Express Mail Service Quality Improvement Using TETRA Communication System

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Abstract **– Express and courier mail service is elite postal service. One of the basic conditions for achieving high quality of service is adequate communication between dispatchers and couriers. Council dilemma is how to transfer, as soon as possible, all the required information from the dispatcher to courier. The problem is that the courier is somewhere in the city and the communication with him\her is via a mobile terminal. The basic lack of current communication is that used system is part of the existing public system with the disadvantages that characterize it, related to security, availability, and others. Therefore, the purpose of this paper is to propose the implementation of TETRA communication system in order to improve the quality of express mail service.**

Keywords **– express mail service, quality, improvement, TETRA, communication system.**

I. INTRODUCTION

Companies involved in express mail industry provide fast, reliable, on demand, integrated, door-to-door transportation service of letters, reports, documents and other goods. Each shipment is tracked and its course of travel is fully controlled. This service is a business class in the field of postal traffic.

Express industry makes transportation of items easier and faster. Beside to the macroeconomic contribution, express industry has an important role by creating a direct impact on the capacity and competitiveness of other sectors of the economy, the productivity of companies that use its services, the reliability of the manufacturing process, reducing the cost of supplies, etc. It also promotes regional economic development and has impact on increasing investment and employment. [1] Modern business can not be imagined without the express industry.

Today, leading companies in this field are multinational, with worldwide coverage territory. These companies have their own fleet of aircrafts and vehicles for land transportation. Airline fleets of these companies are larger than many national airlines.

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Serbian Post, beside its rich history, has introduced express and courier services in year 2002, by department called Post Express. As basic characteristics of these services, the Serbian Post highlights security in transportation, speed, high quality and reliability. Within a relatively short time, the national postal operator, has taken a significant share of the express mail market in Serbia. [2]

The user can request the service by phone, by calling the Call Center or by coming to Post Office. Given that one of the most important elements that provide additional quality to express courier service is exactly the coming to client's home or business address, this type of service request is very common. Speed of responding to the call is a parameter which the users give a great importance in assessing the overall quality of service.

The basic element for successful technological process and the high quality of service lies in adequate communication system between all the entities participating in this process, especially between dispatchers and couriers. Therefore, the subject of this paper is precisely the impact of different communication systems on the technological process. The new system for communication between dispatchers and couriers is proposed and it could contribute to increasing the productivity of enterprises and greater customer satisfaction.

II. THE ROLE OF COMMUNICATION SYSTEM IN TECHNOLOGICAL PROCESS

In this chapter, manual and automated technological process, depending on the use of appropriate communication means, will be presented. In the first case, communication with the courier is done via mobile phone, by calling the courier or by sending him/her SMS messages. The other, automated system, uses the modern GPRS terminals. Although the second case provides an opportunity for improvement of work process in several points of the production chain, which will be discussed in the following text, it is still used in practice in a very small percentage. The reason for this phenomenon lies in the fact that this system is part of the public communication system, which does not provide an adequate level of quality network required for express and courier service.

The scheme of manual technological process is presented in Fig. 1. Technological process begins with client's giving the mail at Post Office counter or, like more common case, by calling the Call Center in order to ask for the courier to come to client's home or business address. Request of the sender is registered at the central server and forwarded to dispatcher. He/she has to determine to which courier the request should be send. With the mention request, the courier must obtain

information about the sender, recipient, type of required services, some specific services, weight and shipping volume, the way of payment and others.

