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# The impact of the distributed ledger technology on the Single Euro Payments Area development

**JEL Classification:** *F36; G15; G21*

**Keywords:** *SEPA; blockchain; distributed ledger technology; virtual currencies; financial integration*

**Abstract**
**Research background:** The year 2016 ended the period of the migration from national payment services to the Single Euro Payments Area (SEPA) instruments. At the same time, however, it has become apparent that some problems remained unresolved. Overcoming them requires finding suitable technological solutions. The potential of the distributed ledger technology (DLT) is currently being explored by the financial sector and its implementation may affect the SEPA schemes in a variety of dimensions.
**Purpose of the article:** The aim of the article was to determine the potential impact that the DLT transfer to the banking sector may have on the functioning of the SEPA in the future. The paper presents SEPA's assumptions and the current status of the project as well as the DTL's concept. It describes the technology transfer implications for the banking industry and compares the SEPA schemes currently operating with those based on the DLT. It also indicates the opportunities and threats that are the consequence of the new technology implementation and examines their significance for the SEPA.

**Methods:** In the article, a qualitative analysis is supplemented with a quantitative one. Elements of descriptive statistics have been used to characterize the functioning of the main pillars of the SEPA schemes. The final conclusions are based on the comparative analysis of the SEPA schemes and developed DLT applications.
**Findings & Value added:** The existing problems might be solved by supplementing the SEPA payment schemes currently operating with the applications based on the DLT. The systems that will be subsequently developed will provide the required real-time processing and a global reach. They will also extend the functionalities of the SEPA schemes with the ability to transfer other currencies. The implementation of this technology will result not only in new financial products but, first of all, in creating new business models. Consequently, we may expect a modification of the currently operating SEPA schemes, based on their supplementation rather than total replacement in a short time frame.

## Introduction

Since the establishment of the Economic and Monetary Union, the Eurosystem has aimed to create a single market for financial services. In order to implement the primary idea, various measures have been introduced, and they required a close cooperation between the European public institutions and market players. TARGET2 (the second generation of the Trans-European Automated Real-time Gross settlement Express Transfer system) and the Single Euro Payments Area (SEPA) are considered to be the most significant initiatives in the field of payment transfers.

As the year 2016 ended the period of the migration from national payment services to the SEPA instruments, it seems to be the right time to attempt at a certain summary of the project. It has become apparent that some problems are still unresolved. Non-existence of an operating pan-European instant payment scheme for retail transfers threatens with a re-fragmentation of the euro payments market, which is becoming a most urgent issue. Furthermore, the intentions of expanding the geographical scope of the SEPA have been not converted into concrete actions yet. Overcoming the shortcomings of the project requires finding suitable technological solutions.

On the other hand, the interest in the distributed ledger technology (DLT) derived from virtual currency schemes is rapidly increasing and the technology starts to be recognized as having the potential to reshape the financial market infrastructure. The realization of this vision may affect the SEPA schemes in a variety of dimensions.

The aim of the article is to determine the potential impact of the DLT transfer to the banking sector on the future functioning of the SEPA. The starting point for further considerations is the presentations of the SEPA's assumptions and the project's current status. The following characterization

of the distributed ledgers concept combined with the description of the technology implications for the banking industry provides grounds for a comparison of the SEPA schemes currently operating with DLT-based solutions. It also allows to identify the occurring opportunities and emerging threats that result from the implementation of the new technology and to indicate their significance for the SEPA.

## Methodology

The article presents the results of the authors in-depth analysis of the currently operating SEPA schemes and the DLT-based solutions tailored developed for the banking industry. The main sources of information have been legal regulations, publications of the European Central Bank (EBC) and other relevant institutions, as well as reports of various entities, including the Euro Banking Association.

The qualitative analysis has been supplemented with the quantitative one. For the characterization of the functioning of the main pillars of the SEPA Schemes the elements of descriptive statistics have been used. The newest *Payments statistics* published by the EBC, presenting comparable information separately for each EU Member state have been used as the ground for compiling the information regarding the share of non-SEPA transactions in the total value of funds transferred inside and outside the Eurozone.

