DESCRIPTION OF A MODERN DIGITALIZED AND CO-OPERATED BORDER CONTROL ENVIRONMENT AT AIRPORT

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Abstract

The subject of the study was the entries and timing of the registration of third-country nationals in order to determine the conditions for entry, stay and departure. The starting point was that data from a thorough entry and exit check can be obtained automatically from the air carrier systems to the use of border control.

The effectiveness of border control is a major factor in the flow of travel and internal security. In order to ensure fluency of flow in the future, the border authorities, airport companies and carriers will have to take into consideration what changes are needed due the increasing travel flows of border traffic in their processes. The core question in this study was whether border controls for government activities are needed solely for sovereign solutions or whether efficiency can be improved if the travel and inspection processes would be more closely linked together.

Drawing attention to the most important variables during the process of the border control process, it was possible to identify the factors that could improve the process. Observations from the analysis and the novel data collection itself gave concrete time factors. Measured control times allowed to compare whether the processing capacity at different line volumes corresponded to what could be expected from the average control time. Even tough major part of the study is related to Helsinki-Vantaa Airport the observations are extendable inside European Community.

Keywords: carrier, passenger information, border inspection, data

Introduction

In modern traveling, airport operations and the implementation of border checks are very time-critical. Short connecting flight schedules at Helsinki-Vantaa Airport, coupled with high level of the passengers passing through the airport to the next flight, require smoothly running border control process. This demand challenges the border inspection capability to be flexible and able to fill the level required for a fluent border traffic. Passengers' delays from connecting flights can be a significant operational and financial risk for airlines and ultimately passengers themselves. The border inspection authority has no legal right to waive border controls or to change the content of inspections to ensure the smooth running of traffic. The flow of traffic cannot get priority over the border control protocols that are in line with the regulations. However, it is very important that the border inspection process is operated without significant queuing times. (Boarder Guard 2016)

Therefore, a sustainable border traffic management carried out by authorities in co-operation serves both internal security and business needs. In the border traffic management exploration made in 2012 the increasing border traffic and its impacts have been studied on a scenario-based basis. In that survey work, it has been explicitly stated that the business community and the authorities should continue and develop proactive interaction in order to manage the growing border traffic. As far as the Border Guard is concerned, border traffic management should continue to be supported and safeguarded by a viable and cost-effective audit process. (Ministry of Internal Affairs 2012).

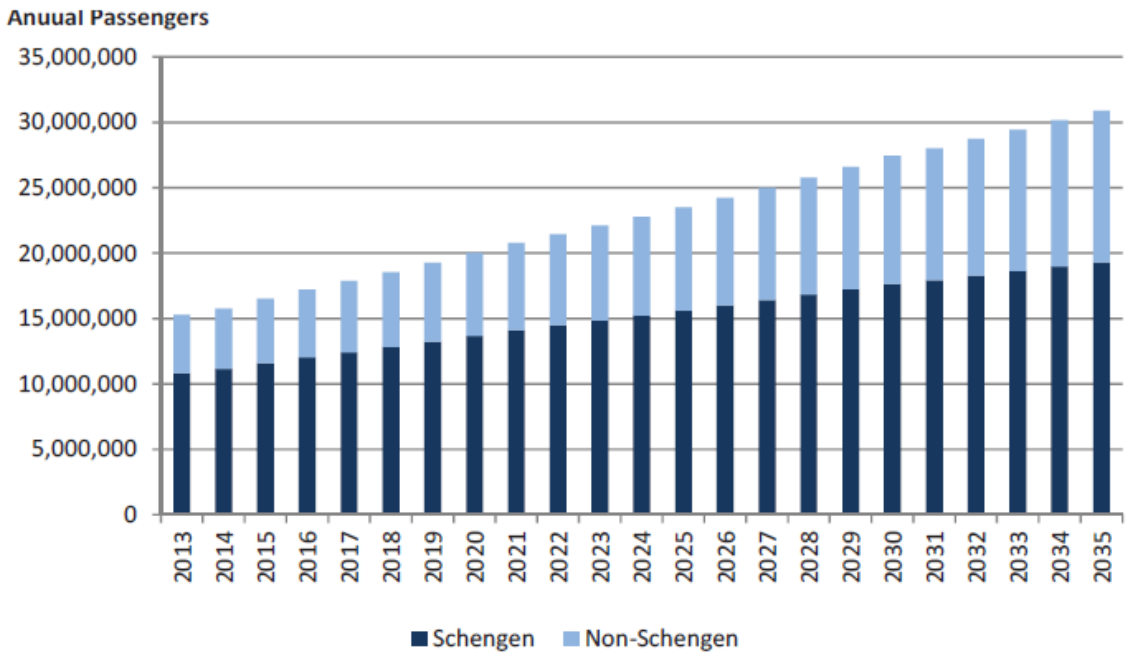
Main research question is to study can cooperation-based data processing help streamline entry and exit checks in border? Secondly can we obtain reliable data to make further analysis?

