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Working Paper

Network-based analyses of Hungarian cash supply

MNB Occasional Papers, No. 104

Provided in Cooperation with:

Magyar Nemzeti Bank, The Central Bank of Hungary, Budapest

Suggested Citation: Bódi-Schubert, Anikó; Ábrahám, Zsolt; Lajkó, Erika (2012) : Network-based analyses of Hungarian cash supply, MNB Occasional Papers, No. 104, Magyar Nemzeti Bank, Budapest

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Anikó Bódi-Schubert–
Zsolt Ábrahám–Erika Lajkó

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2012



MAGYAR NEMZETI BANK

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The views expressed here are those of the authors and do not necessarily reflect the official view of the central bank of Hungary (Magyar Nemzeti Bank).

Occasional Papers 104.

Network-based analyses of Hungarian cash supply

(A magyarországi készpénzellátás hálózati szempontú elemzése)

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Budapest, July 2012

Published by the Magyar Nemzeti Bank

Publisher in charge: dr. András Simon

Szabadság tér 8–9., H-1850 Budapest

www.mnb.hu

ISSN 1585-5678 (online)

* The authors special thank goes to Andrea Gelei, the associate professor of the Corvinus University of Budapest for her valuable remarks and criticism.

Contents

Abstract	5
1 Introduction – network characteristics and the economic significance of cash logistics	6
1.1 Methodology of the study	7
2 Conceptual framework of the study – concept of business networks	8
2.1 Concept of the business network and its evolution	8
2.2 Guiding principles of the network, interdependency of actors	11
3 The subject of our analysis – cash	13
3.1 The value-based approach to cash, as a special product	13
3.2 The use value of cash	14
3.3 The accession and time value of cash	16
4 Structure of the cash supply network	17
4.1 Actors, activities and resources in the network	17
4.2 Summary – business processes in the network	26
5 Assessment of the operation of the Hungarian cash network	30
5.1 Configuration	30
5.2 Coordination	31
5.3 System of relationships of network actors	34
5.4 Interpretation of efficiency in the operation of the cash network	35
5.5 Recommendations for improving the efficiency of the operation of the network	38
6 Summary	41
7 References	42
8 Annex	45

Abstract

This paper focuses on analyzing the cash supply network, in which the central bank – as an institutional member – acts as a key influencing node/party. By analyzing the case study example of the Hungarian cash supply, the paper introduces the different kinds of special network patterns that can appear in cases, when the network exists in an institutional (B2A) context and the institutional network member has a special regulatory role in influencing the manner of other business network members.

The research findings are based on the application of the case study method. One case will be analyzed that focuses on introducing the main features of the Hungarian cash supply network and the behavior of its key members [central bank (the institutional one); cash logistic providers, commercial banks, post office, retail chains (business ones)].

From managerial point, the analyzed case provides evidences that influencing and interplaying network effects are valid for an institutional member as well, even if it has "special rights" to influence the basic network processes and structure.

JEL: M190, M110, L140.

Keywords: network, institutional-business network, network members, cash, cash supply.

Összefoglaló

A tanulmány a hazai készpénzhálózat felépítését elemzi, amelyben a központi bank - mint intézményi szereplő - kiemelt befolyással rendelkezik. A magyar készpénzhálózat fejlődésének elemzésén keresztül a tanulmány bemutatja milyen speciális hatások jellemzik egy üzleti-intézményi hálózat működését, amelyben az intézményi szereplő szabályozói jogokkal rendelkezik.

A bemutatott kutatási eredmények empirikus esettanulmány-feldolgozáson nyugszanak, amely elemzi a magyar készpénzhálózat jellemző tulajdonságait és kiemelt szereplőinek [jegybank (intézményi), kereskedelmi bankok és posta, készpénz-logisztikai szolgáltatók, kiskereskedelmi láncok (üzleti)] viselkedését.

Menedzsment szempontból a tanulmány megállapításai fontos üzenetet hordoznak: rámutatnak arra, hogy még az erős szabályozói hatalommal felruházott intézményi szereplők sem függetleníthetik magukat a hálózati hatásoktól; szabályozói döntéseiket a hálózati struktúrára és a további hálózati szereplők adottságaira tekintettel kell meghozniuk.

1 Introduction – network characteristics and the economic significance of cash logistics

Our study is clearly business oriented, focusing on the network-based analysis of the Hungarian cash supply system. Nowadays, it is commonplace to say that complexity of relationships among enterprises and business networks rather than individual companies compete with one another in the real economy. As the role of networks has emerged in recent decades, the fundamental nature and tool set of competition within industries or between industries and countries has changed (Gelei, 2009). As business networks have become the building fundamentals of the global economy, both strategic management and supply chain management and the thinking about relationship marketing have changed, with a focus on the effective identification of potentials in the relationships between companies and the exploitation of the resulting competitive advantages (Pecze, 2006).

Our study uses the example of cash to demonstrate that this network effect is clearly exist not only in the business sector but also in the “mixed” relationships between the public sector and the real economy, and that the regulatory node (in our case, the central bank) may not neglect them in its regulatory and management decisions. In this context, this chapter offers a brief discussion of the economic significance of cash logistics; Chapter 2 reviews the theoretical literature on the network concept. Chapter 3 looks at cash, the subject of the analysis, as a product, followed by the presentation of the evolution and development of the Hungarian cash network in Chapter 4. Chapter 5 analyses and evaluates the cash network from the aspects of network configuration and coordination while the last chapter examines issues of network efficiency.

Logistics can be considered as a set of activities that systematizes the flow of persons, materials, information, energy and cash within and between systems. It's basic aim is to satisfy customer needs and the demands of cost efficiency (Halászné, 2001). Traditionally, the role of logistics is to coordinate (plan, control, realize, monitor) material and information flows in the value chain. The logistics strategy of manufacturing entities is generally integrated into their purchasing, inventory management and distribution policies, often supplemented by the management of reverse flows.

Today, the streamlining of logistics operations is a priority economic objective on the macro and micro levels alike. The reason for this is illustrated in the framework of double value creation:

- Important changes happened in the dimensions of consumer value creation: essentially, **consumer value increase is focused more and more on the accession and time value of the products**. This has major implications both for the competitive environment and for corporate operations. Services that raise the standards of meeting consumer/user requirements and bring the product closer to consumers are becoming ever more important facets of competition. Integrated supply chain management, business networks and resource sharing are becoming key concepts. Consequently, the role of IT and logistics is appreciating and their scope is expanding in the value and supply chains.
- It is generally true that logistics is an activity of outstanding importance for shareholder value creation: in the case of manufacturing companies, logistics expenditures constitute a notable part of the products' unit cost.¹ Logistical operations are rather resource intensive, thus these days logistics are widely outsourced for economies of scale reasons. Increasing fuel and time costs only reinforce this trend. Thus the streamlining of logistics both on the macro and micro levels is indispensable for economic efficiency; as a result, the establishment of infrastructure facilitating efficient logistics is in the interest of the whole national economy.

¹ For an average enterprise, total logistics costs correspond to around 8.28% of sales revenues, the figure varying between industries and products.

Analogously with the definition of logistics, **cash logistics** is responsible for all the material and information flows that contribute to the immediate availability of sufficient quality and quantity of cash to economic actors (the state, enterprises and households) for the execution of their transactions. Two equally important objectives must be achieved in the course of cash logistical operations: uninterrupted and efficient cash supply and the quality of banknotes in circulation.

The appropriate functioning of the cash supply system has a welfare value, thus logistical flows in the case of cash deserve special attention also for reasons other than the business considerations listed above:

- **It is essential for the proper functioning of the economy that the payment and settlement systems operate smoothly and efficiently** because cash facilitates the exchange of other goods. Cash plays a major role in this process considering that it is still the most common mode of payment despite the appearance and spread of cash substitutes. In the US cash circulation increased by 76% between 1990 and 2005 and according to projections made at the time, by 2010 the stock of cash circulating in the economy would reach 1000 billion USD (Rajamani et al., 2005). In the UK, 66% of household consumption is forecast to be still paid for in cash in 2011 (Rajamani et al., 2005). Similarly, in Hungary cash is the dominant mode of payment in terms of the number of transactions (Turján et al., 2011).
- Central banks guarantee confidence in cash and cash transactions: they assure that the cash requirements of the economy are satisfied, they continuously monitor the quality of cash in circulation, they take action against cash counterfeiting and, indirectly, they sustain the stability of the value of cash by curbing inflation. They do all this using taxpayer money and public resources. **Consequently, the rational operation of cash supply is particularly important to assure efficient redistribution of national resources.**

1.1 METHODOLOGY OF THE STUDY

Our study has a descriptive nature: we wanted to verify the applicability of established theories and analytical methods in business practice. The methodology we used in our research is essentially qualitative, relying mostly on secondary data analysis and direct participant observation. The following techniques were used for data collection:

- Six semi-structured interviews were conducted. When selecting interviewees, we strived to contact the key players in the sectors relevant for the cash network or their representatives. That is how we chose the heads of cash logistics at Magyar Nemzeti Bank, Magyar Posta Zrt., G4S Készpénzlogisztikai Kft. Security and OTP Nyrt. (4 interviews), and two other experts from MNB (2 interviews). During the interviews, detailed hand-written notes were taken.
- In the course of the analysis of documents we studied international literature on cash logistics and reviewed internal corporate documents (presentations, analyses) made available to us by key actors in the industry.
- One of our co-authors works as a cash policy expert at the Magyar Nemzeti Bank; because of his position, he has direct experience on the workings of the cash network. The experience gathered in the course of this participant observation was also an important element in the analyses.