Since the analysis of future consequences of the assumed DLT transfer from virtual currency schemes to the banking sector cannot be based on quantitative data, the Authors have decided to use the comparative analysis of SEPA schemes and the DLT applications. This has allowed to accomplish the aim of this article and has given grounds for the formulation of final conclusions.

## The creation of the Single Euro Payments Area and the main SEPA schemes

The Treaty on the European Union (EU) signed in Maastricht in 1992 couched the three stage approach to the European and Monetary Union (EMU) outlined in the Delors Report (Jantoń-Drozdowska, 1998, pp. 384–386). The EMU encompassed a close coordination of economic and fiscal policies, a single monetary policy, a single currency (euro) and the common financial institutional infrastructure.

In 1999, the ECB officially stated that the introduction of euro was an insufficient condition for obtaining the benefits that were expected in the area of retail cross-border payments. Their prices were substantially higher than the fees for domestic transactions, and their execution times were much longer (European Central Bank, 1999, pp. 5–7). Therefore, in 2002 the EU Authorities, seeking to increase the financial integration of the involved markets, launched the Single Euro Payments Area (SEPA) process, consisting of a series of initiatives aimed at the introduction of common instruments, standards and infrastructures for retail payments in euro. The main objective was to allow users to make payments in euro throughout Europe from a single bank account, using a single set of payment instruments, as easily and securely as in the national environment (Kokkola, 2010, pp. 187–188). The SEPA was also to encourage a shift from cash to electronic payments. Since empirical evidence suggests that the migration to electronic payment instruments might stimulate the real economy (Silva *et al*., 2016, p. 406), it was assumed that the standardization of transactions and their electronic processing might bring substantial benefits for various stakeholders.

The European banking sector responded to the EU Authorities' SEPA initiative and created the European Payments Council (EPC) — an international not-for-profit association focused on defining the basis on which the SEPA would evolve. The SEPA project has been organized in three layers. The first layer consists of the processing infrastructures which provide operational services. The second layer comprises common SEPA schemes governed by a set of interbank rules, practices and standards for the execution of the payments in euro. The third layer consists of products and services offered to customers by banks and other service providers on the basis of the core schemes (Kokkola, 2010, pp.189–190).

Currently, the SEPA includes payment service providers from 28 EU Member States as well as Iceland, Liechtenstein, Norway (countries of European Economic Area — EEA) and Switzerland. These non-euro countries have also chosen to adopt SEPA standards for their payments in euro.

The SEPA Credit Transfer (SCT) Scheme and the SEPA Direct Debit (SDD) Core and Business to Business Schemes are the crucial parts of the SEPA. The former, launched in 2008, enables payment service providers to offer a core and basic credit transfer service throughout the SEPA for either single or bulk payments. The latter, launched in 2009, serves as a basis for processing direct debits in the private and business customers sectors.

The migration process to the SCT, as well as to the SDD Scheme, started in 2008. By 1 August 2014, all euro-zone countries had replaced national euro credit transfers and direct debits with the SEPA schemes. Non-euro

countries had to comply with the SEPA Regulation by 31 October 2016, and now the migration process is over. Consequently, all euro-denominated credit transfers and direct debits initiated in SEPA countries and sent to accounts in other SEPA countries now rely on the SCT and SDD Schemes.

Despite that, a significant part of executed transfers in the EU is categorized as non-SEPA. This also refers to countries with the single currency in use. For the whole euro-area more than a half of all transfers (taking into account their value) were non-SEPA ones — in 2014 as well as in 2015. Direct debits met the requirements of the SEPA more frequently. In the Eurozone, only one third of direct debits executed in 2014 and one fifth of those completed in 2015 were described as non-SEPA. The share of non-SEPA credit transfers and non-SEPA direct debits in the value of transactions in all EU Member States are shown in the figures 1 to 4. It can be assumed that the cause of these state of affairs are funds transferred outside the SEPA, transfers in other currencies and transfers called instant payments.

