

17-osios jaunujų mokslininkų konferencijos „Mokslas – Lietuvos ateitis“ teminės konferencijos  
**TRANSPORTO INŽINERIJA IR VADYBA,**  
vykusios 2014 m. gegužės 8 d. Vilniuje, straipsnių rinkinys

Proceedings of the 17th Conference for Junior Researchers 'Science – Future of Lithuania'  
**TRANSPORT ENGINEERING AND MANAGEMENT**, 8 May 2014, Vilnius, Lithuania

Сборник статей 17-й конференции молодых ученых «Наука – будущее Литвы»  
**ИНЖЕНЕРИЯ ТРАНСПОРТА И ОРГАНИЗАЦИЯ ПЕРЕВОЗОК**, 8 мая 2014 г., Вильнюс, Литва

## STRATEGY OF RFID-TECHNOLOGY IMPLEMENTATION IN THE INTERNATIONAL AIRPORT “BORYSPIŁ”

Viktoriiа Ivannikova<sup>1</sup>, Viktoriiа Svryduk<sup>2</sup>

*National Aviation University, Kyiv, Ukraine*

*E-mails: <sup>1</sup>vicg@bigmir.net; <sup>2</sup>miloshevich696@mail.ua*

**Abstract.** The aim of the research is scientific grounding of recommendations due to creation and application of strategy of RFID-technology implementation in the cargo terminal of International Airport “Boryspil”.

**Keywords:** optimization, corporate strategy, cargo handling, terminal capacity, RFID-technology, business-models, efficiency.

### Introduction

Contemporary information technology, in particular technology of radio frequency identification, allows optimization of warehouses work, contribute to optimize business processes and reduce expenses of airport.

Today, realization of radio frequency identification systems is extremely important. This question is lighted up in foreign scientific researches. Some of them take a special place, for example S. Ahson and M. Ilyas, P. H. Cole and D. C. Ranasinghe, scientific works of J.-P. Curty, M. Declercq, work of O. Günther, W. Kletti and U. Kubach, and also E. W. Schuster, S. J. Allen and D. L. Brock.

Native scientists, especially Z. S. Samoylenko, Ye. V. Nahornoho, V. A. Androsenko, also devote themselves to studying the problem of RFID technology implementation.

### Study Area

Statements and results of theoretical and applied developments in the sphere of economics and process of cargo turnover handling created by native and foreign scientists comprise theoretic and methodological base.

Statements of theory system, statistical and analytical methods are applied to solve target tasks.

RFID (Radio Frequency Identification) is the most contemporary technology of identification with great potentialities in comparison with others. Typical system, which is based on RFID-technology, consists of several basic elements (Fig. 1).

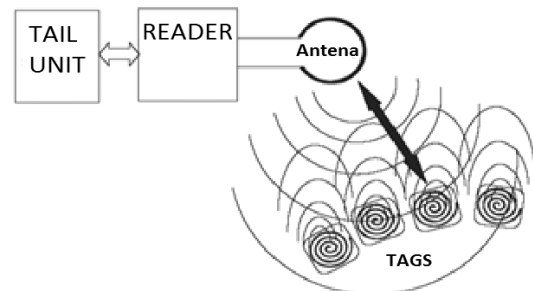


Fig. 1. Scheme of RFID-system functioning

Information transmission (reading or recording) technology with the help of radio waves comprises the core base of its work. There are special marks on it, which holds either identification or assign for user information.

International airport “Boryspil” is a main airport of “Ukraine International Airlines”, situated approximately 30 km from Kyiv.

According to the strategy of Ukraine concerning with UN integration, measures for increasing the level of service quality and production forces were applied during the last decade. It tied with increasing importance of airport as the mail air gates of Ukraine and mail airport for leading airlines of Ukraine.

Insufficient terminal capacity makes it difficult to satisfy demand on air transportation and break transformation of “Boryspil” airport into transit hub of transcontinental significance.