In this article first chapter is motivation and presents current Helsinki-Vantaa airport environment, second chapter goes through possibilities of collaboration-based data-handling, third chapter presents the results and fourth chapter gives conclusions and discusses about future directions of this research.

Operating environment and future challenges

The development of Helsinki-Vantaa Airport emphasizes the growth of passenger traffic across the Schengen border, which has a direct impact on the Border Guard's operations as well. Estimated growth forecast for traffic will take into account Finavia's and Finnair plans and projections. The largest operator in the airport is Finnair, which invests in traffic between Europe and Asia. (Finnair 2018). Finavia's future growth strategy underlines the strong growth of transit travelers. In Helsinki-Vantaa this means that Asian passenger traffic will increase, which significantly adds the number of passengers with a visa requirement. (Finavia 2017, Finavia. Annual Report 2015)

Table 1. Estimated passenger growth between 2013 and 2035. (According to Finavia. Development program 2015)

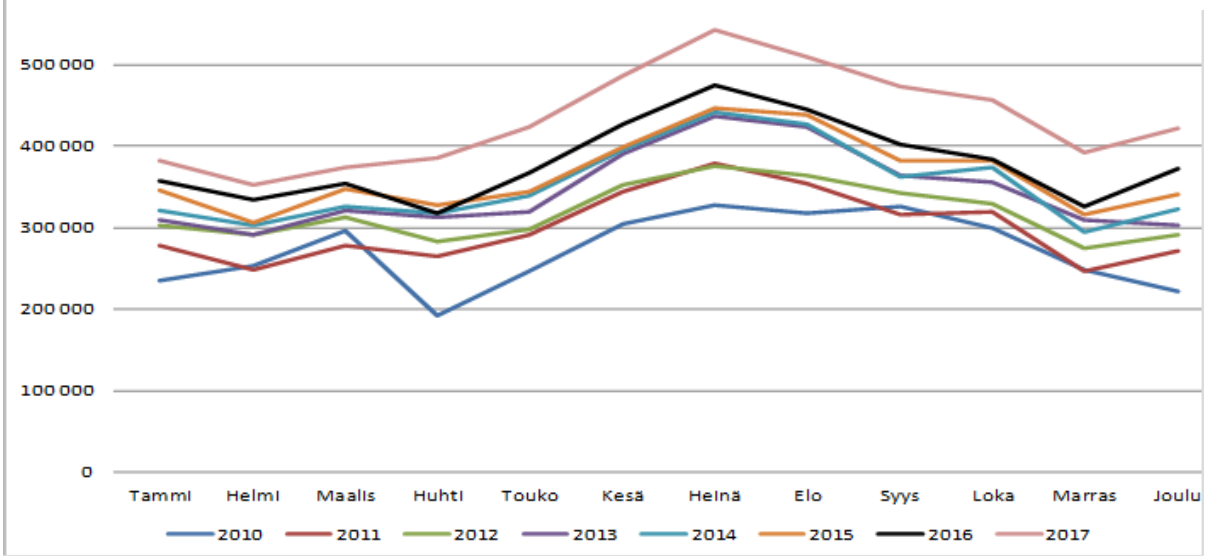


Helsinki-Vantaa Airport has a leading position in Asian traffic. The airport has extensive flight connections and the shortest routes between Europe and Asia, making it a major hub for Northern Europe. Much of the passengers pass through the airport only to switch the flight, which is a significant piece of information, when planning for a smooth running of the border control process. (Finnish Law 579/2005) The number of external border traffic at Helsinki-Vantaa Airport is increasing steadily. Table 1 shows Finavia's estimation for number of

passengers up to the year 2035. Estimation forecasts an average growth rate of 4.7 percent per annum. Traffic growth is expected to be particularly high on third-country passengers. (Finavia. Development program 2015)