The continued use of non-SEPA compliant products is one of the outstanding issues (PwC, 2014, p. 13). As expectations for immediate payments are growing, the SCT Scheme seems to be an insufficient "remedy" for retail payments market in EU, especially in the context of market integration. The lack of a pan-European instant payment scheme threatens with the re-fragmentation of the euro payments market as common schemes might by replaced by systems developed for national markets only. Therefore, the EPC has engaged in the creation of the SEPA Credit Transfer Instant (SCT Inst) Scheme — a separate system for immediate (real-time) payments. In contrast to SCT and SDD Schemes, the participation in the SCT Inst Scheme will remain, at least for some time, optional. Service payments providers have had the possibility to notify their adherence to the scheme since January 2017, but the launch of the scheme was scheduled for November 2017 (European Payments Council, 2017). Although its rules have already been published, its final form is still to be clarified.

While the SCT Inst Scheme is being launched onto the market, the SCT and SDD Schemes still have the opportunity for further growth owing to new participants. The participation criteria express certain intentions to expand the geographical scope of the SEPA beyond the EU and the EEA (European Economic Area). To join the system, the Applicant (a bank or financial institution from a non- EEA country or territory) must demonstrate the ability to use euro in payment transactions and prove a strong economic relationship with the EU, as well as meet several other requirements (European Payments Council, 2015, pp. 2–4). The above criteria, addressed to the non-EEA banks and financial institutions reflect the open

stand of the involved EU Authorities and their wish to expand the geographical scope of the SEPA Schemes.

## Distributed ledgers as an alternative to central registers

The execution of real-time payments as well as expanding the geographical scope of SEPA requires the creation of an adequate financial infrastructure that would be appropriate for participants located in various parts of the world. It may lead to the reorganization of the whole system, since in such payment schemes the superordinate role of European financial institutions might be questioned. The number of national currencies in EU Member States as well as SEPA's potential partners may induce the extension of the SEPA schemes' functionalities with the ability to transfer other currencies. A possible solution to all indicated problems is the development of payment schemes based on the blockchain or distributed ledgers — a technology derived from virtual currency schemes that were launched onto the market with the advent of Bitcoin.

Modern payment systems are generally centralized. They have a master ledger that keeps track of transactions maintained by a trusted central counter-party, which is also responsible for transfers validation. In a distributed ledger system, multiple copies of the central ledger are maintained across the established network by a large number of private entities. Transactions are validated with technologies derived from cryptography, allowing a consensus to be achieved across the network members regarding the validity of the ledger (He *et al*., 2016, p. 18).

The term cryptotechnologies refers to the combined application of different cryptographic techniques on a decentralized network to create a distributed ledger which presents a singular repository of transactions or account balances not requiring a centralized control (Euro Banking Association, 2015, p. 6). Being a kind of a shared database, it allows the network participants to store information relating to transactions executed or account balances of a given digital asset and to transact them as well. While carrying out transactions, the ownership of those assets is verified and a set of transactions called a block is validated by a distributed computer network. Then each transaction is recorded in a blockchain acting as a history log. Alternative versions of such systems, classified as consensus ledgers, do not keep track of transfers history, but instead operate on the basis of a consensus reached on a ledger of accounts, which are updated with new transactions at each validation round (European Central Bank, 2016a, pp. 1–2).

In fact, the technology is not merely another version of a more technologically advanced transaction system. For some the key to understanding this phenomenon is to think of it as a protocol, akin to those that underpin the Internet. Therefore, the technology is sometimes described as an "Internet of money" (Ali *et al*., 2014, p. 272). The Blockchain is an open, global infrastructure upon which other technologies and applications can be built. Thus, it allows people to bypass traditional intermediaries in their dealings with one another, thereby reducing costs of transactions and speeding up their processing (Underwood, 2016, p. 15). It has broad implications for the way of transacting over an electronic network.