Contemporary technology implementation and utilization on international standard level will put in order terminal complexes.

RFID opens new possibilities for improvement of cargo handling. This is strategic aim of Boryspil International Airport.

### Strategy of implementation RFID-technology

Implementation of new technology can cause considerable and difficult changes in organization culture. It is important to develop the strategy of implementation RFID.

Strategy of an enterprise – is the system of perspective steps, which guarantee to reach the target aims. Task of strategy can be determined by effective usage of resources needed for reaching the main aim through solving interval ones (Table 1).

RFID implementation strategy should be aimed, above all, to obtain concrete results using RFID technology, secondly, to optimize the costs of RFID technology.

It is needed to identify and calculate the actual and potential effects of business process automation.

Resources needed for implementation of RFID-technology are defined not only by financial capacity of the company.

Implementation of system seriously affects business processes in which RFID-solutions are implemented.

Readiness of leadership to change these business processes is a necessary resource.

Key areas of the implementation strategies of automatic identification technologies, RFID, in the cargo terminal of airport “Boryspil” have been identified and described (Table. 2).

### Stages of implementation of RFID-technology in the „Boryspil” airport

RFID implementation strategy includes the following steps (Fig. 2).

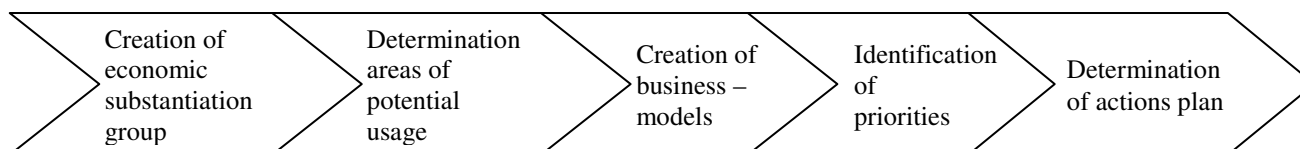
**Table 1.** Aims of creation implementation strategy of RFID-technology

Aims of creation implementation strategy	Justification of aims of creation implementation strategy
Identifying impacts of RFID-technology on performance of the company	The use of RFID-technology in the cargo terminal of the International airport " Boryspil " may affect the following parameters: <ul style="list-style-type: none"> <li>– The efficiency of business processes;</li> <li>– The cost of the enterprise;</li> <li>– Income of the company;</li> <li>– Quality of service;</li> <li>– Productivity, etc.</li> </ul>
Achieving a basic understanding and involvement of senior management	RFID Strategy shows the potential benefits of using this technology on a level where they can be viewed, analyzed and understood by the senior management decision makers. The implementation of a successful RFID-systems can be difficult, and taking control of its elements will allow the responsible managers concentrate on their decision.
Preparing a business plan of high level	Business Plan (BP) – is a document that defines the outline of the company within a time perspective, which is the basis for the feasibility study, deployment strategies and other policies. RFID strategy drives the next level of activity that includes: <ul style="list-style-type: none"> <li>– Assessment of the benefits of technology;</li> <li>– Estimate of the cost of implementation;</li> <li>– A strategy for deployment.</li> </ul>
Getting support units that perform various functions	The activity of the cargo terminal touches on the design and processing of transport documentation for goods vehicle transport, public transport, warehousing and transportation activities, etc. To address these issues, you can use RFID-technology. The decision to use it, will likely require input information from all interested parties, usually at senior management level.

