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Model of an integrated air passenger information system and its adaptation to Budapest Airport

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ABSTRACT

Air passengers use several functions of passenger information systems during their journeys. Inadequate information management may generate uncertainties. Experience shows that the quality of information provision can be improved by the integration of data sources and information services. Development of increasingly integrated solutions requires the use of more abstract modelling methods. Nevertheless, these complex methods have only been partially elaborated and are yet to be adequately published. Therefore, our aim was to develop several methods for analysis and modelling. We applied an approach, where organisations, functions, data groups, and information terminals (interfaces) have been considered. All model components, service functions and their correspondences have been identified and visualised in matrix format. Finally, our method is applied for the case of Budapest Airport. Based on this research, useful subsystems, most notably integrated passenger mobile applications, may be developed in the future.

1. Introduction

Several transport operators and service providers focus on their own activities solely when serving air passengers. Thus, passengers have to adapt to various changes in services they encounter during the travel chain. Their success in this adaptation depends crucially on the efficiency of transport information management, as passengers are provided with information from several sources (e.g. airline applications, airport web pages, staff information at the airport, flight track applications, etc.). The lack of continuity in the information flow often results in discrepancies. For example, airport operators, who are responsible for managing airport processes, typically communicate delays relatively late, while experienced passengers often receive information earlier via online flight tracking applications, such as Flightradar24. In order to increase passenger satisfaction, not only time-management problems should be solved, but the level of integration in information provision is also fundamental (Barros et al., 2007; Kelemen, 2007; Francis et al., 2003). According to Brida et al. (2016), investments in new means of communication, based on Information and Communications Technologies (ICTs), would indeed improve passengers' perception of airport service quality.

Airport operators often strive to satisfy the information-demand of passengers via the application of mobile technology, thus making travelling more efficient (Benjamin, 2011; Lopez, 2012). Passengers can receive information on their mobile devices before and during the journey regarding airport services, travel and parking facilities, terminal maps, flights, or the allocation of check-in desks. Thanks to implemented scanners, passengers can use their mobile devices as the boarding pass. A mobile application developed for each airport is typically used for real-time information provision and decision support. Moreover, airlines increase passenger-satisfaction and supplement their marketing through mobile applications (Budd and Vorley, 2013 Avram, 2013). The quality of airport-specific mobile applications has become an issue of prestige and customer satisfaction. According to Profillidis and Botzoris (2015), information technology will continue to develop even if travel demand remains constant in the future.

The aim of this research is the elaboration of an *integrated air passenger information system and service model* that is built on already existing databases. Integration of databases cannot be realised without the cooperation of the database owners (i.e. service providers, from now on referred to as 'organisations'). Therefore, the first step of integration is required on the operational side.

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Thereafter, the human-machine interface, which provides additional value in the form of consistent information for passengers, is being developed. This rather complex service supports users in decision-making, decreases stress and uncertainty, and provides real-time, predictable, and personalised information during travel. The service is available through a mobile application.

As the information management processes are based on an air travel chain, the entire process of travelling has been modelled. A **function – data-group – organisation approach method** has been applied, and subsequently, machine subsystems and information terminals have been analysed. Information terminals are considered as passenger-information interfaces. An **air passenger information system model** is then elaborated based on the results of the analysis of data flows between the elements. We consider the model as a framework for the development of passenger information functions and applications. The research process is summarised in Fig. 1.

As an interaction between information technology and scientific research, the integration of the entire transport information system can be a realistic goal, especially given that the aviation industry has already committed itself to manage integrated data coming from various sources (Kampichler and Eier, 2014). Overall, system- and process-oriented academic results are rarely published in this field. Systems in aviation, the air traffic control (ATC) system in particular, suffer from the lack of a unified modelling framework (Bayen, 2003). The difficulty of modelling the ATC system arises from the number of different components interacting within the system. Bayen and Tomlin (2005) previously described the organisation and structure of ATC. Sandor (2017) performed functional modelling of air traffic control, but other fields of aviation were not analysed with this approach. Our analysis and modelling method is aimed to fill in the niche.

The paper is structured as follows. Section 2 introduces the modelling methods that we apply in subsequent analyses. Section 3 contains the methodological results. The passenger information functions are identified and systematized, with special focus on the airport part of the transport chain. The main elements and data sources are described. The comprehensive model of the integrated passenger information system is presented as well. Finally, in section 4, we demonstrate the case study of Budapest Airport to showcase how the model performs in a realistic scenario.

2. Analysis and modelling methods for integrated information systems in transport

Complex systems are modelled for several purposes. Therefore, different model types are introduced and applied herein. The identification of correspondences between elements and functions is the key step of integration (Fig. 2).

A system consisting of elements and correspondences is constructed with specific objectives. The functions can be derived from the objectives. The structure of the system is represented by **element-element correspondence models** (between organisations, between organisation and machine subsystems, and between machine subsystems). The assignments of operation processes to elements are represented by **element-function correspondence models**, such as organisation-function and machine subsystem-function correspondences. **Function-function correspondence models** describe the operational processes.

The data groups are to be assigned to the correspondences and the details (e.g. volumes of data flow, data transfer technology) can be determined.

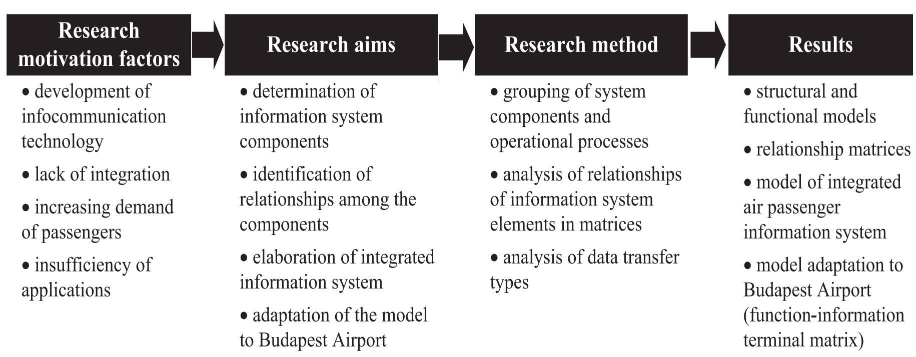

Fig. 1. Research process.

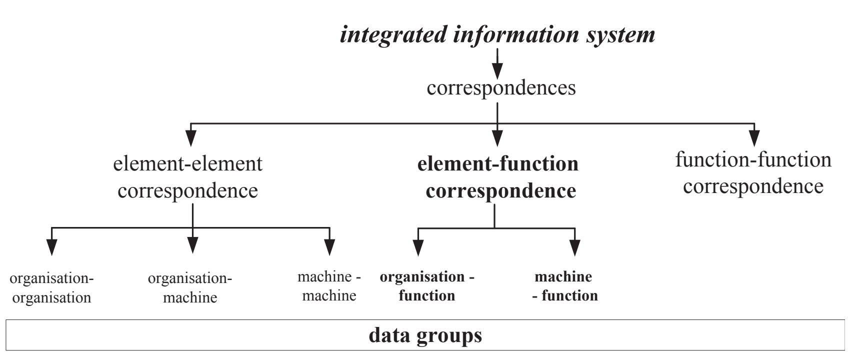

Fig. 2. Categorisation of model types describing correspondences.

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