## DLT applications tailored for the financial industry

The awareness of the technology's potential has been growing rapidly, and this prompts financial institutions to explore the emerging opportunities. An increasing number of business entities are considering the implementation of various transfer and recordkeeping solutions based on DLT. Already 80% of banks have declared the willingness to initiate such projects by the end of 2017 (World Economic Forum, 2016a, p. 14).

These plans entail extensive modification of the acquired technology. The characteristics of the technology that are crucial in virtual currency schemes (such as pseudonymity of market participants — meaning the possibility of using pseudonyms instead of real identities, immunity from supervisors, accessibility of the ledger copies to anybody all over the world or irreversibility of executed transactions) are not relevant to financial industry. Instead, the institutions in the sector focus on the compatibility of the technology used with the standard they are required to meet (Pinna & Ruttenberg, 2016, p. 11). Consequently, financial institutions cannot copy directly the solutions used in virtual currency schemes that are a kind of payment systems with an in-built transfer mechanism based on the blockchain technology, but have to adapt the technology to their own needs.

Technologies classified as asset-centric are potentially the most interesting category for the transaction banking and payments domain, both for processes within and between organizations. Currently operating DLT systems based on the technology, such as Ripple, Stellar and Hyperledger, concentrate on the exchange of digital representation of existing assets — e.g. fiat currencies or various securities. They use the non-public version of a shared ledger. The network participants use these systems to issue digital assets which are subsequently used as the basis of executed transfers. Direct links created between system users allow payment service providers,

who form the nodes of such network, to transact with trusted partners on an exclusive basis without the use of third parties' support. Some of those entities are additionally entrusted with the task of converting traded assets and act as "gateways" bridging the gap between the physical and virtual world (Euro Banking Association, 2016, pp. 4, 9–10).

Solutions based on the technology increase efficiency in different areas, providing — among other benefits – real-time processing combined with cost-effectiveness. They can also be integrated with legacy IT and legal frameworks (Euro Banking Association, 2016, pp. 4, 10). Existing studies have not, however, analysed their effectiveness, especially from the technical perspective. The identified main research gaps include the lack of research on the blockchain usability and concentration on Bitcoin environment at the expense of other fields, where this technology could be applied (Yli-Huumo *et al*., 2016, pp. 21–22, 23–24). Nevertheless, the technology is expected to lead to the emergence of innovative payment solutions. Their introduction may provide various benefits among which the most important are:

- transfers in multiple currencies with the use of a single transaction system;
- global reach;
- real-time payments;
- 24/7/365 processing;
- cost-effectiveness and a consequential significant cost reduction, especially in international transactions;
- automatic recording of transaction from different locations combined with secure and cost-effective data storing solutions.

The foresight regarding forthcoming changes is really hard. Nevertheless, according to the World Economic Forum's analysis, the new financial services infrastructure built on the distributed ledgers "will redraw processes and call into question orthodoxies that are foundational to today's business models". It will be one of the technologies that form the foundation of the next-generation financial services infrastructure (World Economic Forum, 2016a, p. 18). So far, information technology has contributed significantly to the evolution of financial markets, yet without revolutionizing the way in which financial institutions interact with one another. DLT may change this, bringing about revolution in the sector (Pinna & Ruttenberg, 2016, p. 2).

The above assumptions are based on the characteristics of a distributed ledger technology, which determine its ability to carry out tasks typically performed by intermediaries and other institutions currently forming the market infrastructure. This would entail replacing the current inter-banking

infrastructures with those based on central nodes in charge of operations such as authorization, clearing, fraud prevention, dispute resolution and execution of payments and contracts (Garcia, 2015).

## DLT solutions competing with SEPA systems

The actual impact of distributed ledger technology on the financial market and its infrastructure will depend on the way in which market participants will embrace it. Although the future is uncertain, the scenario in which the group of core market players adopts the technology, thus providing so called critical mass achievement, able to shift the whole market segment to distributed ledger-based solutions, is identified among the most probable ones, even by the European Central Bank (Mersch, 2016).

DLT-based applications prove to be more competitive when compared to the systems currently ensuring the functioning of the SEPA. The summary of basic characteristics of both systems is shown in the table 1.