Table 2 shows the realization and development of cross-border traffic in the Helsinki-Vantaa external border traffic 2010-2017. In 2016, Helsinki-Vantaa's total passenger traffic was 17.2 million passengers (Table 2). During the year 2017 the growth was 800,000 passengers. By the year 2022, the number of passengers on external border traffic is estimated to increase approximately by 74 per cent, from 4.6 million (2016) to 8 million passengers. In 2017 more than 5.2 million border checks were carried out. (Lentoposti 3.Jan.2018)

Table 2 Boarder crossing actual values and development in 2010- 2017 /source RATTI 2018



The Head of the Coast Guard of the Gulf of Finland has pointed out that Helsinki-Vantaa Airport's volume and profile of the passenger traffic, especially during the afternoon hours, pose a challenge for the operators, airline carriers and authorities. (Border Guard Resource Plan 2018) To respond to the challenge, the Border Guard's operational processes are continuously evaluated and developed. Efforts to streamline and manage passenger traffic have been attempted to meet the needs of growing passenger flows. These actions include the efficient use of personnel and passenger guidance as well as other development measures for the border inspection process. The passenger guidance system has been developed as a co-operation between the airport authority and the Border Guard. (BG 2016)

In the actual border checks, processes have been continuously enhanced. As an example, automatic self-service border control desks in the Helsinki-Vantaa Airport have helped to

speed up the increase in passenger flows. The major factor in the automated border control utilization is the increase in the proportion of biometric passports. Safety regulation and features for biometrics passports and travel documents are provided at EU level. (Council Regulation (EC) No 2252/2004). As such they made an important step towards the development of technical components at border controls at European level.

The share of EU / EEA / CH nationals in the Helsinki-Vantaa external border traffic has been steadily about 70% of the total number of passengers traveling each year. In 2017, EU passengers accounted for around 66% of Helsinki-Vantaa's external border traffic. The number of automatic border checks on total traffic has still been below 40%. (RATTI 2018) However the predicted growth of passenger traffic in the group of third-country nationals means also growth in the group with limited access to the automated system, which demands biometric passport. (Finnish Law 579/2005) (RATTI 2018) This necessitates the need for the development of audit processes. As an operating environment, the airport requires that the border authority must take into account, in its own activities, the time and activity-related factors determined by the carrier and the airport. (BG R Plan 2018) These are important for the airport competitiveness, because effective processes are important success factors. Strengths of Helsinki-Vantaa Airport are short distances and at best plane can be changed in 35 minutes. Quick access to connecting flights is a competitive factor and as Asia's transit traffic increases, the smoothness of processes is an essential part to the success of the airport. (Finavia 2017)

The challenge for border checks at Helsinki-Vantaa Airport is the fluctuations in the time distribution of border crossing air traffic. This means number of passengers' variate heavily according to the time. Peaks are related to the structure of Finnair flights. In the afternoon the congestion of border checks for incoming and outgoing flights is mainly due to the so-called "the Asian wave". At that time, Finnair's traffic generates incoming traffic at border checks of up to 3,600 passengers per hour. As an example, if Finnair's long-distance traffic would add two daily flights that would mean that the number of border crossing individuals would increase between 400 to 600 border crossing individuals per day. On an annual level, increase would be up to 200 000 border checks more. (BQ 2016)

According to Finavia's preliminary data, in summer, especially in May, the number of passengers is growing strongly. (Finavia. Statistics 2017) Below is the highest number of passengers on May 31st. Figure 1 illustrates the hourly variation for air travelers on May 31st.