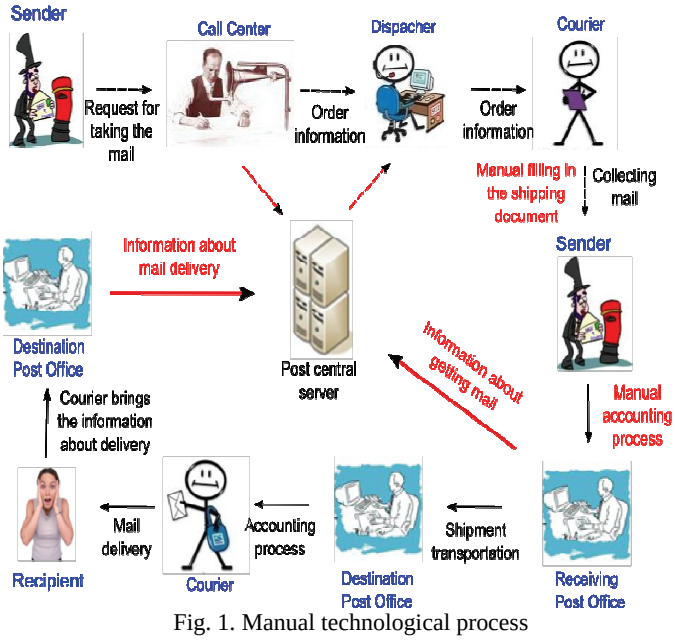

Fig. 1. Manual technological process of express mail transportation

In the manual technological process, courier receives the information via SMS or in direct conversation via mobile phones. Problems that arise in this kind of work may be various. One of them is the small capacity of the SMS message. All the necessary information can not be always conveyed in a single SMS message. Then, the cost of calls via mobile phones can significantly increase the cost of services. Also, if the conversation takes place during the drive, it results in courier's reduced security, because courier needs to note the data for following pick up. In these circumstances, it is a great possibility that an error occurs in the work.

When the courier arrives at the location in order to take the mail, shipping document should be filled in. The courier manually fills in the document with data obtained from dispatcher, but after they are verified by sender. The sender gets a copy of shipping document like the evidence that the shipment was submitted to the transportation. The other copies follow the mail during the transportation.

The items collected during the working day, courier brings to the Receiving Post Office. Shipments are unloaded from the vehicle and enter the sorting process. Courier has an obligation to visit the accounting worker to give the evidence about the mail that has been taken this day and to deliver all collected money, if some senders paid the postage in cash. Accounting worker has to register every item, entering the data into computer. Working in manual technological process means that each shipping document should be handles manually.

When the shipment arrives at the Delivery Post Office, couriers need to charge the shipments for delivery. For this purpose, every courier gets the delivery book, representing the document where all the items to be delivered are listed. In this delivery book, the recipient puts its signature as a proof that the mail has been delivered.

After the delivery of all shipments, courier returns to the Destination Post Office, to the accounting worker. Accounting worker reads from delivery book information about delivered mail and the time of delivery and puts it into computer. This is the end of manual technology process.

What has brought the technological process to automatic one is the implementation of modern GPRS mobile terminals. They greatly facilitated phase of receiving shipment. In this case, all data received in the call center, are available to courier via GPRS terminal in electronic form. As previously mentioned, it is data about shipments, types of service, the sender, recipient, the way of payment, special services, etc. Compared to mobile phone conversation, this kind of work brings to cost savings and increased courier's security in moment of driving. Also, the possibility of error is reduced.

This way of technological process leads to the reduction in errors in payment methods and better collection of postage. One of the numerous advantages is that the postage is automatically calculated. All data received in the call center are available to the courier during mail collection. After sender's confirmation, the postage is automatically calculated.

The next advantage of automated process that refers to collecting mail is in filling shipping document. Having in mind that all data in electronic form are available to courier over the server, there is no need for manual filling in the shipping document. Courier just has to print it using GPRS terminal. In this way time saving is made. On printed document, there is also a bar code, so there are savings as well on bar code labels. Even more importantly, the courier does not waste the time on hand writing the shipping document. This reduces the time spent on collecting location, i.e. accelerates the technological process, reduces the enterprise's costs and increases productivity.

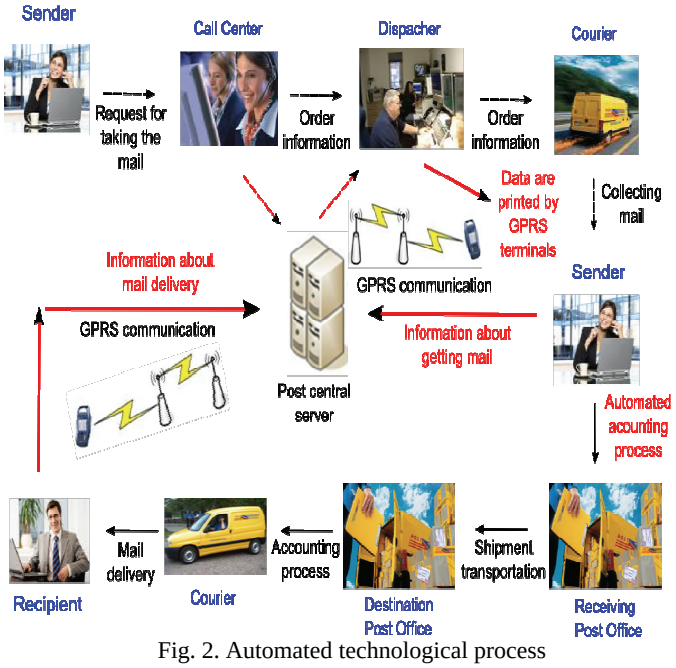

Fig. 2. Automated technological process of express mail transportation

Since the GPRS terminals are in relation to the central server, there is on-line transmission of information about collected shipment and therefore enables connection with Track and Trace system for tracking shipments.