The solutions based on distributed ledgers will provide a possibility of transferring various currencies on a global scale and make instant payments a standard. These parameters cannot be achieved in the currently operating main SEPA systems.

The indicated advantages should be juxtaposed with costs incurred by network participants as well as end users. Currently, a comparison of actual transactions costs between the analysed systems is not possible. Nevertheless, there are grounds for presuming that the ultimate costs of DLT transfers will not be higher than that of the SEPA ones. On the other hand, the potential savings related to the new technology implementation should not be overestimated. Estimates as those made by analysts at Santander InnoVentures, which suggest that by 2022 the technology could have saved banks more $20 billion annually as a result of savings in settlement, cross-border payment and regulatory costs (Fanning & Centers, 2016, p. 56; World Economic Forum, 2016b, p. 8), seem unrealistic. They are also made in isolation from the technology set up and the transitions costs.

There are, however, other areas where DLT-based applications could prove their superiority over currently operating SEPA schemes. The migration from national services to SEPA instruments completed in 2016 has led to cost reduction in cross-border transfers, but has not solved other problems in the field of payment. The lack of pan-European instant payment schemes seems to be the most urgent issue. The expected shift to instant payment execution offers an opportunity for new processes and technologies, whereas decentralized payment networks are considered to be one of

the main alternatives that can feasibly provide real-time services (Mai, 2015, p. 1, 11).

In fact, systems based on distributed ledger technologies should not be regarded as conflicting with the main idea underlying the Single Euro Payments Area and the solutions that have arisen on this ground. Due to their multi-currency option, they could ultimately contribute to further financial integration in the EU, where besides euro there are several national currencies in use as well, and a common payment system for only one currency seems to be insufficient. The DLT systems may lead to the realization of the idea of extending SEPA's geographical scope.

Despite this perspective, there are concerns that a multitude of different approaches could jeopardize financial market integration by increasing fragmentation, and in consequence hamper the smooth functioning of SEPA. If market participants or clusters adopt their own models respectively, this could be to the detriment of standardization and interoperability. The risk in this case is the consequence of the fact that distributed ledgers allow users to modify records in a shared database without necessarily needing to use a central validation system that imposes its own standards and processes (Pinna & Ruttenberg, 2016, p. 6, 23). Thus, establishing common technical standards and business rules should be a prerequisite to reap full benefits of the new technology without any negative impact on the market harmonization. This requires involvement of the Eurosystem's institutions.

The EBC recognizes the technology as not sufficiently mature for use in central banks market infrastructure, precluding their settlement services operation in a DLT environment. Instead they consider central banks interoperation with DLT-based settlement services offered by external entities. This may prove unavoidable if the solutions mentioned above are adopted by the users of the Eurosystem infrastructure. In order to lead the way in forthcoming changes, the EBC has engaged itself in international collaboration. Together with the Bank of Japan it has launched a joint research project on the possible use of DLT for the market infrastructure (Mersch, 2016). This initiative is not the only one in the Eurosystem. For example, the Banque de France, the country's central bank launched an experiment using the technology to evaluate the consequences of decentralizing SEPA ledger management functions (Banque de France, 2016).

Such intense efforts should bring desired results. Finding satisfactory technical solutions does not, however, guarantee smooth functioning of the single payment market. Payment habits are slow to change, and the payment market still differs across Europe. The successful introduction of SEPA does not automatically translate into the convergence of actual pay-

ment behaviour in European Union Member States (Martikainen *et al*., 2015, p. 81). Nonetheless, systems based on distributed ledger technologies could significantly support the convergence process as they are a reflection of the present trends: globalization, virtualization, networking, active users' participation and striving for cost reduction. Therefore, they have a good chance of general acceptance (Mikołajewicz-Woźniak & Scheibe, 2015, p. 375). It seems to be an excellent ground for mastering the market.

