

**Digging for Data:
Barriers to overcome before using Mobile Positioning Data
for Tourism Statistics**

(SESSION I 'New Technologies as Data Sources and Collection Methods:
Evolution or Revolution?')

1. Acknowledgement

All results presented in this paper originate from the *Report 2: Feasibility of Access* from the *Feasibility Study on the Use of Mobile Positioning Data for Tourism Statistics* commissioned by Eurostat. This report has been jointly authored by Rein Ahas (University of Tartu), Laura Altin (Positium), Jimmy Armoogum (IFSTTAR), Siim Esko (Positium), Ingrid Grigorjeva (Positium), Maiki Ilves (Statistics Estonia), Epp Karus (Statistics Estonia), Jean-Loup Madre (IFSTTAR), Ossi Nurmi (Statistics Finland), Françoise Poitier (IFSTTAR), Ave Piik (Borenius), Erki Saluveer (Positium), Dirk Schmücker (NIT), Ulf Sonntag (NIT) and Margus Tiru (Positium).

2. Background:

Problem statement – need for alternative data sources in tourism statistics

A key output of the system of tourism statistics is statistical information on tourism flows, i.e. number of trips and nights spent away by visitors outside their usual environment. Traditional data sources include surveys filled in by accommodation establishments (reporting on their guests) and surveys filled in by households/individuals (reporting on trips made during a recent reference period).

However, it is stated by Eurostat (2012) that the European Statistical System (ESS) is increasingly being called upon a reduction of the administrative burden for European enterprises, households and administrations. As a consequence, actions need to be taken to find a better balance between user needs and burden put on producers and respondents. The new legal framework, namely Regulation 692/2011 (EC 2011), includes several actions to reduce the administrative burden.

New technologies can lead to new ways of collecting data. The availability of enormous amounts of information in administrative or business information systems can lead to a revolution (or at least evolution) in terms of data gathering, one example being mobile positioning data (MPD) stored by the mobile phone network operators (MNO). MPD can be a source for monitoring flows of persons, inside or outside their usual environment. In the short or mid-term, it might be an additional source of information for the system of tourism statistics, in the long term it could possibly replace part of the existing data collection work. Research and experiments are ongoing and results are very promising, e.g. in Estonia (Ahas et al 2007; Ahas et al 2010; Tiru et al 2010), Israel (Shoval and Isaacson 2010), Czech Republic (Vogelová 2012) and other countries.

3. Introduction and Purpose: Eurostat feasibility study and scope of this paper

Against the background of a changed ESS business environment (new data requirements, need to simplify collection process and reduce ensuing burden, use of ICT tools) and changed ESS business architecture (integration of data sets, re-use of existing/administrative data) (EC 2009), Eurostat needs to play a role in developing more efficient ways of collecting data, also in the field of tourism statistics. In this context, Eurostat initiated a feasibility study on the use of mobile positioning data for tourism statistics to explore the possibilities - and limits - of using MPD for measuring tourism flows (Eurostat 2012).

During the period December 2012 until March 2014, a consortium consisting of six main partners, Positium LBS (EE), NIT (DE), Statistics Finland (FI), IFSTTAR (FR), Statistics Estonia (EE) and the University of Tartu (EE) has been working on this study (More details: <http://mobfs.positium.ee/>).

The methodology explored in the study is the use of location information from memory files of MNOs for statistical purposes. The aim is to assess the feasibility of using such data for estimating domestic, outbound and inbound flows and to address strengths and weaknesses related to access, trust, cost and methodological challenges (delimiting tourism, representativeness) of using MPD for tourism statistics.

The first and very crucial issue when starting to deal with this topic is the actual access to MPD. This paper will present the central findings of the Eurostat study concerning the barriers of access. It will start with theoretically introducing the three major types of barriers:

- a) Privacy and regulation-related barriers
- b) Financial and business-related barriers
- c) Technological barriers

The main part of the paper will share the actual experiences that were encountered when trying to overcome these barriers. The findings will be based on discussions with the MNOs and the official data protection organisations (DPO) as well as on lessons-learned in related projects in several European and Non-European countries. They will also include the outcome of a legal expertise and the results of a survey conducted with tourism experts all over the globe.