2 Conceptual framework of the study – concept of business networks

In contrast with the classic economic approach that regards transactions between enterprises and/or citizens to be independent, unique events, the concept of business networks evolved in management studies in the 1970's, mostly drawing on interfirm marketing research².

In this period a number of theoretical concepts emerged to describe the cooperation of businesses, adapting to changes in management practices: triggered by the ever keener competition in the world of converging, dynamic industries and technological revolutions, strategic alliances mushroomed. A paradigm shift was also called for in day-to-day corporate management and in the underlying theoretical concepts. The concept of business networks evolved as part of that process. On the one hand, it offers a uniform framework for the systematic analysis of the dynamic, multilevel business environment surrounding a company. On the other hand, it normatively encourages the shift from the prevailing egocentric attitude towards a more cooperative business thinking, thereby supporting the idea of shared value creation.

Under the network concept, the cooperation between enterprises is seen as a complex process of mutual interactions. The relationship between enterprises is considered as independently existing, which cannot be controlled by the unilateral decision of either party; the activities, resources and capacities possessed by the enterprises in the relationship can be activated only in the framework of the relationship concerned and they are assessed and utilized in that context (Gelei and Mandják, 2011).

2.1 CONCEPT OF THE BUSINESS NETWORK AND ITS EVOLUTION

In this section we briefly describe the concept of the business network used as the theoretical framework for our paper. In our summary of literature we rely primarily on the publications of the international research team known as the Industrial Marketing and Purchasing Group (hereinafter: IMP).

In order to understand the meaning of network operation that is in the focus of the analysis, we must be familiar with the major milestones of the evolution of the business network. The starting point of the formation of relationships is the **exchange** or **transaction**³ between enterprises. Ford et al. (2008, p. 7) define transaction as the unique and discrete transfer, with a content of its own, of products, services or money between actors. A transaction is seen as a *mechanism* between the actors that connects them for the duration of the transaction but it has limited independent content. Transfers are reciprocal, they are based on the needs of the actors but it happens without any significant intervention between them. The schematic process of exchanges between actors is illustrated in Figure 1.

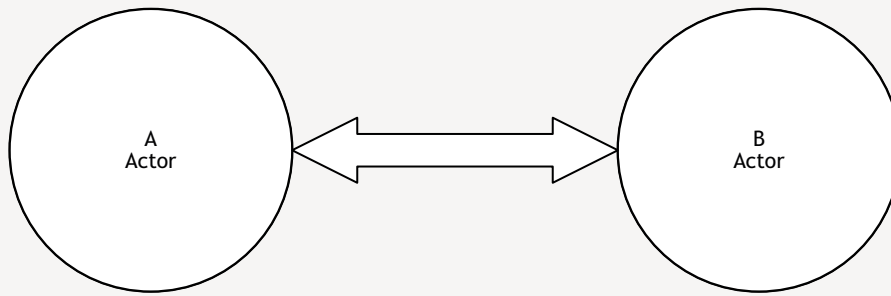
Håkansson (1982) calls the repetitive sequences of unique, simple exchanges or transactions with different objects **episodes**⁴. Similarly to transactions, episodes have the focal element of the *exchange of products or services* between the parties; its characteristics depend on whether the buyer's needs are clearly defined and how complex the product characteristics are. The *exchange of information* accompanying the products is another component of episodes; it may consist of formal or informal, well or badly structured elements and it may contain typically interpersonal or interorganisational

² The research projects launched by the Industrial Marketing and Purchasing Group established at the University of Uppsala in Sweden were the flagships of the spread of the relationship/network based research and study approach in Europe, the theory based primarily on qualitative research. Simultaneously, network thinking also appeared in the management schools of North America, mostly relying on the quantitative analysis of the measurable elements of interactions between enterprises.

³ Several authors refer to this as exchange transaction, see Kapás (2002), Bárdos (2004).

⁴ The transaction cost theory calls these episodes exchanges, see Williamson (1975, 1979).

Figure 1
Exchange or transaction between enterprises



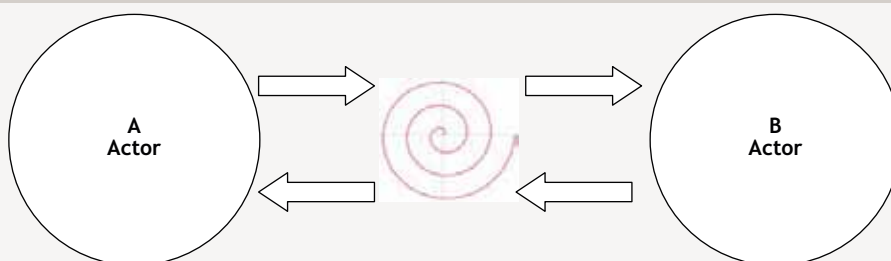
Source: Ford et al. (2008, p. 8)

elements. The exchange of products or services is followed by a *financial execution process*, the form and terms of which are often factors of uncertainty within the episodes. In addition to the elements listed in the context of transactions, episodes also contain *social factors*, which contain characteristics such as the cultural attitudes of the parties, mutual trust or the will to establish trust. Social elements tend to be the softest, most difficult to define elements of relationships. Within the unique interactions and episodes, or related to them, there are unique and reciprocal **actions** (Holmund, 2004) between companies, which may entail discussions of operative details, posting and receiving orders, deliveries or even telephone calls. Thus actions consist in the independent activities of the parties, the interlinked series of which constitutes the episode itself.

The phenomenon of **interaction** relates to the processes of interfirm cooperation, which results from a sequence of episodes between actors and creates a system of relationships where a structure composed of the two parties emerges which cannot be unilaterally controlled and/or managed by either party (Ford et al., 2008). Interaction between actors is illustrated in Figure 2, which shows that interaction means an independent set of processes going beyond participants that emerges in the course of cooperation. According to Blois (1972), the processes of interaction between enterprises may become so significant that they take on quasi-organisational characteristics, making the interaction even more institutionalised and turning it into an interfirm relationship. In the course of the interaction, the responses and counter-responses to the actions in the interfirm cooperation are at least as important as the original action (Mandják, 2005). Thus interaction in interfirm cooperation is a consciously managed system of processes that can be interpreted on the level of processes, which contributes to the institutionalisation of the linkages between the cooperating parties and to the establishment of solid relationships between actors.

In the view of the researchers of the IMP Group (Håkansson, 1982; Ford et al., 1986), the *processes of interaction* emerge as a sequence of repeated episodes, through which episodes are embedded in the *organisational routines* of both parties. Routines help organisations *institutionalise* episodes; as a result, relationships are formalized, transaction costs are reduced, bonds are established or reinforced between parties and the partners become “interconnected”. This institutionalisation is supported by the evolution of the aforementioned interaction and the processes within the interaction becoming more organized. Expectations on the counterparty, the routines and cooperation practices characteristic of the

Figure 2
Interaction between enterprises



Source: Ford et al. (2008, p. 9).

relationship are strengthened and the attitude and behaviour becomes forward-looking in the cooperation. Interaction and routines promote the evolution of long term **relationships**. A relationship represents a closer link than an interaction in respect of three major parameters (based on Holmund, 2004):

1. it has a *time dimension* and is *forward looking*, i.e., it has a “past”, the experiences of which are incorporated into the routines, and it is essentially “looks to the future”;
2. it is definitely *institutionalised*, i.e., its processes are characterised by stable, formalised cooperation often supported by a framework agreement;
3. *mutual adaptation evolves* on the level of processes in the course of the cooperation between the parties.

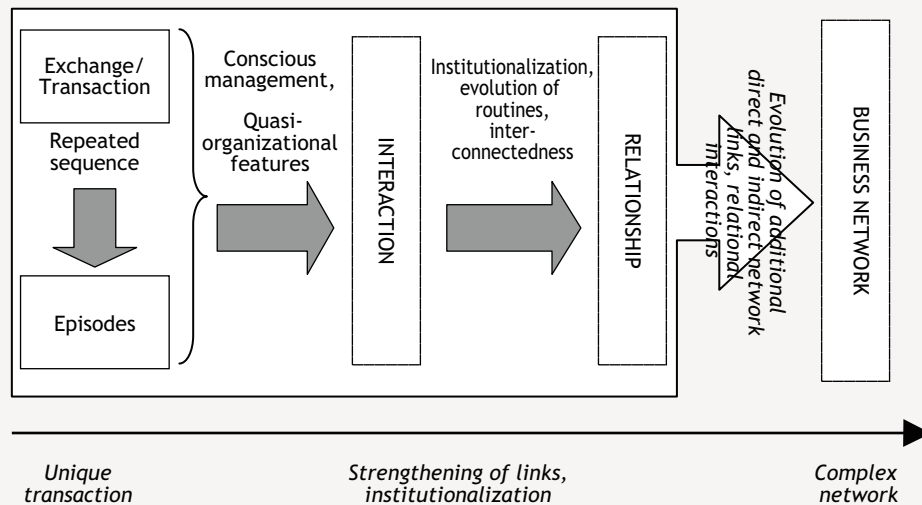
Business networks can be interpreted as the group of two or more interrelated business relationships, where each business exchange occurs between the enterprises construed as collective actors (Emerson, 1981, quoted by: Anderson et al., 1994). In this case, the degree of relatedness shows the extent to which “exchange in one relationship depends on an exchange, or lack thereof, in another relationship” (Cook and Emerson, 1978:725). In addition, two connected relationships are directly or indirectly linked to other relationships, which also affect their operation and constitute a broader business network (Anderson et al., 1994).