Upon arrival in the Receiving Post Office, courier's discharge procedure is much simpler and shorter because all data are already on central server. Therefore, there is less employees working on the computer entry, resulting in a reduction of total costs.

In the delivery phase, when the GPRS terminal are used, delivery book exists only to be signed by recipient like a paper proof that the shipment is received. All the remaining necessary data is entered into the mobile terminal. Also, the delivery information is immediately transmitted to the central server, although the courier has not yet returned to the Post Office. Automatically, the data are ready for discharge before his return and accounting employee only check whether a particular assigned shipment status is correct. In this stage, we also have on-line transmission of information on the status of delivery of items, i.e. monitoring the delivery in real-time, supporting the Track and Trace system in this way.

Comparing manual and automated production process, it can be concluded that there are many advantages in using the GPRS terminal at several points of production cycle. These benefits greatly contribute to reducing costs, increasing speed of providing services, better utilization of labor, increasing the quality of services and better productivity. However, beside all these advantages, the automated system is implemented in a very small number of cases. The most common reason for this is poor availability of GPRS terminals because the system is designed to be part of a public communication network. As a potential solution to this problem, in this paper the new communication system for closed user groups is introduced.

III. TETRA COMMUNICATION SYSTEM

Terrestrial Trunked Radio (TETRA) is a digital trunked mobile radio standard developed by the European Telecommunications Standards Institute (ETSI). The purpose of the TETRA standard was to meet the needs of traditional Professional Mobile Radio (PMR) user organizations such as those listed below:

- Public Safety: police, customs,
- National safety: military, border guards,
- Emergency services: fire, rescue, first aid, ambulance,
- Authorities: prison administrations, other authorities,
- Transportation,
- Utilities,
- Government,
- Military,
- Public Access Mobile Radio (PAMR),
- Commercial & Industry,
- Fleet Management,
- Closed User Groups.

Because the TETRA standard has been specifically developed to meet the needs of a wide variety of traditional PMR user organizations it has a scaleable architecture allowing economic network deployments ranging from single site local area coverage to multiple site wide area national coverage. Besides meeting the needs of traditional PMR user organizations, the TETRA standard has also been developed to meet the needs of Public Access Mobile Radio (PAMR) operators.

The common mode of operation for TETRA is a group calling mode in which a single button push will connect the user to the users in a selected call group and/or a dispatcher. It is also possible for the terminal to act as a one-to-one walkie talkie but without the normal range limitation since the call still uses the network. If enabled by the Subscriber Management, TETRA terminals can act as mobile phones, with a full-duplex direct connection to other TETRA Users or the PSTN. Emergency buttons, provided on the terminals, enable the users to transmit emergency signals, to the dispatcher, overriding any other activity taking place at the same time.

TETRA uses Time Division Multiple Access (TDMA) with four user channels on one radio carrier and 25 kHz spacing between carriers. Both point-to-point and point-to-multipoint transfer can be used. Digital data transmission is also included in the standard though at a low data rate.

TETRA Mobile Stations (MS) can communicate Direct Mode or using Trunked infrastructure (Switching and Management Infrastructure or SwMI) made of TETRA Base Stations (TBS). As well as allowing direct communications in situations where network coverage is not available, Direct Mode or DMO also includes the possibility of using one (or a chain) of TETRA terminals as relays for a signal. This functionality is called DMO gateway (from DMO to TMO) or DMO Repeater (DMO to DMO). In Emergency situations this feature allows direct communications underground or in areas of bad coverage.

In addition to voice and dispatch services, the TETRA system supports several types of data communication. Status messages and Short Data Services (SDS) are provided over the system's main control channel, while Packet Data or Circuit switched data communication uses specifically assigned traffic channels.

TETRA provides Authentication Mechanisms of Terminals towards Infrastructure and vice versa. For protection against eavesdropping, air interface encryption and end-to-end encryption is available.

The main advantages of TETRA over other technologies, such as GSM, are:

- High spectral efficiency - 4 channels in 25 kHz and no guard bands, compared to GSM with 8 channels in 200 kHz and guard bands,
- The much lower frequency used gives longer range, which in turn permits very high levels of geographic coverage with a smaller number of transmitters, thus cutting infrastructure costs,
- Very fast call set-up - a one to many group call is generally set-up within 0.5 seconds (typical less than 250 msec for a single node call) compared with the many seconds (typically 7 to 10s) that are required for a GSM network.,

- The system contains several mechanisms, designed into the protocols and radio parameters, to ensure communication success even during overload situations (e.g. during major public events or disaster situations), thus calls will always get through unlike in cellular systems. The system also supports a range of emergency calling modes,
- TETRA infrastructure is usually separate from (but connected to) that of the public (mobile) phone networks, resulting in (normally) no call charges for the system owners, substantially more diverse and resilient communications and it is easy to customize and integrate with data applications (vehicle location, GIS databases, dispatch systems etc).
- Communication between different types of networks is becoming increasingly important. TETRA has the ability to connect with a variety of external networks. For example, the TETRA network can be connected with the public and private telephone networks, different types of data network and a large management and signaling networks. All of these networks can be accessed directly from a mobile terminal. The sheme of various possibilities of tetra system is shown in Fig. 3.