In its conclusion part, the paper will illustrate and discuss actual and possible solutions to overcome the different types of barriers. These results will be valuable for organisations that are interested to use MPD to measure tourism in the future, by providing a guideline about what to consider and what challenges to expect when trying to access MPD on EU, country or regional/local level.

4. Methodology and results

4.1 Barriers of access: A theoretical approach

Access to MPD is the first barrier in all countries. Most of the MNOs are individual business units that sell communications solutions (calls, information exchange) as their main business model and by default are not eager to begin cooperation especially with such sensitive topics as providing their customers' data in any form to third parties. There are three major barriers for MNOs to providing MPD in research and applications such as tourism statistics:

a) Privacy and regulation-related barriers

- Privacy protection issues of subscribers – subscribers' personal data that is stored in MNO systems involves information that is highly sensitive and is essentially protected by privacy protection (Data Protection Directive (DPD), EC 1995) and telecommunications (E-privacy Directive (EPD), EC 2002) regulations;
- Ownership questions of the data – who is the owner (subscriber or MNO) of the data and are MNOs or third parties allowed to process it anonymously;

b) Financial and business-related barriers

- Business secrets of MNOs – the data holds highly sensitive business information. The main characteristics that operators are afraid to expose to other operators and third parties are the real identities of subscribers, number of subscribers and roaming clients, number of connections (calls, messages), internet usage volumes, locations of antennae;
- Public opinion about surveillance and tracking – any kind of privacy-related topics often receives negative reactions (reasoned or not) from publicity and is therefore handled very carefully by MNOs. Such negative opinions decrease the motivation of MNOs and can cause legislative initiatives or campaigns to stop using the data regardless of if privacy protection methods are implemented or not;
- Small or no revenue and considerable technological investment for MNOs – compared to their basic business of selling communications solutions, the revenue from positioning data is very small and often not interesting compared to the possible risks of losing subscribers or creating a bad image;

c) Technological barriers

- Differences in network systems (hardware and software) – technological accessibility to the data in different MNO platforms (Ericsson, Nokia, Siemens, Huawei, etc.) may vary and accessing different databases and registries might create problems of consistency and comparability of results from different MNOs. Licensing policies may play an important role as technology used by MNOs is often licensed by vendors who have limited the use of the system to very specific functions;
- Patents and intellectual property rights – a number of technologies that have direct or indirect relations to extraction of these types of data have been patented or are under patent-pending status;
- Continuity of data access – for statistical solutions it is vital to have long-term access to data generated using the same methodology;

4.2 Barriers of access: Experiences and findings

4.2.1 Privacy and regulation-related barriers

The data relevant in terms of the study corresponds to the data subject to the data retention obligation under the Data Retention Directive (DRD) (EC 2006). It is essential to note that the MNOs' obligation to retain data under the DRD does not exempt the MNO from processing personal data according to the general rules of the personal data processing arising from the Data Protection Directive (DPD) (EC 1995) and the E-privacy Directive (EPD) (EC 2002). To further extent the DRD is not relevant in the context of the study since the obligation to retain data arising thereunder is imposed for the purposes of making data available to law enforcement authorities for the purposes of the investigation, detection and prosecution of serious crime.

4.2.1.1 Location data as personal data and the question of anonymisation

It is essential to identify whether the data provided by an MNO is deemed personal data. In general, personal data means any information relating to a natural person who is or can be identified, directly

or indirectly, in particular by reference to an identification number or to one or more factors specific to his physical, physiological, mental, economic, cultural or social identity. The applicability of the DPD and the relevant local laws depends on whether the MPD constitutes personal data or not. The DPD does not apply in case the MPD processed does not qualify as personal data. In such case the data could be freely used, including transferred to the state statistics authorities or third party service providers as may be necessary.

Since the qualification of data as personal data comes down to a matter of assessment in each given situation, there is no universal answer to that question. The laws and the practice in each sample jurisdiction are slightly different. Out of the four sample countries (Estonia, Finland, France, Germany) France is the only one where the regulator has provided some guidance as to anonymisation keys. In Finland the Data Protection Ombudsman has stated that purely pseudonymised data is not sufficient to be considered as anonymous. Today's guidance on the Article 29 Data Protection Working Party (Working Party) level has not addressed the topic at hand in sufficient detail (Working Party 2011). The general approach of the Working Party is, though, that MPD is as a rule personal data. Therefore, if not in aggregated form, it should be presumed that location data is personal data.