Business relationships and the functions, operation and development of the links within them can be analysed and interpreted through the **actors, resources and activities** they involve (Håkansson and Johansson 1992; Anderson et al 1994; Håkansson and Snehota, 1995). These three **layers** express the interconnectedness of interfirm relations and their networks. The *actors layer* represents the interpersonal relations between the counterparties, encompassing attitudes, emotions and norms that determine the level of trust, commitment, recognition and influence between the parties. The *activity layer* expresses the existence of the integration or joint coordination of processes within the relationship. The material flows between participants in the relationship and the accompanying information flows (such as demand management, distribution, customer service, document management) may be integrated on different levels, thus the degree of “interrelatedness” generated by the activities may also be different. The mutual adaptation of the *resources possessed by the parties* is the third important layer in the relationship between the parties. Some resources of the parties to the relationship are continuously confronted with and/or adapted to each other, resulting in the creation of pooled resources in the relationships, which deepen the interrelatedness.

The aforementioned three layers are not independent but closely related: activities may support or hinder the mutual adaptation of resources; resources may limit or promote integration between activities and actors may discover or postpone opportunities for the adaptation of resources and deepening the integration of activities. Not only do the layers between actors, activities and resources link elements of the specific relationship in which they exist but they also help establish bridges connecting the relationship with additional relationships, thus the three aforementioned elements can be considered as building blocks of the network surrounding the relationship concerned. Consequently, Mandják (2005) considers the business relationship and network to be the peculiar lattice of the three layers listed above.

The forms of relationships among enterprises described above as the building elements of business networks are systematically presented in Figure 3. In the figure, the development of the business relationship from transaction level is depicted as a single set while the business network is shown as a related but separate unit because according to the IMP group’s approach, business network can be considered as a set of interfirm elements. Consequently, a network may exist even if it contains no business well-developed relationship within its content.

Figure 3
Systematization of interfirm linkages



Source: Bódi-Schubert (2011), revised.

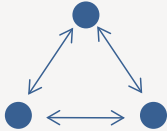
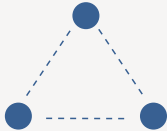
2.2 GUIDING PRINCIPLES OF THE NETWORK, INTERDEPENDENCY OF ACTORS

Networks are driven by different principles. Some of these can be shaped consciously, but we can differentiate between so-called hard, static elements also referred to as configuration principles and so-called soft, dynamic elements, as coordination tools:

- **Configuration** means the processes and organisational routines the conscious design of which can affect the network. This essentially corresponds to the formal and hierarchical coordination elements defined in the transaction cost theory, which aimed to reduce opportunistic behaviour (Williamson, 1975, 1979).
- **Coordination**, on the other hand, means the guiding principles that are own to the networks: informal elements that can be substitutes to contracts and rules. Supplementing the theoretical framework of Williamson, Granovetter (1985) claims that experiences with a business relationship determine the transaction costs to be incurred later in the relationship concerned – that is, coordination is not merely a function of a static cost analysis. In addition to market and hierarchical coordination, Power (1990) also recognises network coordination, in which formal and informal elements are equally important. Later Goshal and Moran (1996) establish that opportunistic behaviour is also a question of attitude that is affected by the quality of and experiences with the past relationship with the partner concerned. Clearly, in this new network approach, reputation resources and trust are also major forces of coordination. In the rest of the paper we examine the cash supply network using such differentiation.

Dependence between members of the network may develop either horizontally or vertically. Thompson (1967) classified such interorganisational dependencies into three categories, which has since become the established framework for analysing interorganisational relationships. In the table below, relying on Håkansson and Persson (2004) as well as Lazzarini et al. (2001), we summarise the essence of the difference between sequential, reciprocal and pooled interdependencies. The sum of sequential relationships is the supply chain, which becomes a network by the addition of the other two types of relationships. For purposes of network management the tools that can be used to manage an activity or dependency are important. For sequential relationships, the main coordination mechanism is planning, which can be used to reduce the transaction costs of processes in the chain. In case of reciprocal interdependencies, coordination is needed to promote the exploitation of synergies stemming from differences in knowledge and resources. As a result, organisation-level co-operation, direct feedback mechanisms and shared decision making are most suitable to achieve mutual benefits. Pooled interdependencies typically mean the pooled use of resources; therefore the exploitation of economies of scale and economies of scope is most important in their case. To this end, the use of pooled resources are often standardised within the network.

Table 1
Types of interorganisational interdependencies in networks

Figure	Type	Description	Nature
	sequential	A uses the output of B	direct, unidirectional, vertical relationships
	reciprocal	A uses the output of B and vice versa simultaneously	interrelated, repeated, (knowledge) intensive relationships
	pooled	A and B both use the output of C or use the same resources	indirect, weak relationships between independent actors

Source: Based on Håkansson and Persson (2004), Lazzarini et al. (2001).

Under the approach of some researchers, networks did not merely herald a new form of interorganizational cooperation; rather, the network as an independent, institutionalised base unit of the economy is characterized by its own coordination mechanism, which is significantly different both from the classic market coordination and from bureaucratic coordination. The characteristics of market, network and hierarchic coordination are compared in Table 2. Under the traditional approach, transaction costs can be reduced through contracts or by the hierarchical organisational principles of the enterprise, i.e., through formal mechanisms. In contrast, in a network new types of mechanisms are present, the so-called informal coordination elements, which can reduce transaction friction equally efficiently. A typical example is trust, which is not enshrined in contracts but it stabilises network relationships and prevents opportunistic behaviour arising from conflicts of interest.

Table 2
Comparison of market, network and bureaucratic coordination

Types of coordination	Market	Network	Bureaucratic
Coordination basis	(Proprietary) Transaction contract	Interdependence	Hierarchical organisation principles (instruction, labour contract)
Communication basis	Prices	Relations	Routines
Means of enforcement	Legal	Reputational	Administrative
Flexibility	High	Medium	Low
Commitment of parties	Low	Medium to High	Medium to High
Tone	Precision, suspicion	Open-ended, mutual trust	Formal, bureaucratic
Preferences of parties	Independence	Interdependence	Dependence

Source: Powell (1990).

3 The subject of our analysis – cash

In this chapter we present cash, the special “product” that is our subject, discussing the actors in the cash supply network and the main processes between them. In our approach cash is not only a tool of exchange and measure of value; instead, we look at all its qualities that are relevant for the purposes of relationships between network actors and for logistical processes. We consider that the product approach used in the management of the value chain is acceptable in the case of cash because in our management approach there are two significant differences between cash and classic products: the right of issue of cash is the sole right of the central bank and the value expressed by cash itself is general, not depending on subjective consumer evaluation. However, these differences have no significant effect on the behaviour of cash in respect of real economic processes, thus the management problems identified in cash management processes are very similar to challenges faced in “normal” corporate operations.

3.1 THE VALUE-BASED APPROACH TO CASH, AS A SPECIAL PRODUCT

Cash is an immediately available direct means of payment, the tangible and most liquid form of money. Any cash, i.e., banknote and coin, that satisfies the issuing and quality requirements set out in the legal act governing the institution authorized to issue money in the country concerned – in Hungary, the Act on the Magyar Nemzeti Bank and the decrees of the Governor of the Magyar Nemzeti Bank – are considered legal tender of the country. Legal tender cash is generally recognized by the central bank of the country concerned as a liability, a claim on itself corresponding to its nominal value; this is an assurance that every economic actor must accept it at its nominal value. **Thus cash fulfils the traditional functions of money (exchange tool, means of payment, store of value, unit of account), that is, it functions as a tool to facilitate and accelerate economic transactions.** As a result of its measure of value and unit of account functions, cash first and foremost has a welfare function: the state makes it available to actors to facilitate the operation of the economy it bears the costs of its issue for this reason.⁵

In our study, cash is presented in a less conventional approach: to facilitate business-oriented analysis, we consider it essentially as a product.

In contrast to products in the traditional sense, cash express value in itself – it performs a function to promote the efficient exchange of “normal” products and services thus its interpretation as a product does not express its full functionality. This is one of the reasons that cash is rarely discussed as a product. There is also a second reason, though: at first glance, cash in its everyday use does not appear to be similar to the market of any other product: the process of buying cash is not explicit, it is unclear or irrelevant for end users (households and enterprises) how much they are paying for it.

Nevertheless, the interpretation of cash as a product is possible for analytical purposes as it satisfies the criteria of „normal goods“. If we accept that a product is a good created through the use of some combination of factors of production that satisfies a consumer demand and that can be offered on a market for this purpose, we run into no obstacles in the case of cash. The treatment of cash as a product is facilitated by the following key characteristics:

- Banknotes and coins are produced by printingworks and mints in a production process that can be described with the traditional production function.

⁵ Simultaneously, the state realises seniorage, i.e., the profit on the issue of cash, thus the issue of cash generates a profit for the state in accounting terms.

- The end-users of cash are economic actors who need the cash for the execution of their economic transactions. We know that there are substitutes to cash in satisfying this consumer demand: it is sufficient to consider the broad range of the ever more prevalent electronic means of payment.
- End-users pay for holding cash mainly through their taxes as the central bank funds the continuous supply of cash, the production of banknotes and coins and the maintenance of their quality from taxpayer's money. As the so-called inflation tax⁶ can also be considered as a kind of income redistribution, arising from holding cash, between the state issuing the cash and the households and enterprises holding cash, it can be seen as a payment process. Furthermore, though it cannot be considered as a payment, the fact that economic actors also bear the opportunity cost⁷ of holding cash has an effect on the demand they create.

3.2 THE USE VALUE OF CASH

Before outlining the supply chain of cash, we need to **identify the features of the product that create value for consumers** that they are willing to pay for. Thus we can identify the activities that are key for value creation. For this purpose, we use the traditional consumer value analysis framework, which divides consumer value into value in use, accession and time (Chikán, 2010).