**Table 2.** Key areas of the implementation strategies of automatic identification technologies

Areas of RFID implementation strategy	Characteristic of RFID implementation strategy directions
Increasing level of safety	Security is probably the most common areas of improvement in any kind of business activity, but it often does not receive adequate resources and effort. RFID technology can offer a comprehensive solution that will cope with all the variety of problems in security. RFID can provide cargo tracking and management. In conjunction with other security measures such as access control, goods tracking let you know which goods, when and by who are accessed. Theft of goods directly affects the results of the airport in the form of damages for loss of profits or even financial losses resulting damages. RFID can provide effective resistance theft by activating an alarm in real time, blocking doors and stuff including video monitoring of suspicious persons and cargo to be stolen. An extremely important issue to national security, which requires the participation of not only the government but also the business community. Terrorists may use hazardous materials, cargo containers for attack against the country. RFID function alarm designed to prevent such attempts.
Improving the efficiency of operations	Due to the introduction of RFID-technology in the cargo terminal the efficiency of operations is improving in the following business areas: <ul style="list-style-type: none"> <li>– Servicing consignees: <ul style="list-style-type: none"> <li>✓ elimination situations of cargo shipment in single configuration and the cost of delivery of documents to the consignee;</li> </ul> </li> </ul>

Areas of RFID implementation strategy	Characteristic of RFID implementation strategy directions
	<ul style="list-style-type: none"> <li>✓ improvement quality of service;</li> <li>– Logistics:                             <ul style="list-style-type: none"> <li>✓ streamlining and optimizing workflow in freight flows;</li> <li>✓ increase the accuracy of data on the number and placement of goods in stock (99.9%);</li> <li>✓ ensure full control over the movement of goods;</li> <li>✓ minimizing the shortage of goods;</li> <li>✓ optimizing usage of storage space (capacity increases from 5 to 25 %);</li> <li>✓ accelerated and increased turnover;</li> <li>✓ using the proper strategies of stowage;</li> </ul> </li> <li>– Operating costs:                             <ul style="list-style-type: none"> <li>✓ efficient usage of trucks;</li> <li>✓ optimizing usage of equipment;</li> <li>✓ reduction of transportation costs (fuel and electricity, reducing maintenance costs and increasing the service life of heavy duty vehicles);</li> <li>✓ human resources management;</li> <li>✓ increasing the efficiency of management;</li> <li>✓ elimination contingencies and identifying their perpetrators;</li> <li>✓ reducing the execution time of all warehouse operations;</li> <li>✓ increasing productivity (generally on 20–30 %);</li> <li>✓ reducing personnel costs;</li> </ul> </li> <li>– Management accounting and documents circulation:                             <ul style="list-style-type: none"> <li>✓ increasing the efficiency of data exchange between all stakeholders of handling process;</li> <li>✓ access to information in real time;</li> <li>✓ reducing the amount of paper work;</li> <li>✓ implementation of warehouse inventory without stopping work;</li> <li>✓ creation of a common information space with the corporate system;</li> <li>✓ minimizing the costs on operating records.</li> </ul> </li> </ul>
Providing the benefits of “Boryspil” airport over the competitors	Advantages of RFID-technology, which will provide the advantage of “Boryspil” airport over competitors: <ul style="list-style-type: none"> <li>✓ application of best practices;</li> <li>✓ high productivity and efficiency of the system;</li> <li>✓ integration of different processes and systems;</li> <li>✓ extensive experience and qualified personnel;</li> <li>✓ individual approach;</li> <li>✓ unique open industry standards.</li> </ul>



**Fig. 2.** Stages of feasibility study method

*Stage 1: Creation of economic substantiation group*

The process of RFID feasibility study must be carried out by a group which is able to analyze the benefits of this technology to different sides of the airport, which in itself imply involvement of such groups of different functional units of the airport.

*Stage 2: Determination areas of potential usage*

At this stage, we define several areas of potential usage: tracking the movement of goods; monitoring and controlling systems of inventory accounting; monitoring the property; protection against theft of goods; access control; protection against unauthorized disclosure of goods.

As RFID technology is in the process of development, it is wiser to use it selectively and iteratively in order its cost, complexity and risk (and profitability) can be constantly monitored to minimize the impact on business operations. It is needed to develop the business model for each application areas.