Recommendation: Updating and specifying the Working Party guidance would be one option to clarify the issue and achieve unified approach throughout the EU. However, given the differences in transposing the EU directives into local laws and consequent differences in implementation may prevent giving a unified guidance.

As long as the local laws differ, giving further guidance by local regulators on implementation of the statutory rules is recommended. If guidance on anonymisation keys is given, it may, depending on such guidance, occur that in certain cases anonymised location data is not deemed personal data and the processing thereof is subject to less formalities (e.g. if the anonymisation keys are valid for a sufficiently short periods of time, etc.). It is also highly recommended to consult the data protection authorities of all relevant EU countries to clarify the accepted practice of applying local laws.

4.2.1.2 Processing location data for official statistics purposes

If location data is in aggregated form (i.e. cannot be used to single out any individual) it can be processed for statistics purposes without limitation from the data protection perspective. If location data is deemed personal data (i.e. if it is not in aggregated form) the approach differs from country to country as to what specific terms and conditions must be met in order for such processing to be lawful.

Although the EU directives serve as the basis for relevant regulation in the Member States, the directives provide for quite some flexibility to the Member States upon transposing the directives into local laws. Consequently, the general unique principles set forth by the EU have been implemented differently in detail in local laws. Thus, in order to obtain a full overview of the obstacles set by local laws, the local laws of all relevant Member States need to be analysed in detail.

One possible solution to eliminate the need to obtain data subject's consent for the processing of personal data for statistics purposes is to verify if the data categories and intended use of the location data in the context of the study would be covered by those set out in Art 3.1 of Regulation 692/2011 that is directly applicable in all Member States.

Notwithstanding the above, since the practice of interpreting and applying the relevant acts is limited and ambiguous in the investigated countries it is highly recommended to further consult the regulatory authorities in each relevant Member State.

Alternatively, the legislation on the EU level should be amended to be introduced in sufficient detail with more detailed guidance to the Member States for implementation thereof. Given that the Draft Regulation is currently in the process of being negotiated, it would be useful to identify the possibilities of introducing such clarifying provisions in the Draft Regulation that will be directly

applicable in the Member States. More specifically, since the delegated acts that the European Commission will be entitled to give under the Draft Regulation will likely be the instruments whereby the specific criteria of processing data for statistics purposes will be set forth, the focus should be on finding ways to highlight the current deficiencies to the Commission and help them draft respective delegated acts so as to introduce the specific enough provisions. That would preclude the need to amend each relevant local law.

Apart from the legislative measures, contractual measures can be applied to overcome the statutory obstacles. The main issue common to all investigated jurisdictions is that either it is not possible to transfer the personal data to statistics authorities without the data subject's prior consent or it is not fully clear if and on what conditions it may be done. One should bear in mind that obtaining separate consents from data subjects is not practically feasible. Therefore, in each case where the data subject's consent for transfer of data to by an MNO to the state statistics authorities is needed, it is recommended that the MNOs' agreements with their customers include the customers' respective consent. The consent should not be part of the standard terms and the refusal by a customer to give one should not deprive the customer from entering into the agreement with an MNO. The data subject should be able to revoke the consent at any time. Detailed requirements to the terms and form of the consent should be investigated in each relevant jurisdiction.

4.2.2 Financial and business-related barriers

4.2.2.1 Financial burden for the MNOs

Financial interests were one of the most mentioned reasons for not providing data to interested users from the responses of the survey and interviews, which was further asserted by the consortium's efforts to access pilot data for the current study. MNOs have to take into consideration the required human and technological resources required to provide the data. In case of MNOs, these might be expressed in substantial financial figures.