The **value in use** of cash comes from its fundamental role: it can be used for payment. Naturally, the use value of the various notes and coins is their **nominal value**. However, in order to be suitable for payment, that is, to have use value, cash needs to satisfy the criteria laid down in law, namely, it must be genuine and fit legal tender. The two main legislative criteria having the greatest effect on use value are discussed in the two subsections below:

1. **Genuineness.** Any cash issued by the institution authorized to issue money in the country concerned – in Hungary the Magyar Nemzeti Bank – is considered genuine and is thus acceptable in payment transactions. As an important difference to “normal” products, the production of cash is the prerogative of a single actor in every country: the state guarantees the monopoly of issuing money to central banks. As a result of this peculiar role of issuer, the central bank is able to regulate, with direct or indirect means, the behaviour of cash in payment transactions. Any cash issued by entities other than the central bank is counterfeit, unacceptable in payment transactions and its “manufacture” is a criminal act.
2. **Fitness.** The central bank can influence the fitness of cash, i.e., its “acceptability” in payment transactions and its recirculation, in two ways. On the one hand, with its strategic decisions on the structure of denominations it determines what notes and coins are legal tender in a given country, i.e., which ones can be generally accepted by economic actors. Typically, central banks revise their denomination structures in the medium and long term and issue new notes and coins or withdraw old ones. However, withdrawn non-legal tender means of payment are still genuine, and they generally can be exchanged for fit currency in the central banks for a long time after their withdrawal.

In addition, the central bank also regulates the fitness of notes and coins in terms of quality, specifying so-called sorting criteria for their reissue. Any cash that fails to satisfy any of the sorting criteria⁸ is unfit for circulation. The institutional actors in the cash supply chain (commercial banks, post office, cash logistics service providers) are obliged to withdraw unfit notes and coins of substandard quality and return them to the central bank, which destroys the “scrapped” items and replaces them with new, high-quality money.

However, different recirculation rules apply to banknotes and to coins as the features of these means of payment and the role they play in payment transactions are significantly different. Coins are made of metal, thus their life cycle is

⁶ Through inflation, the purchasing power of cash is reduced, thus debt is also worth less. Thus the budget debt is reduced to the detriment of economic actors that run a positive balance because the value of the cash stock in their possession decreases.

⁷ The opportunity cost of holding cash is the loss of the interest that they would obtain if they kept their income in other, interest bearing instruments rather than in cash.

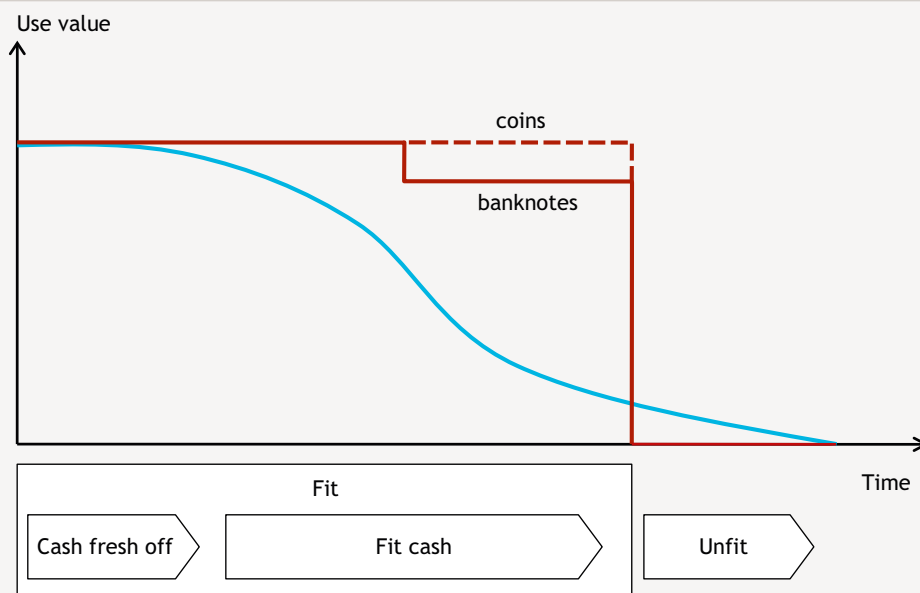
⁸ In Hungary, pursuant to Decree 11/2011 (IX. 6.) of the Magyar Nemzeti Bank, any note that is soiled, stained, graffiti soiled, de-inked or has significant significantly reduced solidity due to wear and tear, is crumpled, dog-eared, torn, has a hole or is mutilated or repaired (taped) is to be considered unfit. Pursuant to MNB Decree No. 12/2011 (IX. 6.), any Forint coin that is defective (mutilated, damaged, lost its original shape) or difficult to recognise (worn or discoloured) is unfit for circulation.

considerably longer than that of banknotes and the risk of counterfeiting is significantly lower due to their small value and their material. Banknotes are printed on special security paper made of cotton, they are much less durable than coins and they are more exposed to counterfeiting because of their high value. Thus the central bank sets considerably tighter rules for the recirculation of banknotes for the actors in the cash cycle. The genuineness and fitness of banknotes may be examined either using a banknote verification machine tested by the competent authority and satisfying legal criteria or through manual checking. Banknote handling machines can verify the genuineness of cash more efficiently than human staff, while the latter can determine compliance with sorting criteria more accurately. Some countries allow only machine-verified banknotes to be reissued through ATMs. Compliance with the banknote recirculation rules is continuously monitored by the central bank.

The set of criteria concerning genuineness and fitness, which affect the use value, have two important consequences for the value of cash as a product.

- On the one hand, **the use value of cash is guaranteed by law, it is less differentiated for final consumers than traditional products**, thus distribution is a minimum criterion rather than a competitive aspect. That is because cash fit for circulation must be accepted at its nominal value in payment transactions by everyone and aesthetically less pleasing used notes or coins must not be discarded even if their use in payment transactions is restricted, instead, they can be exchange for high-quality ones. Automated processing increases use value only by more accurately assuring genuineness. Thus the life cycle of cash by use value⁹ does not follow the traditional curve (cf. Figure 4) if we take into account the qualitative requirements for notes and coins laid down in law.
- On the other hand, cash has another important feature: as during its life cycle it changes consumers many times – it circulates in the economy –, its **use value** depends not only on the manufacturing process (quality of banknote printing and coin minting) but it is also **strongly related to cash logistics operations (more particularly cash processing and the related quality assurance)**.

Figure 4
Life curve of banknotes and coins by their use value



Source: figure compiled by authors.

⁹ It should be noted that the life curve by use value is not the same as the product life cycle model. The latter can be interpreted for banknote and coin families: how their product life curves in line with technological advances and protection against counterfeiting. This dimension, however, goes beyond the scope of our paper.

3.3 THE ACCESSION AND TIME VALUE OF CASH

The **accession and time value** of cash originates in the fact that consumers obtain it wherever and whenever the demand arises and they can use it for payment wherever they want. The former is affected by so-called accessibility, i.e., the geographical location of automated teller machines (ATM) and bank branches and post offices where cash can be withdrawn. The paper of Helmeczi (2010) explicitly shows that in Hungary this accessibility that affects accession value is unevenly distributed: it is highest in Budapest and most limited in small villages. In communities with very few or no ATMs, the accession value of cash is limited, consumers may have to incur substantial costs to gain access to cash. Thus the better the quality of cash supply in a geographical unit, the greater the accession and time value of cash. There are much fewer constraints in terms of acceptance as the general acceptance of cash at nominal value is guaranteed by law, even though the use of large denominations may sometimes render payment more difficult.¹⁰

Uninterrupted cash supply is indispensable for the economy to work smoothly, thus its maintenance is in the public interest for welfare considerations, a task delegated to central banks. The accession and time value is increased by all the activities that contribute to getting the product to the consumer, mostly logistics responsible for the implementation of material flows and activities supporting their optimisation such as IT systems. **Thus, logistics assuring distribution and recirculation is the key activity for the value creation function of cash.**

In summary, cash is a highly particular product with a welfare function, which is an indispensable agent in the exchange of other products, that is, in the execution of economic processes. Because of its focal role, assuring the adequate quality and availability of cash is more than a business interest: it is in the interest of welfare, which renders the analysis of cash supply from a business aspect difficult. In order to safeguard welfare, central banks impose strict criteria, mostly of a legal nature (except in Anglo-Saxon countries), for the quality of cash in circulation, which makes the value chain of cash rather unusual: its use value becomes undervalued, its place and time value overvalued. Consumer value increase and the enhancement of cash supply can be achieved through the optimisation of the system of cash logistics; consequently, market actors will also find it worthwhile to become part of that process.

¹⁰ We often find that small shops are unable to give change from high-denomination notes.

4 Structure of the cash supply network

In this chapter we analyse the actors in the Hungarian cash supply network, the activities among them and the resources required for such activities. After that explanation we assess the growth of the network, that is, changes in the various actors, activities and resources in recent years and their impacts on the whole of the network.