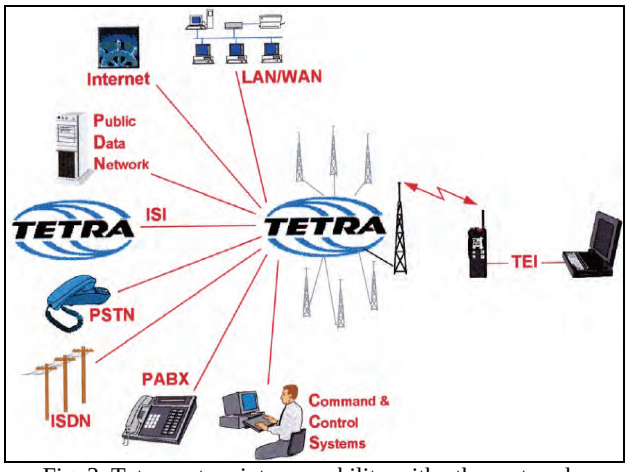

Fig. 3. Tetra system interoperability with other networks

- Unlike most cellular technologies, TETRA networks typically provide a number of fall-back modes such as the ability for a base station to process local calls. So called Mission Critical networks can be built with TETRA where all aspects are fail-safe/multiple-redundant.
- In the absence of a network mobiles/portables can use 'direct mode' whereby they share channels directly (walkie-talkie mode).
- Gateway mode - where a single mobile with connection to the network can act as a relay for other nearby mobiles that are out of range of the infrastructure.
- TETRA also provides a point-to-point function that traditional analogue emergency services radio systems did not provide. This enables users to have a one-to-one trunked 'radio' link between sets without the need for the direct involvement of a control room operator/dispatcher.
- unlike the cellular technologies, which connect one subscriber to one other subscriber (one-to-one) then TETRA is built to do one-to-one, one-to-many and many-to-many. These operational modes are directly relevant to the public safety and professional users.
- Equipment is available from many suppliers around the world, thus providing the benefits of competition

Main disadvantages of TETRA system are:

- Handsets are more expensive than cellular (about 750 EUR in 2003, about 600 EUR in 2006). This is due to the more difficult technology, smaller economies of scale, and different business model (e.g.: need for security, high powers and robustness),
- Data transfer is efficient and long range (many km), but slow by modern standards at 7.2 kbit/s per timeslot (3.5 kbit/slot net packet data throughput), although up to 4 timeslots can be combined into a single data channel to achieve higher rates whilst still fitting into a single 25 kHz bandwidth channel. Latest version of standard supports 115.2 kbit/s in 25 kHz or up to 691.2 kbit/s in an expanded 150 kHz channel,
- Requires a linear amplifier to meet the stringent RF specifications that allow it to exist alongside other radio services.

Having in mind all the advantages and disadvantages of TETRA communication system, the conclusion can be reached that implementation of this communication system would lead to improvement of technological process of express mail service.

IV. Conclusion

In this paper, the importance of communication system between dispatcher and courier is presented. It is clear that huge optimization of technological process of express mail service could be done be using adequate communications. Saving could be achieved in materials, labor and working time. Quality of service could be improved and productivity of express company increased. As one of the possibility for adequately communication, TETRA system is introduced with its advantages and disadvantages.

References

[1] Dejan Marković, Momčilo Dobrodolac, „The Impact of Express Industy on Global Economy“, 24. Symposium on Novel Technologies in Postal and Telecommunication Traffic – PosTel 2006, Conference Proceedings, pp. 196 – 207, Belgrade, Serbia, 2006.

[2] Momčilo Dobrodolac, “The Research of Models for Market Analyzing of Postal and Courier Systems”, Master Thesis, The Faculty of Transport and Traffic Engineering University of Belgrade, Serbia, 2008.

[3] J. Dunlop, D. Girma, J. Irvine, *Digital Mobile communications and the TETRA system*, Wiley, New York, USA, 2000.

[4] http://www.bakom.ch/

[5] http://www.tetramou.com/