The cost of the system that retrieves and processes the data in MNOs consists of the implementation (initial investment required to set up the system) and maintenance costs (price for keeping the system working) and depend on several variables:

- Size of the MNO / amount of data chunk to process;
- Allocation of the processing resources (i.e. whether MNOs only have to extract and deliver the raw initial data to the processing party outside or MNOs have to implement the full processing chain);
- The number of processes to conduct by MNO (i.e. forms of data: inbound and / or domestic and / or outbound; geographical probability calculation for usual environment, etc.);
- Maximum allowed latency (i.e. the maximum allowed processing time from the extraction of the initial raw data to the delivery of the data to NSI);
- External variables not foreseeable in this report (e.g. licencing of external technology, outsourcing costs and cost of internal resources – man-hours).

A rough cost estimate of such a system (full processing chain, all tourism forms) within one MNO with 10 million subscribers and a latency of 15 days is EUR 550,000 for the implementation and EUR 160,000 per year for maintenance. Please bear in mind, that the costs presented here are very rough indications because only MNOs themselves can provide the actual costs based on their internal calculations. The burden on each MNO for providing data continuously might vary greatly depending on the size and internal system complexity of the MNO. In addition to the implementation and maintenance costs on the MNO's side, of course also costs for the receiving party occur (i.e. the national statistical institutes (NSI)).

Obviously the internal costs for the MNO depend on the size of the MNO and the required latency (see Fig. 1 and Fig. 2). The cost of shortening latency time might increase exponentially (latency requirement shrinks towards the near-real-time) as substantial resources are needed to process the data, in addition to the fact that maintenance requires the constant monitoring and attention of specialists.

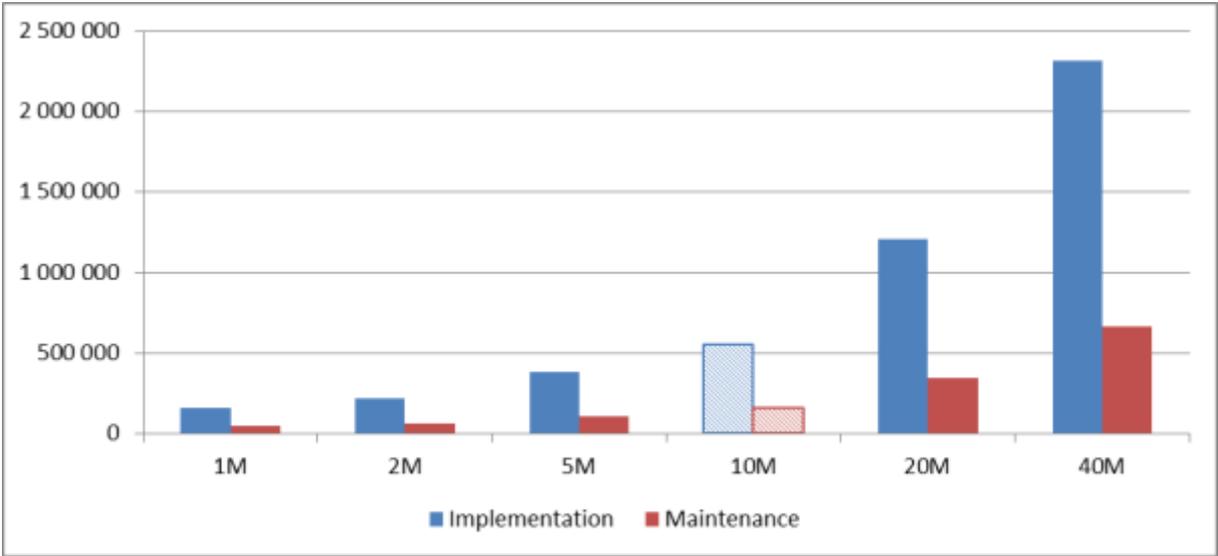


Fig. 1. Cost of the implementation and maintenance of the system based on the size of the MNO (in EUR, maximum extent, latency 15 days). Patterned bars represent the example MNO provided above.



Fig. 2. Cost of the implementation and maintenance of the system based on the latency of the processes (in EUR, maximum extent, 10M size MNO). Patterned bars represent the example MNO provided above.