4.1 ACTORS, ACTIVITIES AND RESOURCES IN THE NETWORK

Before interpreting a detailed analysis of the cash supply network, we consider it necessary to clarify the concepts used in this chapter, particularly the terms 'supply chain' and 'supply network'. For purposes of interorganisational marketing, the supply chain is viewed as a narrowed-down part of the business network. In other words, the **supply chain** is a group of two or more enterprises that directly participates in the generation of the flow of products, information, services and values suitable for satisfying consumer demand and, to that end, engages in coordinated activities (based on Mentzer et al., 2001; Gelei, 2009). Under a different, process approach, the supply chain is defined as the series of value-added processes connecting multiple enterprises that creates a product or service suitable for satisfying customer demand (Chikán, 2008). The two approaches are different only in their focus but are not in conflict and they are both well adapted to the approach to networks as described in the chapter on literature. Accepting the approaches described, in our understanding the supply chain is a strongly focused interpretation of the supply network narrowed down to the actors participating directly in fundamental physical and information processes for the purposes of value creation (based on Gelei, 2009). In our study, we mostly perform supply chain level analyses for the description of actors, activities and resources, discussing network effects subsequently and when describing the individual actors.

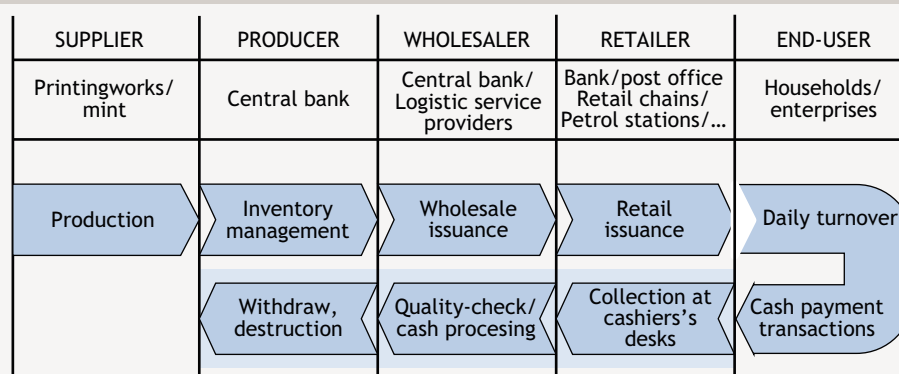
The structure and participants of the Hungarian cash supply chain is first described in the overall Figure 5, then we briefly outline the circulation of cash in the economy, which is followed by the detailed description of the members, activities and resources of the network. Banknotes and coins perform their role in the economy in the following, highly simplified circulation. Deriving from its legislative monopoly, cash is made available to economic actors by the central bank, which also performs functions relating to its production – in Hungary, through its own subsidiaries¹¹. From the central bank, the cash is supplied via credit institutions and the post office to economic actors, account holding enterprises and households¹². In this process of intermediation cash logistics service providers play an outstanding role, as in Hungary banks and the post office have almost totally outsourced the operational tasks of their cash functions to such providers. After households and enterprises have spent the cash held by them through consumption relating mostly to the retail and service sectors, the cash returns to the banking sector and the post office, which, depending on the prevailing demand, recirculate part of it to their retail and wholesale clients while the "remainder" and the rejects of inadequate quality are returned to the central bank. Then the central bank reprocesses the cash received, checks for genuineness and fitness, destroys poor quality, unfit, reject notes and coins and provides for their replacement by new ones.

The traditional supply chain ends where the product reaches the consumer. We have seen that the supply chain of cash is considerably longer. In the course of payment transactions, cash changes hands and sometimes it makes its way all the way back to the cash vaults of banks or even to the central bank, which destroys it or re-issues it to economic actors. One of the purposes of reverse cash logistics is quality control: destruction and replacement of unfit cash. Another incentive for the acceleration of cash circulation is on the part of economic actors. Both households/enterprises and credit institutions/

¹¹ In Hungary banknotes are produced by the Pénzjegynyomda Zrt., coins by the Magyar Pénzverő Zrt.

¹² In case of households, there are significant payments, mostly social transfer related, where there is no account keeping relationship between the households and the institution (post office) implementing the payment.

Figure 5
The closed-loop supply chain of cash



Source: figure compiled by authors.

post offices engage in liquidity management to minimise their interest losses on holding cash. The supply chains in which products are recycled are called **closed-loop supply chains** (Dobos, 2008).

4.1.1 The central bank

In the Hungarian cash supply chain the classic focal company role is played by the central bank (the MNB): (through its subsidiaries) it provides for the production of new banknotes and coins in the necessary quantities each year, which are issued in different volumes by denomination in the course of payment transactions, depending on the outcome of banknote verification and on the cash demand of economic actors; in addition, through its regulatory decisions it determines the denomination structure of the cash stock in circulation, assures the security of supply and protection against counterfeiting, and determines the terms of recirculation to be observed by market actors.

However, contrary to popular belief, the actual quantity of cash in the economy is not determined by the central bank; instead, just as for any other product, the community of consumers/users determine the quantity and denomination structure of the cash used to satisfy their demand. The aggregate level and structure of the demand for cash can be influenced by the central bank only through the very indirect means of monetary policy.

The final stage of cash is also the central bank: the destruction of unfit quality banknotes is the exclusive competence of the central bank¹³, and so is the decision on the withdrawal of outdated denominations. The role of central bank regulation, as provided in the MNB Act in Hungary, extends to influencing the cash transactions of both the professional cash-handling sector (cash logistics service providers, credit institutions, retail units) and households.

We consider, however, that **the role of the central bank in the cash network goes beyond the significance of a traditional focal company**, for the following reasons:

- with its decisions on the structure of denominations, the central bank can actively influence the supply of products, which in turn feeds back to demand-side requirements (e.g., withdrawal of 1- and 2-forint coins, denomination exchange of the 200-Forint banknote-coin) and thus has an effect¹⁴ on the demand of other network actors;
- through its extensive powers in ensuring cash supply, the central bank directly and actively influences the activities and operations of the other members of the network. Depending on the strategic decision of the central bank concerning itself and its interpretation of its role (see boxed article), the activities and possibilities of other network (market) ac-

¹³ This is mostly for practical reasons of cost rather than considerations of principle. In several countries (e.g., Norway, New Zealand) market actors are entrusted with the destruction of worn banknotes.

¹⁴ By effect we mean that the appearance of new banknotes or coins, or the withdrawal of existing ones, has a fundamental effect on cash use and the role of the individual denominations. For instance, after the introduction of the 200-Forint coin in 2009, demand for 100-Forint coins dropped.

tors participating in the cash cycle also change. In respect of their own roles, central banks may operate in two activity structures at the extreme:

- “total or dominant central bank”: the central bank keeps all functions from issuing through recirculation to destruction and allows market actors to participate only in certain elements of distribution (typically in transportation between branches of commercial banks or between retailers and their banks). In this case, the central bank rules the cash network practically alone, possessing the overwhelming majority of activities and resources while other players can be described only as “contributors” in the distribution of cash in the network. Examples include China, Turkey or the Ukraine.
- “minimal central bank”: the central bank reserves only the legal right of issue while it allows market actors to perform functions of recirculation, logistical inventory storage, total distribution or even destruction, supervising their performance according to the quality assurance standards and procedures determined by itself. In this scenario the central bank is in possession of the legal right of issue and the know-how relating to cash operations, while the overwhelming majority of physical resources and cash activities are held or performed by other actors in the network. Examples include New Zealand and Norway.

Box 1

Models of the cash supply network

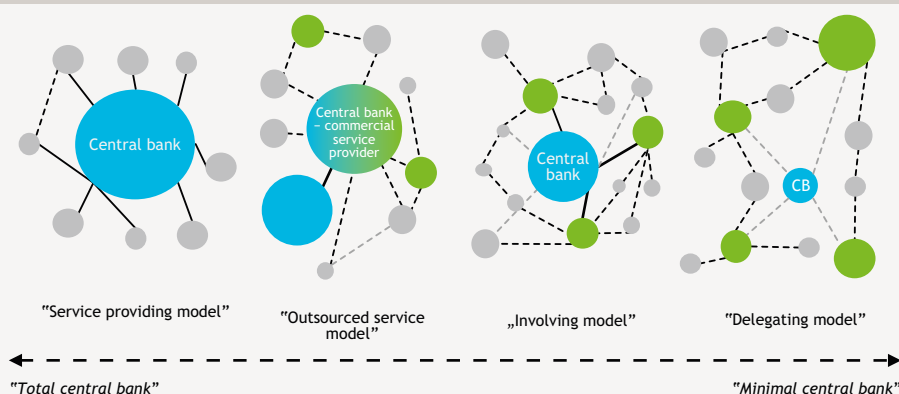
In between the two extremes of the role of the central bank described above, a number of arrangements are known in different countries for the allocation of activities between central banks and market actors in the network. In this overview we present the main elements of the four most typical cash network operational models: service providing, outsourcing, division of labour and delegating. (Schmidt, 2004).

