested, and the use of voice control is currently under examination. Also, the automatization of the production of the delivery book data including maps and route guidance, and the best way of navigation between the subscriber data and the maps are being studied. The pilots have already showed a need for better address management in the systems in order to produce the delivery book in delivery order.

ACKNOWLEDGEMENTS

The authors wish to thank the National Technology Agency in Finland, the Finnish Newspapers Association, Finland Post and other joint distribution organisations in Finland for setting up an interesting project. Special thanks to Bernt Söderlund at Helsingin Sanomat and Pentti Hänninen at Finland Post for taking time and giving valuable information about the newspaper distribution process.

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