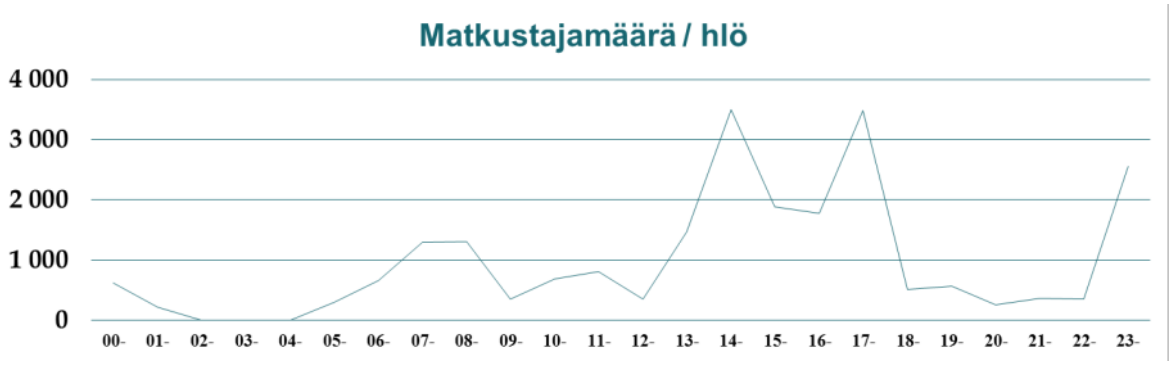


Figure 1. Time fluctuation in passenger volume for 24h at Helsinki-Vantaa. Based on Finavia. Statistics 2017

When assessing the number of passengers, Finnair's own growth forecasts should not be considered as the only source of information. With regard to Helsinki-Vantaa, it would also be worth noting the growing interest of all airline carriers of transit traffic in Helsinki-Vantaa Airport. The admission of new companies to airlines operating via Helsinki-Vantaa may have a major impact on passenger transport growth. However, making forecasts is challenging because it is hard to anticipate passenger flows. (BQ 2016) Mobility is affected by various phenomena and decisions made outside Finland's borders. Surprising changes in people's behavior, mobility and travel can be caused by international security situation, immigration or climate change. (Ministry of Internal Affairs Publication 15/2017)

Automation can significantly assist in verifying a person. The whole set of personal and travel information that has been identified at various stages of the border check process has become complex. Technical progress has made it possible to carry out checks of documents and persons in parallel. Future factors will be the automation of the audit process and the wider utilization of biometric identifiers. The border inspection process is then advancing towards solutions in which at the border crossing point the passengers themselves sovereignly master the procedures while the authorities are there mainly to supervise and help. Technical solutions can ensure the reliability of inspection activities and reduce queues at border crossing points. The implementation of technical services to facilitate the flow of cross-border traffic requires the pooling of data for different authors. (European Commission, Strasbourg COM(2017) 794)

Possibilities of collaboration-based data handling

In order to identify the information needed for border control, a border inspection application is utilized. The necessary data in the application is combined for sources to allow the user to view, process and compare different data. The Border Inspection Application is part of the Border Guard's Operational Information System (RVT) where all data entered at the border check is stored. (Finnish Law 579/2005)

Air carriers provide passenger information to the border inspection authority system Ratas using a secure connection using a standardized message format. At reception of passenger information, an aero-based MQ-based network is used. The communication follows the standards defined by the International Civil Aviation Organization (ICAO), the World Customs Organization (WCO) and the International Air Transport Association (IATA). The message format is the PAXLST message standard that passes within the Type B frame. The Border Guard has its own address on the network, where the sent messages are sent to the Ratas system of the Frontier Guard. (Lakoma, Interview 2018)

Passenger information and regulation on border checks revealed the convergence of entries in border checks in relation to carriers' data in air traffic. It is clear that the current passenger data collected by the air carrier contains data which will also be surveyed and recorded in the entry and exit checks. Passenger information can be used to find the necessary information without requiring the verification of documentary evidence presented in support of this information.

Unlike Advance Passenger Information (API) data, Passenger Name Record (PNR) data cannot be used to support border checks in accordance with the directives. (Directive (EU) 2016/681) The data contained in the PNR data set is related to the information needed to determine the cross-border motive in order to establish the purpose and conditions of the intended stay. The duration of the planned stay of PNR data supports API data in order for officer to determine the real destination.

As a whole, these "pre-requisite border controls" can be used, for example, in entry checks. An air carrier collects the following information that is consistent with the information available at the border inspection:

1. Country of Departure (API)
2. Transport, ID (API)
3. Destination (API)
4. Planed (Scheduled) Travel Date (s) (PNR).

To make better use of passenger data, automation is needed to process the information for acting border inspector. API data is designed for originally arriving passengers, so utilization for boarding is a challenge. Wider use of this data does not seem possible because of the delivery time specified in the law. This change would require both a review of the legal basis and new technical arrangements. (Nokelainen, Interview 2018)