1. The salient feature of the **service providing model** is the central role of the central bank as it controls all the sub-processes of the cash cycle, and market actors are not involved in the recirculation process. The service providing central bank performs a significant part of cash logistical activities through its expansive branch network. The model has the advantage that due to the direct return of bank notes the central bank may directly oversee the quality of banknotes and filter out counterfeits. Disadvantages include the high cost of cash processing in the central bank and the increased length of the path of cash. The high cost of cash processing in the central bank is an additional burden on the national economy if the fees charged by the central bank are too low and they fail to cover the costs incurred. The service providing cash logistical model is exemplified by the Belgian, Czech, French, Greek and German economies.
2. **Outsourced service model:** in some instances, the central bank (Austria, Bulgaria, Denmark) outsources its own cash processing to its (wholly or partly owned) subsidiary. Typically this central bank affiliated company is the exclusive provider of banknote recirculation services; cash logistics service providers tend to perform only network distribution functions. These central bank processing companies tend to have commercial banks as co-owners. The central bank had hoped that through privatisation, a partly privately owned company would operate more efficiently than a wholly state-owned firm would. Even though there are examples of enterprises successful in the operational sense (Austrian firm retained in state ownership, fully privatised Norwegian company), this model was a failure in Sweden, for instance.
3. In the **involving model**, the central bank limits itself to satisfying the cash demand of the economy while the day-to-day functions of cash recirculation are left to market actors (mainly commercial banks and/or cash logistics service providers). Thus the central bank focuses only on the destruction of unfit banknotes and coins, the receipt of the cash in excess of the daily cash needs of the economy and safeguarding the quality of banknotes and coins in circulation. The advantage of the model is to shorten the path of cash and reduce the number of actors in the cash cycle because cash processing outside the central bank happens in competing banks and cash-in-transit companies, which promotes the efficient operation of market actors. The disadvantage is that as banknotes return to the central bank less frequently, the quality of banknotes in circulation may deteriorate. Involving central bank models exist in the US, Spain and Portugal.
4. In the **delegating model**, the central bank lets market actors perform cash recirculation; indeed, going beyond this, it reduces its cash circulation related activities to the minimum, focusing only on the production of cash, banknote issuance and,

generally, destruction as well as monitoring market actors. In this model, central banks do not maintain an extensive branch network as day-to-day cash processing has moved to commercial banks or logistic service providers, which operate on a commercial basis. The central bank's logistical inventory serving to satisfy the daily cash demand is stored separately in privately owned cash centres. Delegated central bank models exist in the UK, Denmark, Ireland, Australia and New Zealand.

According to the "operating strategy" or role perception of the central banks, they practically independently determine the structure of the cash network of their respective countries, thus they may be called network builders. This strong network influence is less typical in corporate life, the focal companies generally have influence of varying degree on the operation of the surrounding network but they can rarely shape it so directly and intensively. In Figure 6 we overview the scheme of possible structures of cash networks influenced by the central bank operational models.

Figure 6
Structural models of cash networks based on the role of the central bank



Blue: central bank; grey: commercial banks, post office; green: cash logistics service providers; unbroken line: strong control relationship; black dashed line: network relationship without direct influence; grey dashed line: weak network relationship.

Source: figure compiled by authors.

Before the political transition, the MNB also ruled the cash sector practically as a total central bank, then from the 1990's onwards, simultaneously with the development of the banking system, it gradually redefined its role. First it replaced the service provider model by the involving model,¹⁵ then in the second half of the 2000s it took firm steps towards further "retreat". According to its current cash strategy adopted in 2008, the MNB proceeds in its internal and external regulatory and (process) development decisions to promote the more efficient operation of the entire cash sector, and at the same time to manage the public funds used for its own operation as cost efficiently as possible. It is important to realise that decisions on the role of the central bank in the network also determine the functions the central bank is going to perform for market actors using public funds. In its own view, the MNB considers it necessary to perform only those cash functions where its role is justified either because of the state monopoly on issuance or for reasons of efficiency or quasi market failure as market actors would certainly be unable to provide a solution optimal for welfare. Thus the MNB has delegated the bulk of tasks of banknote and coin recirculation to market actors (commercial banks, the post office or the logistical service providers appointed by them) and it takes no part in daily cash distribution either. However, it has kept the destruction of banknotes, quality control and coordination and implementation functions relating to the security of supply, and it is likely to do so in the long term as well. The tools¹⁶ used by the MNB to actively influence the operation of the Hungarian cash network are reviewed briefly in the "boxed article" below.

¹⁵ This decision was made for practical reasons rather than as a result of strategic considerations because the MNB was unable to adapt to the increasing cash volumes with the facilities and devices it had at the time; therefore, it increasingly allowed market actors to participate in cash processes.

¹⁶ In addition to the arrangements described, a number of other regulatory solutions exist around the world, which the MNB does not use due to theoretical or market reasons: for instance, it does not interfere in the settlements and charges between service providers and banks (B2B) or the retail rates applied by the post office and commercial banks (B2C), it does not regulate conditions for the installation of ATMs, it issues no "due diligence" requirements in B2B (e.g. security of persons, property and information security), it does not regulate the market and terms of cash transportation, etc.

Box 2**Regulation tools of the central bank**

Of the cash regulation tools of MNB, two plus one tools of administrative in nature and one quasi-commercial arrangement are worth mentioning, which can be used to influence the operating processes of the cash sector in the short and long term alike.

- **Decree of the Governor of the MNB on the processing and distribution of banknotes and coins and on protection against counterfeiting**

The framework for the recirculation of banknotes and coins outside the central bank is regulated by decrees of the Governor of the MNB, at present by MNB decrees no. 11/2011 (IX. 6.) and 12/2011 (IX.6.)

The scope of the decree covers Hungarian credit institutions, the post office and cash logistics service providers and it imposes strict quality standards, particularly in the case of banknotes, concerning the hardware and software versions of banknote processing machines and output quality parameters required for the recirculation of banknotes. In order to safeguard the quality of banknotes and provide protection against counterfeiting, the two most stringent requirements demand that cash logistics providers are obliged to process at least 90% of the banknotes taken for processing by machines approved by the MNB, and that after 1 January 2012 only machine-processed banknotes may be used to replenish automated teller machines. The central bank regularly checks the providers for compliance with these requirements and if any irregularities are found, sanctions may be imposed. These decrees also set the basic standards for the cash-related behaviour of credit institutions and the post office vis-à-vis households through the regulation of the terms of denomination exchange and rules for the treatment of suspect media of payment.

- **Terms of business for clients holding accounts at the MNB and for cash logistics service providers**

The MNB determines in its business terms and conditions the services and terms it offers to credit institutions having an account at the MNB, the post office and their cash logistics service providers. These terms regulate the procedure of lodgement and withdrawal of banknotes and coins and the administrative and technical requirements concerning the execution of transactions, which have a fundamental effect on the market behaviour of these network actors as well. For instance, in case of banknotes the MNB provides no service below 1 bundle (1000 pieces) and for lodgement it accepts only banknotes already processed by the market actors, with the fit and unfit (reject) notes separated. In case of coins, the MNB does not serve market actors as long as they are able to satisfy their needs through transactions between one another.

- **Fee policy**

The so-called commercial-type regulatory tool to regulate the relationship between the MNB and credit institutions and the post office is the fee policy. This means that the central bank performs the services specified in the business terms and conditions for market actors for a fee – with the exception of the acceptance of reject and suspect banknotes – and changing these fees can affect the type and number of transactions it engages in. In the case of the MNB, the use of fees is clearly not for purposes of making a profit; instead, they are used by the central bank as a market regulator motivation tool to influence the behaviour of the actors in direct relationship with it.

- **Authorisation of cash processing providers**

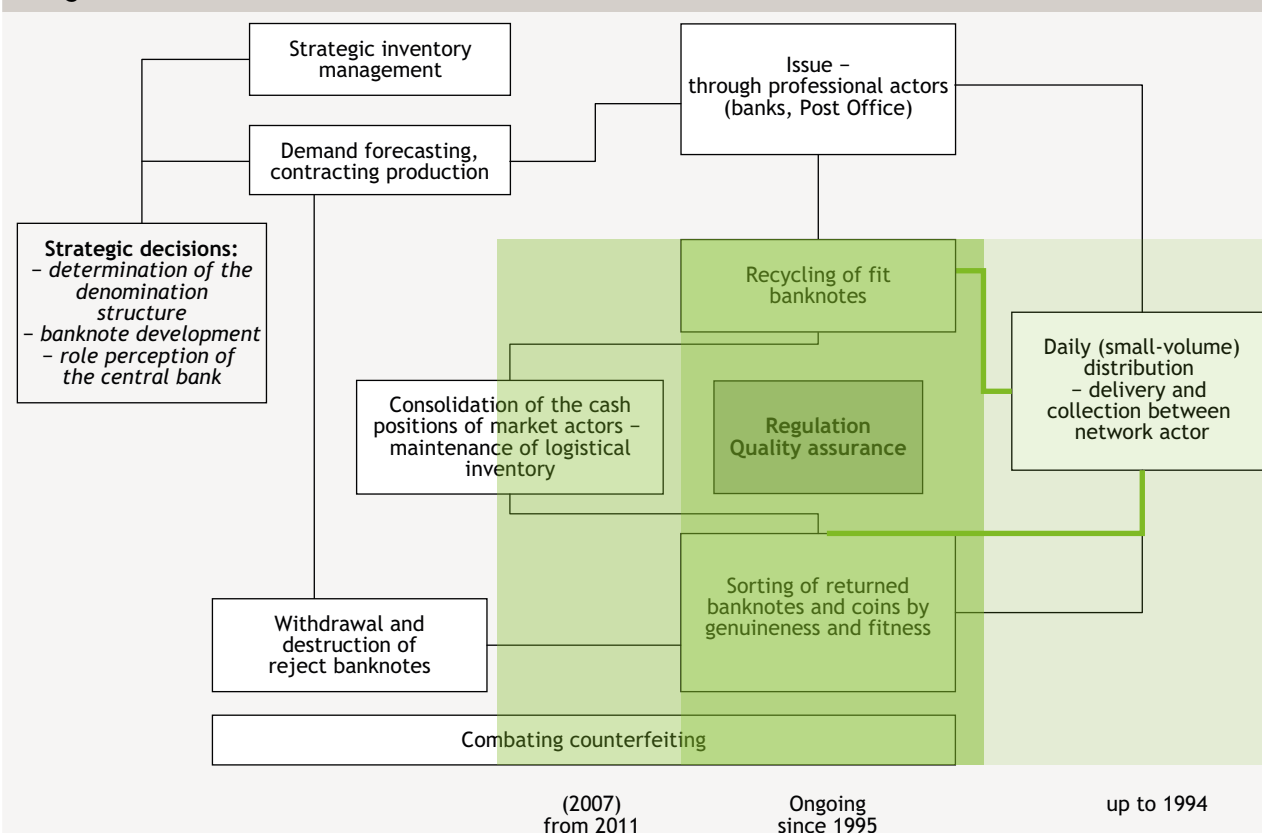
Pursuant to the Act on Credit Institutions and Financial Enterprises (CIFE), the central bank authorizes the activities of organisations providing cash processing services in Hungary. This authorization procedure was introduced in response to the market conditions prevailing in the mid-1990's (a large number of undercapitalized actors with highly varying capabilities and service activities) and it functions as an administrative barrier. Since then, the market of cash logistics service providers has consolidated and matured, thus in practice this regulatory tool is no longer all that important.