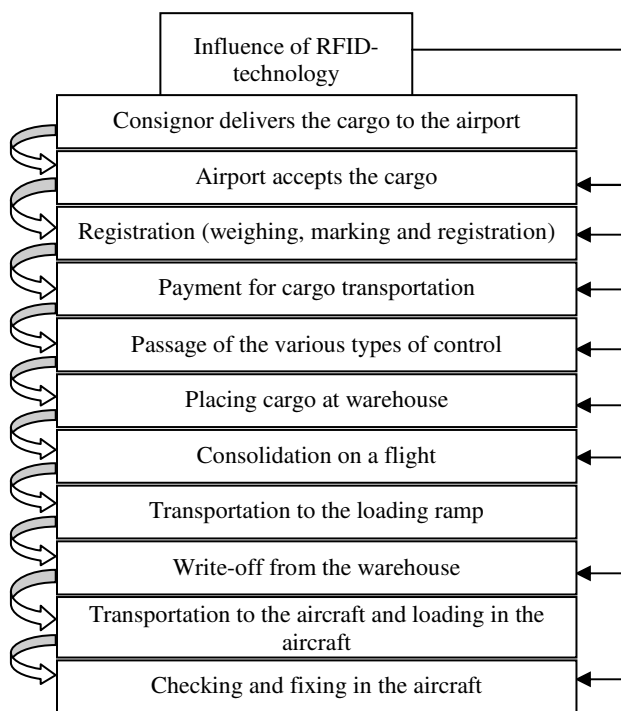
*Stage 3: Creation of business-model*

At this stage, determine how well the business model includes the effect of the factors underlying it (profitability, cost, risk, complexity, payback period).

Profitability – is one of the most important factors in the process of business model creation. We propose to use the method of quantitative determination of profitability on basis of analysis of business flow in the given application field. This method consists of two steps: creation a business flow diagram and determination of critical points of influence (Fig. 3).

Let’s calculate the time per day that you can save using the RFID-technology. Daily time savings is the product of saving processing time of one container (using RFID-technology) to the number of containers handled during the day (with the use of bar coding technology).

Compare the cost of time model “Airport accepts cargo using bar coding technology” and “Airport accepts cargo using RFID-technology” (Table 3).



**Fig. 3.** Scheme of the business process flow with the impact of RFID

If we compare the estimated time of completion (ETC) at models use, the savings in time will be 1003 seconds per a pallet. If we consider that the airport receives cargo 24 hours per a day without interruption, using bar coding technology, it can maximum take 83 unit per a pallets. So, application of the proposed model can save 23.12 hours/day.

Suppose that company pays 2.36 USD per working hour. Every day you can save up to 54.56 USD just for labor remuneration. This is reflected in an annual savings of up to 19914.4 USD, assuming that production year of “Boryspil” airport containing 365 days.

Implementation of RFID-solutions in the airport working environment can affect existing business processes inside it. Some may require the introduction of additional processing steps that may be imposed for the following reasons: input tags into operation; apply a label; read the label; corrective actions, training and coaching; re-usage of the mark.

*Stage 4: Identification of priorities*

Let’s combine the factors involved in the process of a business model “reduction of the period of technological processing of cargo” creation to determine its priorities. To get an idea of the comparative positions of various business-model, use one of the methods of visual representation of variables – creation of “opposition” – factor through a combination of cost factor, risk and complexity. One method of calculating the “supper – opposition factor” is a simple definition of the average value of these factors. To determine the risk and complexity of the business model objectively the empirical method could be used (evaluation of two factors of application system in 5-point scale). The cost of application system is also estimated according to the 5-point scale. Information received from members of the inter-

functional group with a group of experts on RFID-technology.