4.2.2.2 Business secrets

Business secrets are strategically important information about the activity of MNOs. Access to such information by other MNOs could potentially harm the competitive advantage. MNOs consider losing sensitive business secrets to competitors more of a loss than any gain from learning about business secrets from other MNOs. MNOs are mostly concerned about the possibility of acquiring the following information by competitors:

- Number of subscribers (both domestic and roaming);
- Number of service activities (calls, messaging, data) in the network;

- Any information on the constitution of the subscribers (number of pre-paid vs. post-paid cards, socio-demographic information of the subscribers, number of subscribers from various foreign countries, etc.);
- Number and locations of network antennae (the release of this information might also be prohibited by law in some countries due to the terror threat to the vital telecommunications infrastructure of the country);
- Any financial information and strategic plans of MNOs;
- Technological capabilities and information on infrastructure and systems.

This issue is important as it was repeatedly mentioned by MNOs, but can be resolved by determining the procedures that do not allow such information to be exposed to competitors. Either such data would not leave the premises if the infrastructure of the MNO – only aggregated results provided to the receiving party, or the data receiver should have strict data processing rules that eliminate the possibility for third parties to distinguish data about different MNOs. However MNOs consider NSIs to be reliable partners and expect that sensitive business information will not be made available for third parties.

4.2.2.3 Public Opinion

MNOs see the potential in the usage of their data. The tourism statistics domain is mostly comprehensible and the value of the data for public and private users is understandable. Yet, MNOs have pointed out the practical issues that might affect their decision to provide delicate information. In addition to legislation, the main problem they see is the potential decrease of their corporate public image and the decrease of trust of the subscribers, which might lead to a fall in the number of subscribers. It is a business risk and a barrier. Even if the data is handled following all privacy preservation techniques and rules, it does not mean that this is easily presentable to the public and customers. This chapter opens the discussion on the concerns of people with the use of their private data, how they might respond to threats to privacy and how to mitigate very emotive negative responses. It is important to deal with the media before it deals with you. A proactive, open and stakeholder-engaging approach can lead to positive results.

It is important to start with what concerns a person enough to voice their concerns or boycott a service. The 2011 Eurobarometer survey showed that 70% of EU citizens are worried about the misuse of their personal data. And the organisations and agencies they trust the least with their data are telecommunications and internet companies. People are afraid that personal information is used for unknown or unintended purposes – that there is tracking undertaken with results that people are not aware of, that they cannot control and do not benefit from. The citizens of Southern and Western Europe were, on average more concerned than those of Eastern and Northern Europe.

4.2.3 Technological barriers

4.2.3.1 Technological accessibility

The technology has matured enough for the MNOs to be confident in their ability to provide necessary datasets. What needs to be considered is the cost of technology related to large databases, and also what, when and how often one measures. Then, it comes down to processing of data and finding the necessary algorithms, which can prove to be a challenge one has to handle but not a real barrier. Nevertheless, legal resolutions and financial resources have a major impact on the actual technological solution depending on where the data can be processed and how.

Figure 3 represents the general steps of the process from the raw data to the final aggregated and estimated results.