4.1.1.1 Activities and resources of the MNB

We have already noted that according to the strategy and cash-related operating philosophy it chose to adopt, since the political transition the MNB has increasingly moved towards regulatory and quality assurance activities, retreating from the day-to-day operational tasks of cash supply. To explain the particular activities performed by the central bank in Hungary and the changes in the division of labour between market actors and the MNB in recent years, we illustrate the changes in the cash-related activity structure in Figure 7.

In the figure the grey shaded area indicates activities reserved for the central bank while different shades of green show the changes in the division of labour between the central bank and market actors. Until the first years after the political transition (approx. until 1994) the central bank ruled the entire cash-related field and the role of the few commercial banks present in the country and of the post office was restricted to cash distribution in their own branch networks. As the two-tier banking system consolidated and the range of commercial banking services expanded, the demand of actors in the network for cash services of higher standards increased and, although in a primitive form, cash logistics service providers appeared in the market, initially participating only in cash transportation. The central bank's banknote processing capacities proved increasingly insufficient to serve the growing needs of banks and the post office; consequently, the central bank, in several steps, *allowed market actors to reissue in their own networks the cash they held following manual or automated processing*. This meant that market actors were allowed to process the cash "accumulating" in their networks independently and to recirculate it on an as needed basis and they had to turn to the MNB only if they needed additional cash to serve their clients or if they wanted to lodge their "surplus" cash. This step as well as increasing automation on the client service (ATMs) and banknote processing (high-capacity processing machines) sides encouraged *banks and the post office to take on complex*¹⁷ *cash management activities*. In Hungary most banks and the post office chose to *outsource day-to-*

Figure 7
Changes in the cash-related activities of the central bank



Source: figure compiled by authors.

¹⁷ In addition to the network distribution performed before, their activities now extended also to demand planning, inventory management and banknote processing.

day operative cash-related functions to incumbent cash logistics service providers, keeping only management decisions in house. This trend resulted in the expansion of the activities of cash logistics service providers and in the concentration and strengthening of service providers mainly with a view to improving quality. Simultaneously, and as a result of these steps, the day-to-day operative cash logistics role of the central bank was gradually de-emphasized,¹⁸ practically restricted to the consolidation of stock between market actors, and emphasis shifted more and more to the previously less important function of regulation, quality assurance and the related supervision. These changes occurred gradually in the approximately ten years after the second half of the 1990s. The next important milestone in the shrinking of central bank operations was when the central bank allowed market actors to maintain central bank stocks of coins in 2007 and notes in 2011 for consolidation purposes. In practice this means that as the cash positions of the various banks and the post office¹⁹ is different due to the composition of their client base (some actors tend to have cash surpluses while others are so-called dispensing banks and need cash all the time), generally it is the MNB that consolidates the differences in the needs of market actors through the amounts of cash taken over or handed out. In contrast, since the credit institutions and the post office have been allowed to maintain stocks carried in the books of the central bank²⁰ and need not turn to the MNB for stock consolidation on a daily basis but they can equalize the differences in their positions among themselves through cooperation, the central bank only needs to manage stock differences resulting from seasonal fluctuations and the replacement of scrapped notes. This does not mean that the MNB would not have logistical stocks, it merely reduces its role in daily/weekly stock consolidation, replacing it with consolidation between seasonal periods.

In the case of the MNB, the most important **resource** is the know-how accumulated, which is required for the preparation and implementation of cash-related strategic decisions and the performance of its regulatory, monitoring and quality assurance functions. Due to its special role in the network, this know-how of the central bank is completely unique, it is impossible to substitute, replace or duplicate (i.e., its copying by market actors is irrelevant). The changes in cash-related activities described in the previous paragraph also triggered major changes in the resources used by the MNB. Initially, the MNB needed significant physical (buildings, processing machines, etc.) and human infrastructure facilities to perform its daily cash logistics functions. However, as the operational tasks of the central bank diminished, it needed less and less human and physical resources. Accordingly, the MNB closed down its cash handling offices in the country and by now it has centralised its cash-related activities in a single, state-of-the-art facility, simultaneously reducing the headcount significantly as shown in Figure 8. The gradual withdrawal of the MNB from day-to-day cash logistics brought to life new activities and competences in the organisation as the complexity of monitoring and regulatory work has increased significantly. Accordingly, *in terms of human resources, instead of manual labourers with daily operative duties, the central bank now increasingly needs highly qualified experts, analysts and engineers to discharge its new network role as determined by itself.* In terms of *physical resources*, the MNB tends to maintain “back-up” capacities²¹ for business continuity reasons while redundancies have been minimised; indeed, in some critical cases (cash deliveries in emergencies, loss of facilities) it acquires services from the market. Resources worth noting include the *IT system* offering real-time client and settlement connection (WebeC) used since 2007, which facilitates on-line payment transactions vis-à-vis the MNB and the real-time monitoring of the MNB cash held to order by market actors.

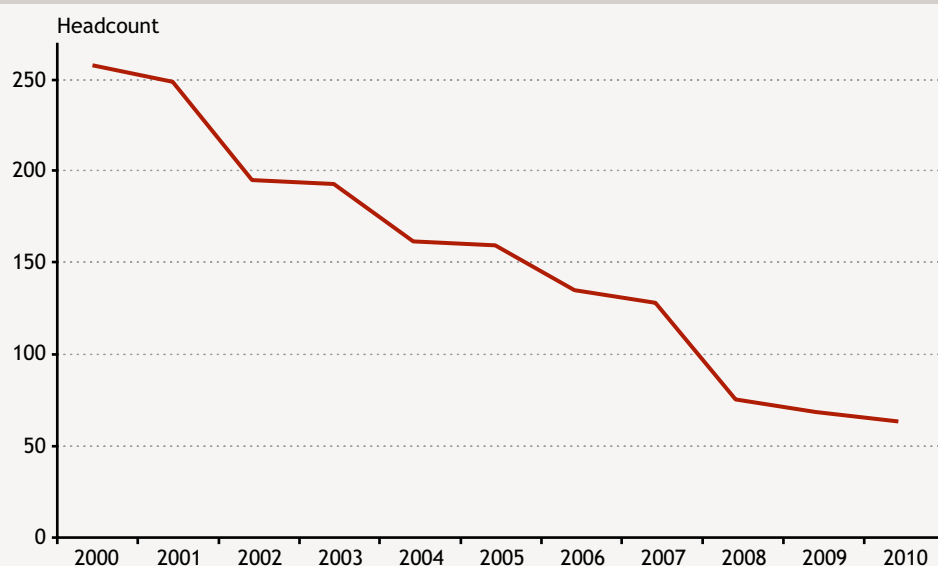
¹⁸ By now the role of the MNB in the recycling of cash has declined so much that the return frequency of banknotes in Hungary is around 1, meaning that on average each banknote “returns” to the central bank’s processing machines once a year. In respect of banknote processing, the division of labour between the MNB and cash logistics service providers is 20%-80%, that is, the central bank processes approximately 1/5th of the cash in circulation, the rest being reissued by other providers.

¹⁹ The balance of the cash deposited to and withdrawn from them at the end of each banking day.

²⁰ Due to the different market behaviour, value and risk of banknotes and coins, there is a fundamental conceptual difference between the notes-held-to-order and coins-held-to-order schemes. Essentially, the stock of banknotes held by market actors (only commercial banks and the post office) is owned by the central bank but up to its maximum amount it is covered by funds on a subaccount kept at the MNB, thus if there is any deficiency compared to the value of the inventory on the books, the MNB can be indemnified immediately. Stocks of coins are maintained by cash logistics service providers, each provider managing them to consolidate the demands of the various banks and post offices. In this case, the MNB accepts bank guarantees or insurance policies with itself as the beneficiary as cover up to the maximum value of the stock.

²¹ The cash transportation capacities of the central bank are negligible. It maintains notable banknote processing capacities in case the processing facilities of a cash logistics service provider fail or if for certain banknote denominations a dangerous counterfeit impossible to detect by processing machines appears, thus recirculation outside the central bank needs to be suspended temporarily.

Figure 8
Headcount of the cash logistics department in the MNB



Source: MNB.

4.1.2 Cash logistics service providers

From the logistics point of view, cash logistics service providers are the most important node of the cash supply network. Practically 100 percent of the cash supply tasks for the branch and ATM networks of commercial banks and the post office maintaining accounts at the MNB²² are performed by cash logistics service providers because, as explained in the previous point, **credit institutions, their clients and the post office have outsourced all of their cash-related activities**. In practice, as the role of the central bank in operative cash logistics diminished, the activity structure of service providers has expanded. Having grown beyond the cash transporting role initially fulfilled, now they perform complex activities for their principals so that the physical and information processes between actors in the cash network are practically performed almost entirely by such service providers.