Uniform operating models for collecting data may also contribute to collaborative information processing. Co-operation based data processing is not only related to the use of passenger data. Automation is not just a check-in automation. It is expected that technological solutions will not only be limited to checking-in or making reservations, but that the services will be further extended in the future (Janina 2015) (Government's proposal to Parliament HE 201/2017). At the same time, it is necessary to ponder the question whether or not independent controls are needed for border controls or would they be more efficient when the activities are linked together into the entire travel process? From the point of view of border checks, identification data from travel and personal documents can be obtained from the check-in desk. Primarily, the use of check-in machines would be airport-specific and related to the start-up inspection. The use of check-in machines for entry checks is technically complicated both in collecting and delivery of data. (Nokelainen, Interview 2018)

Results

Real data was collected by the author 1. More details for can be found in the pro-Gradu study (Mattila 2018). For each sample type of the border check, an average was calculated. The sampling rate for the different phases was to represent the whole population. The uncertainty of sampling error was expressed by the error margin for each phase. (E.g., Pripp 2013) The

error margin was used to describe the time at which the actual check-up period for the whole population was 95% probability. The error margin was shown in confidence intervals.

From Tables 3-5, it was found that in regular measurements the average and median were close to each other. If the phase distribution was in the direction of small measurement values, then the mean was less than the median. If the distribution had many other higher values, the average was higher than the median.

Table 3. Time deviation of the in-depth arrival inspection.

Size (n) 50	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
Mean	13.91	6.86	17.66	2.59	21.56	103.10	6.61
Deviation	4.74	7.61	34.89	0.52	14.17	56.78	3.56
Minimum	5.94	2.17	3.13	2.02	5.44	45.23	3.09
Median	13.45	4.59	8.96	2.47	18.11	86.22	5.64
Maximum	28.72	47.34	224.00	5.36	67.31	270.00	23.59
Confidence interval	12.60 - 15.23	4.75 - 8.97	8.00 - 27.34	2.44 - 2.73	17.63 - 25.49	87.37 - 118.84	5.63 - 7.60

Table 4. Time deviation of the in-depth boarding inspection

Size (n) 50	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6
Mean	11.85	4.94	7.09	11.89	2.11	5.28
Deviation	3.12	1.38	3.64	4.74	0.80	1.16
Minimum	6.90	3.36	1.82	4.78	1.18	3.40
Median	11.33	4.49	6.90	11.28	1.98	4.96
Maximum	19.20	9.89	20.20	30.75	5.86	8.36
Confidence interval	10.99 - 12.72	4.56 - 5.32	6.09 - 8.10	10.57 - 13.20	1.90 - 2.34	4.96 - 5.61

Table 5. Time deviation of the in-depth automated inspection

Size (n) 50	Phase 1	Phase 2

Mean	7.75	16.05
Deviation	2.65	7.00
Minimum	3.94	6.73
Median	7.32	15.99
Maximum	19.17	34.26
Confidence interval	7.02 - 8.48	14.11 - 17.99

Based on the measurements, the average length of inspection of a third country citizen was 169.70 seconds. In phase 6 asking "the motive or reason for the crossing border" the researcher noted that the border inspector's and the passenger's interaction lasted for the entire border inspection time, but for the recording process was clear enough to be separated and marked as an own stage in the whole inspection procedure. The recording of the borderline crossing motives lasted for an average of 103.1 seconds. Other steps formed a clearer cycle.

In average ground exits, the inspection period averaged 43.16 seconds. For the sake of completeness, the study took into account all the outbound examinations required by the border code in its basic form and, if necessary, the inspection measures to be taken. According to the discovery, outbound examinations included the verification of the visa and all fingerprint examinations of VIS visas. It was also possible to check that the permitted length of stay in the Schengen area was not exceeded. (Regulation (EU) 2016/399)

Existing entry and exit checks included the same steps. In the measurement fingerprint examinations of entry and exit VIS visas. Average time difference of 11 s (10.57) was observed. The investigator found the difference because the procedure under observation was repeated at the outbound inspection and therefore it was familiar with the passengers, and no (supporting) action was required by the border inspector.

Based on measurements, it was found that the inspection carried out on by the automated device lasted an average of 23.8 seconds. In the case of thorough entry checks, the request and authentication of a travel document by a border inspector took 13.91 seconds and outbound checks for 11.85 seconds. In the border inspection automata, passenger Phase 1 was taken by 7.75 seconds. The measurement did not take into account the time consumed before the passenger was ready for the reader, so only the automatic reading of the document was marked. The result of the study was to show the variables that could be enhanced by

collaborative data processing. The time required for the action required by phase 1 is saved if common processes are used to collect the data.