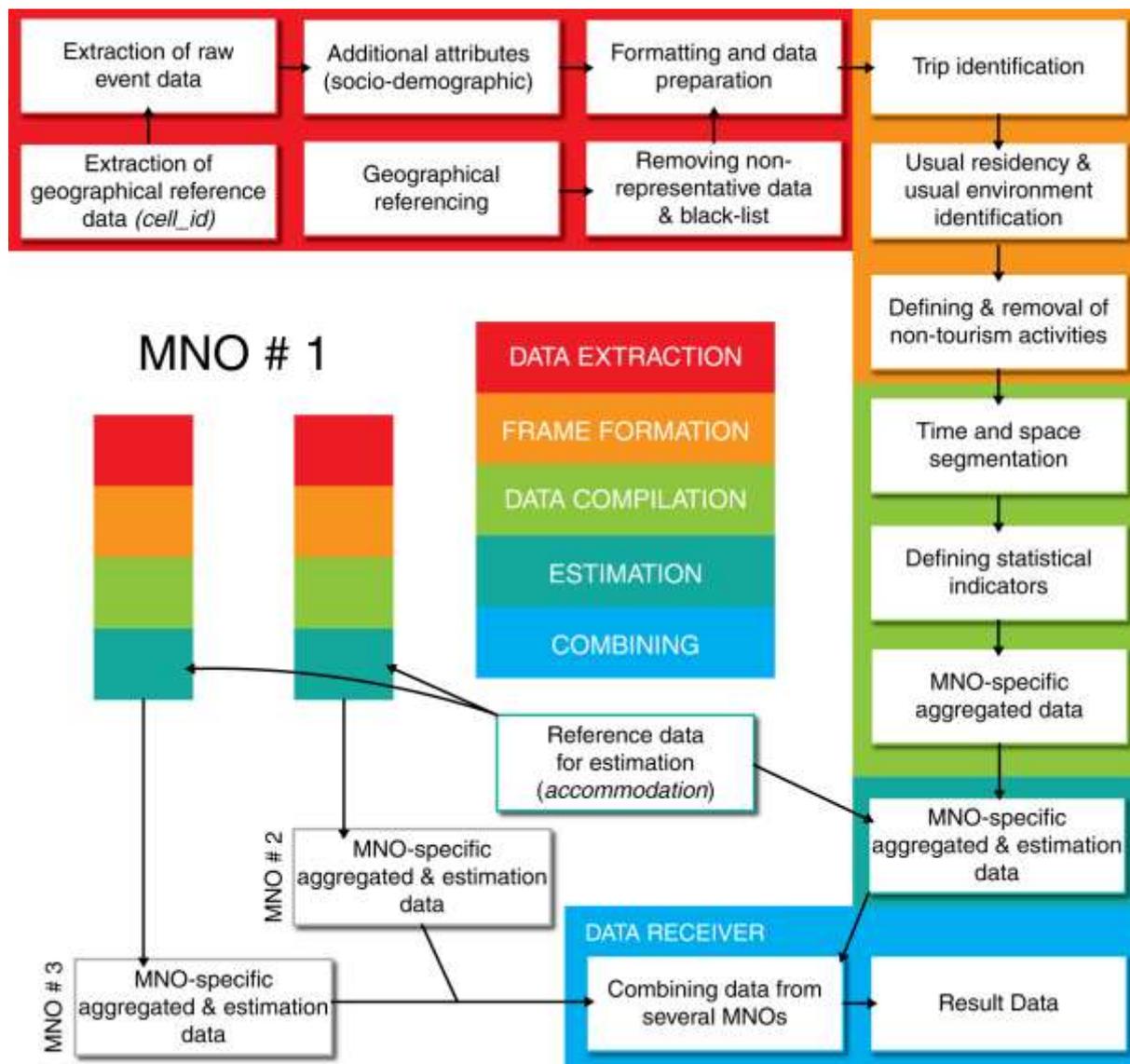


Fig. 3. Data processing steps

4.2.3.2 Patents and Intellectual Property Rights

The relevance of understanding patents and intellectual property (IP) rights for this feasibility study is that it provides an understanding of on-going technological developments and their direction as they take place in the European and global market place. The collection and processing of data for tourism statistical purposes – as explained in previous chapters – is technology intensive and sees the application of a range of data processing methodologies and techniques.

Because the actual relevance and potential infringement threat is fairly difficult to establish, it is not within the scope of the current report to declare the patents that act as barriers in generating tourism statistics. The presented list is merely an indication of the patents that might or might not be relevant to the technology used to generate tourism statistics. However such list might also present opportunities to involve technologies mentioned as their use might improve the quality of the data or simplify some processes.

4.2.3.3 Continuity of Data Access

From the point of view of tourism statistics and other domains where passive MPD can be used, it is important to be able to use the data continuously over a longer period of time for the sake of comparability over time and between regions. There are three main causes for this continuity to be altered. In all cases there can be positive and negative effects that might or might not have an effect on the quality of the data:

- Major global shift in mobile technology;
- Changes of the characteristics of the data;
- Administrative changes (e.g. changed number of providing MNOs).

It is difficult to foresee the final effect of the changes on the results when the changes have just been made. In some cases changes might not affect the outcomes at all if the methodology and the estimations are adjusted properly. Ideally including all MNOs in the country should have insignificant increase in the quality compared to a single MNO with good coverage and adequately implemented methodology and estimations. Each change should be well assessed before any adjustment is made.