## Conclusions

With the establishment of the Economic and Monetary Union, it was clear that streamlining complicated processes would be essential to making cross-border payments faster and more cost-effective. The Eurosystem has been working to put in place a harmonized financial infrastructure facilitating the task. The creation of the Single Euro Payments Area has been one of this infrastructure's pillars. The migration from national services to the SEPA instruments, completed in 2016, has contributed to the achievement of the main objectives of the project. However, stopping at this stage would mean leaving many problems unresolved and resigning from further expanding the SEPA's geographical scope.

The problems mentioned here might be solved by supplementing the SEPA payment schemes operating currently with those based on the distributed ledger technology derived from virtual currency schemes launched onto the market with the advent of Bitcoin. The developed systems will provide the required real-time processing and a global reach as well as they may extend the functionalities of SEPA schemes with the ability to transfer other currencies. This factor might be crucial for EU Member States that use national currencies as well as for potential new SEPA participants coming from various parts of the world. In such a scenario, a regional integration would be replaced with the global one.

The anticipated benefits of the distributed ledger technology implementation in various sectors of financial market motivate market participants as well as infrastructure providers and central banks to explore the technology. This should result not only in new financial products, but first and foremost in creating new business models. Thus, the implementation of technology will lead to reshaping the market infrastructure and transactional systems. It may also form the basis for further development of the SEPA Credit Transfer Instant Scheme. Consequently, we may expect modification of the currently operating SEPA schemes, based on their supplement rather than total replacement in a short time frame.

The distributed ledger technology has undoubtedly an enormous potential to improve the effectiveness of individual institutions as well as the whole financial market, but it is not yet completely mature. Furthermore, critical operational, legal and governance issues are still not sufficiently clarified. Depending on which the direction of action is chosen, distributed ledgers-based solutions will remove the existing shortcomings of SEPA systems by solving various issues relating to the financial integration in the EU, or induce a re-fragmentation of the market. This is therefore a great challenge for institutions involved in the realization of the SEPA project.

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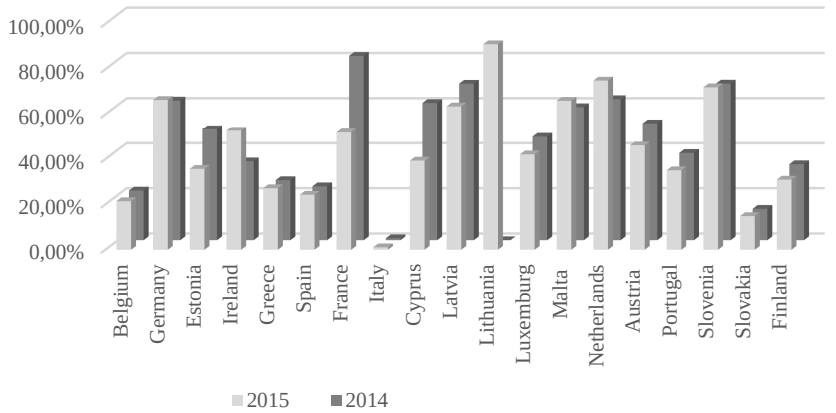
## Annex

**Table 1.** Comparison of the currently operating SEPA schemes and developed DLT-based solutions

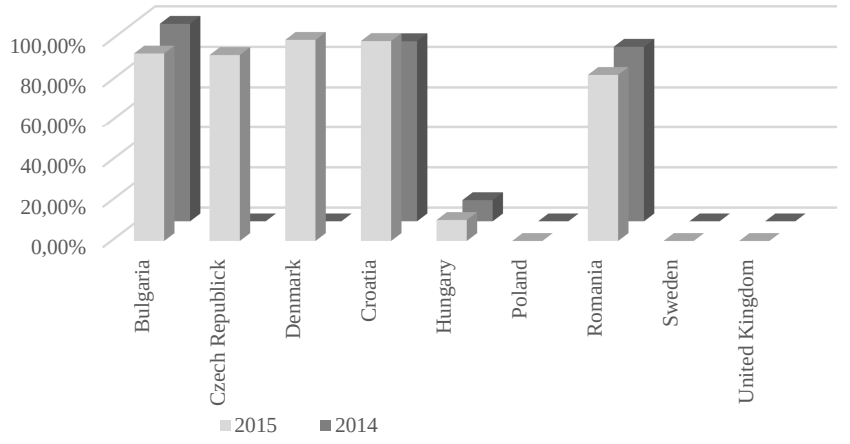
| Systems characteristics | SEPA schemes | DLT-based solutions |
|---|---|---|
| **payment instruments** | credit transfers<br>direct debits | credit transfer at the initial stage of systems functioning, other instruments introduced in the next phase |
| **currency** | euro | at least the main currencies |
| **geographical scope** | European countries being SEPA members | global |
| **clearing and settlement** | dependent on payment instrument, usually delayed for one day | instant payments |
| **processing** | differing, dependent on the system's type | 24/7/365 |