**Table 3.** Time model “Airport accepts cargo” and “Airport accepts cargo using RFID-technology”

Airport accepts cargo using RFID-technology	Airport accepts cargo using bar coding technology
The acceptance staff locates pallet with goods in RFID-portal (Estimated time of completion (ETC) = 10 seconds).	The acceptance staff checks the number of cargo on the pallet according to the documents (ETC = 5 seconds).
RFID-tag of pallet is automatically read by RFID-reader.	If there is cargo which is absent in documents, the pallet is returned unopened (ETC = 2min).
Customized RFID-tags is also read automatically.	If there is a valid cargo, the staff reveals (ETC = 3 min).
Checks conformity of the number of cargo on the pallet with documentation (ETC for stages 2 – 4 = 2 seconds).	The acceptance staff checks the cargo units on their correspondence with documentation (ETC = 10min).
If there is cargo which is absent in documents the pallet is returned unopened to the shipper (ETC = 2 min).	If a primary cargo unit is invalid, the acceptance staff marks the object manually and sends it back (ETC = 3 min).
If there is valid cargo or separate is invalid, then: this information is automatically entered into the system (ETC = 1 second); pallet opens (ETC = 2 minutes – this is extra time), the primary cargo unit is sent back (ETC = 3 min).	If the cargo unit is valid, it is placed in the reception area, where next stages of processing load will be implemented (ETC = 10 seconds).
If there is valid load on the pallet without any invalid primary loading units, the entire pallet is placed in the reception area (ETC = 20 seconds).	Total ETC: Σ ETC = 5 + 3 × 60 + 10 × 60 + 10 × 25 = 1035 seconds
Total ETC: Σ ETC = 10+2+20= =32 seconds	

*Stage 5: Determination of actions plan*

After determination of the best business models for airport based on their priorities, actions plan is created for the chosen business model. Action Plan divides the total solution of business model to a number of control events. It has strategically planned subset of all tasks within a business model that can be resolved within the period of controlled event.

**Conclusions**

In general, benefits of RFID-technology implementation in “Boryspil” airport are reaching of the following results:

- increasing efficiency in the management of consignment;
- improvement monitoring facilities;

- reducing the length of the queue;
- increasing handling capacity;
- rational decreasing time consumption, etc.

Economic effect of the introduction of RFID-technology in the cargo terminal of International Airport “Boryspil” is achieved by reducing the period of cargo handling, which reduces the costs on labor remuneration and increases airport capacity. In turn, increasing of goods

and mail transportation volumes, leads to the increasing of income from business aviation infrastructure of the airport.

On the basis of the developed strategy of RFID-system implementation in “Boryspil” airport and carried out calculations, it was determined that the investments necessary for project implementation are 80300 USD. Payback period of the project will be 0.3 year, which is a positive result.

## References

- Ahson, S. RFID handbook: applications, technology, security, and privacy [Prin.] / S. Ahson, M. Ilyas. – Boca Raton: CRC Press Taylor & Francis Group. 2008. 690 p.
- “Boryspil”: Official site [electronic resource]. Mode of access: <<http://kbp.com.ua/ukrainian/golovna/index.html>>.
- Curty, J. 2007. *Design and optimization of passive UHF RFID systems*. New York: Springer. 267 p.
- Dobkin, D. M. 2008. *The RF in RFID: Passive UHF RFID in Practice*. – Amsterdam ; Boston: Elsevier / Newnes. 342 p.
- Finkenzeller, K. 1999. *RFID Handbook*. New York: Academic Press. 284 p.
- Koelle, A. R.; Depp, S. W.; Landt, J. A.; Bobbett, R. E. 1976. Short-Range Passive Telemetry by Modulated Backscatter of Incident CW RF Carrier Beam. *Biotelemetry*, Vol. 3. New York: Academic Press. 337 p.
- Schuster, E. W.; Allen, S. J.; & Brock, D. L. *Global RFID: The value of the EPCglobal network for supply chain management*. – Berlin; New York: Springer. 2007. 234 p.
- Shepard, S. 2005. *RFID: Radio Frequency Identification*. New York: McGraw-Hill. 423 p.
- State Aviation Administration: Official site [electronic resource]. The State Aviation Administration. Mode of access: <[http://www.avia.gov.ua/zakon\\_aero\\_ukr.html](http://www.avia.gov.ua/zakon_aero_ukr.html)>.