If all of providing MNOs cease to provide the data, then there is little to do as historical data is not projectable to the future. Therefore the legal framework for using the data should minimize the possibilities for MNOs to bail out.

Some technological changes in the essence of the data (characteristics, type of data, etc.) might require the recalculation of historical data. In such case the recalculation can only be done using the stored initial data and if the effect on the results is major, then it will not be possible to compare the old and new results. Ideally change in the data source should not result in the change of methodology. If changes in the methodology are required, then such change should aim to be able to produce the same results as with previous methodology.

The flexibility to introduce the changes depends on the configuration and the setup of the system. From the point of view of the allocation of the technology the changes are more easily adopted when the processing resides outside of the MNOs and MNOs only extract, prepare and transfer the data to the processing party (e.g. NSI). In case of new available data MNOs only need to change the extraction process to include the new data types. Altering this process is fairly simple. However the following processing might require more extensive modification. If the following processes are allocated in NSI, then it is easier to modify as the changes have to be made in one system. But if the processes are located in MNOs, then all MNOs have to update the system to be able to handle the new data and this is more costly and time consuming. Obviously all such changes require a period of testing when new and old system might be required to run in parallel.

5. Conclusion

The objective of this paper was to show experiences and findings of different aspects of accessibility to MPD in the EU. This includes the description of and discussion on regulatory, privacy protection, technological and financial barriers as well as discussion on possible solutions where possible.

The survey showed that many organisations are interested in using MPD for the production of statistics and research. NSIs anticipate the value that this data source could bring to their field and there are some that have tried reaching out to operators, with only a few gaining access to the data as of yet. The main constraints to access are regulatory, privacy-related, and financial.

What interviews clearly brought out is that MNOs have the most concern regarding regulations. The value in providing data is understandable, and most MNOs sympathise with the idea of using the data

for statistics, but clearly state that many issues need to be dealt with before that is possible. MNOs are looking into utilizing their data commercially and are interested in tourism statistics as one potential domain. However financial concerns, possible disclosure of business secrets and the effect of public opinion are also considered important besides the regulatory concerns. From the privacy protection point of view, it is considered important that the sensitive private data of subscribers is used according to the legislation and is also presented to the public as appropriate, lawful and that the objective is not to track individual people. The MNOs are confident the technology is mature enough not to pose problems and the main technical problem is making sure the data is handled in a way that is methodologically correct.

Legal analysis concludes that there is no single clear understanding at the moment on how MPD can be used in generating statistics. Although the EU regulations and directives are same for every Member State, the underlying national regulations are implemented differently and do not propose a single simple way for NSIs to obtain such data. Although in some Member States it is possible to implement the effective national statistics act in order to enforce the requisition of the data from MNOs, in most Member States the act has to be amended in order for the statistics authority to have specific obligation to collect data from MNOs for specific purpose. Unfortunately, as legislation in this part differs, there is no single clear suggestion on how to do it conformably in every Member State. The same applies to the specific procedure and processes on the data acquisition – it is not clearly stated if the transmitted data should be personal or anonymous, processed or simply aggregated (though not essential, transmitting personal data provides the best outcomes in terms of methodology). This is also important from the point of view of the methodological harmony between Member States as implementation of the common methodology and processing logic would result in the smallest differences in the statistical results between Member States.

The alternative option is to introduce mobile data as required data at European legislation level (i.e. Regulation 692/2011) that is directly applicable in all Member States. However, for both options (local and EU level) the prerequisite is that mobile data is necessary for the performance of a specific task (e.g. the question becomes whether to meet the prerequisite the data should be inevitably necessary for the performance of the task or is it sufficient if the performing of a task is easier, more efficient, etc. as a result of processing the data compared to possible alternative measures).

During the project several MNOs were contacted for interviews, information on accessibility and technical consultation. MNOs were also asked if they could provide pilot data for the current study. Pilot data from three countries was accessed, but only the Estonian data proved to be of a sufficient quality for the required empirical tests in this study. Although contacted MNOs were interested in the project and showed interest in the outcome, only few responded to the possibility of providing the data. The main obstacles were connected to the regulations and missing legal basis for providing the data.

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