**Figure 1.** The share of non-SEPA credit transfers in the value of all credit transfers – the Eurozone



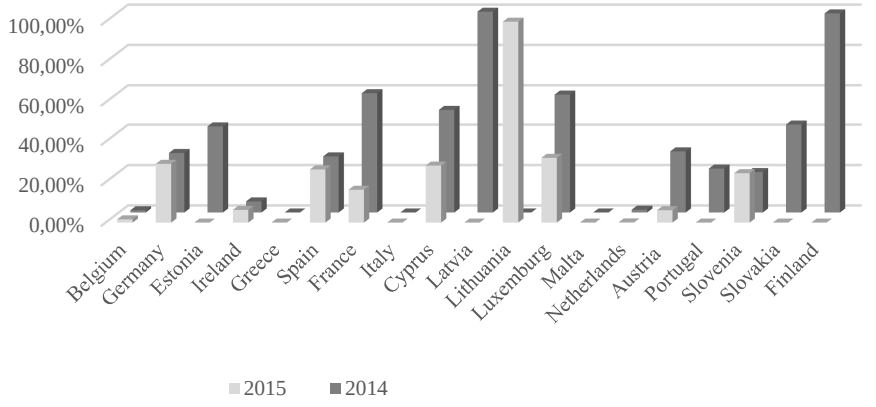

Source: own calculation based on the European Central Bank (2016b).

**Figure 2.** The share of non-SEPA credit transfers in the value of all credit transfers – the EU Member States with national currencies



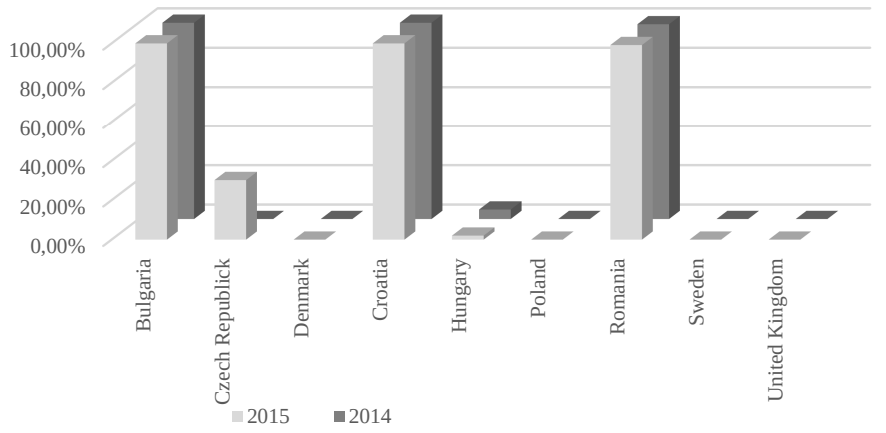

Source: own calculation based on the European Central Bank (2016b).

**Figure 3.** The share of non-SEPA direct debits in the value of direct debits – the Eurozone




Source: own calculation based on the European Central Bank (2016b).

**Figure 4.** The share of non-SEPA direct debits in the value of direct debits – the EU Member States with national currencies




Source: own calculation based on the European Central Bank (2016b).