Table 6 shows the effects of the usage of advanced passengers information(API) to the inspection-time. We see that result is significant.

Table 6. Effects of the use of passenger information to the inspection-time

	Present (s)	**Automated (s) (change %)**
In-depth arrival inspection - Phase 4 - Departure (API), conveyance, identifier (API) - Phase 6 - Destination (API), Travel plan (PNR).	169,70	64.01 (- 62.28 %)
In-depth boarding inspection - Phase 5 - Destination (API), conveyance, identifier (API)	43.16	41.05 (- 4.89 %)

Conclusions will change if the Frontier Guard's effectiveness goal is not taken into account, but only the time of the process efficiency to support connecting flight in terms of the success of Helsinki-Vantaa as a transit terminal. It means that changing plane can be done in 35 minutes. That includes all authority processes. To enable Helsinki-Vantaa's essential strength and competition factors, like a fast changeover time, airport personnel's and border officers need to work in co-operation in order to find out those time elements and structures that enable the connectivity in 35 minutes also in future. In addition to the border inspection, airport infrastructure, the number of passengers on the premises, and other factors restricting or enabling travel and fluidity. These variables have not been emphasized in this study but should be taken into account in full investigation. Border inspection is a statutory task whose implementation must be ensured in all conditions. If the goal is to reach only the targets set by Finavia, time spent on border control can be increased if the airport's infrastructure allows. Then the number of border inspectors may be a variable factor.

The study shows that automatic procedures for handling current passenger data could be developed in the future so that border inspectors will be able to access the necessary information electronically. The question is mainly about the new technical implementation and the new sharing of information among the different authors. Passenger data sharing speeds up the required checks to a significant extent in the actual border crossing process. This impact was particularly apparent in a thorough entry examination, which took only about a third of the current standard procedure time.

Table 7. Effects of combining of the processes to the inspection-time.

	Present (s)	**Change (s) %**
In-depth arrival inspection	169.70	(0 %)
In-depth boarding inspection	43.16	31.31 (- 27.46 %)
Automated inspection (boarding)	23.80	16.05 (- 32.56 %)

Conclusions and Future

The study showed that the challenges presented in the introduction could be met by gathering data and combining processes. Co-operative data processing could facilitate thorough entry and exit checks. The results showed that the changes were important and the removal of the manual work stages brought value to the overall goals.

The impact of improvement of data processing on the border inspection process was significant. The time limit for border checks has been shortened and, in addition to this, the apparent effects are that the possibilities for recording errors are reduced when the same data is automatically generated only once. Based on these direct research results, it can be deduced that resources could be directed from recording the data to the verification of its accuracy.

Expansion work of Helsinki-Vantaa Airport tend to match the challenge of growing passenger volumes. Co-operation with the Frontier Guard is essential to implement the border inspection process requirements to the new terminal. Particular attention should be paid to the smooth running of passenger flows and border controls. Further monitoring the effectiveness through modelled time consumption is one way and the simulation model developed in author 1's dissertation would be one example of process monitoring tools. The simulation model can be utilized if we want to measure the effects of reforms and the increase of passenger flows on changes in the time spent in border control.

According to the Social Security Strategy and the Internal Security Strategy, the Border Guard has an important role to play in ensuring cross-border security. The international security situation and the changes occurring therein require a continuous examination and

development of border control safety. Particular attention should be paid to investigating and anticipating cyber-security threats when automated solutions are added.

The new cross-border information system will bring changes to the information that will be stored at the border crossing. From the point of view of further research, it is appropriate to examine the significance of the data recorded at border checks and whether it would be necessary for other authorities to maintain a national system alongside the future border information system for the storage of certain data. This study can naturally be linked to the assessment of cyber threats.

For the future, further research should not focus on describing already existing activities but should focus on the requirements of future implementations and their functionality. From a process point of view, the study did not fully take into account the importance of the added value of the combined process and the effects of its development on the perspective of other non-border authority functions. In the researchers' view, it would also be important to study how to combine several different government functions into the travel process. The activities of the European Union's border management model do not end at the EU's external borders, so the researchers believe that opportunities and effectiveness could also be explored for internal security operations.

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