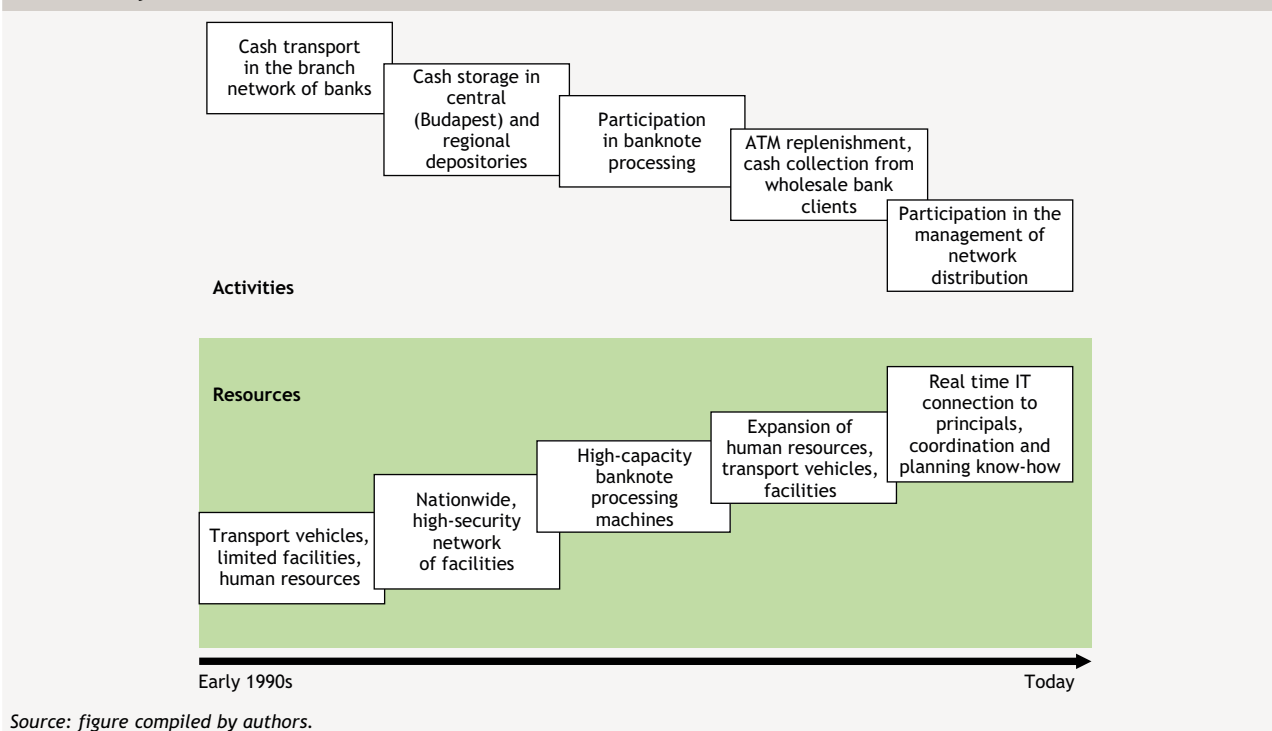
Like in many other countries, the market of cash logistics service providers is highly concentrated: G4S Kft., the multinational firm with the largest market share, has a dominant role in cash supply in Hungary. Brink's Zrt., the subsidiary of another multinational, is also a large player but with a much smaller market share. The third notable market actor, JNT Security Kft. is a subsidiary of Magyar Posta Zrt. (the post office), consequently, it primarily supplies cash to post offices while also having contracts with some commercial banks and retail chains. In addition to the three "big ones", there are three smaller actors present on the market focusing their activities on coin logistics and the processing of vouchers.

The aforementioned service providers are responsible for the "circulation" of cash on a daily basis between economic actors, in the following manner: At the end of each working day they collect the cash from the clients of credit institutions (mostly retail units) and from branches of the credit institutions and post offices, to process it at night at the central facilities (counting, sorting by genuineness and fitness). The processed genuine and adequate quality cash is picked by destination from their depository and the next day they deliver it back to bank branches and retail stores or use it to replenish automated teller machines. Reject banknotes identified during processing are paid into the account of the credit institution/post office at the MNB; alternatively, if their principal needs cash, they withdraw the required amount from the MNB and transport it to the bank branch or post office. The next day the process starts all over again: households and enterprises withdraw the cash they need from ATMs, bank branches or post offices and use it to execute payment transactions. Thus cash, having changed hands, returns to retailers, then to bank branches and post offices, from where cash logistics service

²² Only credit institutions and the post office maintain separate accounts at the MNB, for which the MNB pays overnight interest on the cash lodged. With the exception of denomination exchange transactions, in the case of lodgements and withdrawals cash logistics service providers may not turn to the MNB in their own name, they can only perform transactions on behalf of their principals.

Figure 9

Changes in the activities of cash logistics service providers and the required resources from their market entry to these days



providers collect it, then process, store, pick and deliver it again. The expansion of the scope of activities performed by cash logistics service providers and the changes in the necessary resources are illustrated in Figure 9. In the figure, boxes in the yellow area symbolize activities, boxes in the green area the required resources. The overlaps of the boxes indicate that the activities or resources are created relying on each other, often connected to each other, in the course of the operation of the service provider and are present in the operations.

4.1.3 Credit institutions and the post office

We regard credit institutions and the post office so-called professional or wholesale actors as the central bank gets the necessary amount of cash to households and enterprises directly through them as intermediaries and they are the only entities the MNB has contacts with during cash operations. As noted earlier, the daily **cash positions of the various credit institutions and the post office vary significantly**. Consequently, there are so-called “depositing” banks in the supply network that tend to have surpluses all the time and enterprises are generally overrepresented in their clientèle. The so-called “dispensing” banks are the ones that tend to lodge less cash than they withdraw. The latter group tends to serve households. In addition, there are **intra-month fluctuations**²³ in the cash demand of credit institutions and the post office: at the beginning of the month, when citizens get their salaries or social transfers, the cash demand of professional actors tends to grow significantly, then by the end of the month the cash “flows back” to actors through retail trade and, again, the post office. The **interbank cash market**²⁴ has been a good initiative of the sector to offset the differences between the demand arising from the different cash positions of credit institutions – typically between the clients of a single cash logistics service provider – but its operation is less than perfect, therefore the consolidation role of the MNB explained above is needed. Furthermore, several initiatives of the MNB to increase efficiency (among others, the structure of the fee policy, the design of terms of service of the central bank and the use of cash-held-to-order arrangements) also serves to promote more intensive cooperation between professional actors.

²³ Moreover, there are also seasonal fluctuations within a year, which is related to (national) holidays and public holidays.

²⁴ If on a certain day the principal does not need banknotes anywhere in his network, it has two options. It may sell (exchange) the bundle of banknotes on the morning “physical delivery” cash market to/with another credit institution that has the opposite position. Alternatively, it may have it delivered to the central bank. Account holders may decide between recirculation, sale to other actors or delivery to the central bank at their discretion, depending on their business interests, taking into account the fees of the central bank, transportation costs, daily demand etc.

As mentioned earlier, with a few exceptions commercial banks have outsourced cash-related activities to cash logistics service providers and in most cases they have retained only the management decisions. This also means that they do not possess the resources necessary for the performance of operative cash management activities, they only hold the know-how – and the IT connection – that they need to determine the daily cash demand of their own branches; in addition, they arrange for the cash supply of their (mostly) corporate clients. This “delegation of activity” is most notable in the operation of automated teller machines because all the information, know-how and physical infrastructure necessary for running the ATM network is concentrated in the hands of the cash logistics service providers. Often banks do not possess even the essential security information required for the replenishment of an ATM. This delegation of activity and responsibility is probably cost efficient for the banks under normal conditions and assures high standards of cash supply. In the long term, however, it is worth considering how the majority of commercial banks would be able to react if their logistics supplier were, for some unforeseeable reason, unable to provide adequate quality services and whether the excessive dependence of the service providers would render banks vulnerable and jack up logistics costs. To some extent, the diversification of the service provider portfolio could be a solution to this problem but in the present state of the market the two smaller service providers do not have the physical and human resources that would allow them to take over the responsibilities of the largest actor. Below we will analyse the expected changes in the allocation of responsibilities between banks and cash logistics service providers.

4.1.4 Enterprises, retail chains, households

The most numerous group of actors in the cash network consists of enterprises and households, who obtain cash in the course of their payment transactions as clients of a bank or the post office, then they “re-channel” the cash to retailers and service companies as they consume. As a result of its special measure of value function, money follows through payment transactions, mostly in the form of cash as established in an MNB study conducted in 2010. By its nature, the use of cash does not require users to possess special activities or resources²⁵.

In addition to its use in normal transactions, we should also mention *the relationship of cash with the hidden economy*. Because of its anonymity, it is the most suitable medium of payment for illegal transactions and for the accumulation of income from the hidden economy. The MNB considers it possible for several reasons (see Odorán and Sisak 2008; Bódi-Schubert, 2010) that in the second half of the 2000s (between 2004 and 2009) one component of the dynamic growth of cash demand in Hungary was the expanding cash need of the hidden economy. Such use of cash, however, endangers the original welfare function of cash as the state does not make cash available to economic actors to allow them to engage in illegal transactions that in most cases cause severe losses to the state itself.

4.2 SUMMARY – BUSINESS PROCESSES IN THE NETWORK

In the previous points we have presented the most important actors in the cash supply network, the activities they perform and the resources they hold. In this sector, in a summary chart, we review once again the key processes of network operation and analyse the points of friction that can be identified between the actors following from the operating logic of the network. In Table 3 we present the actors, activities and resources in a systematic layout.

In Figure 10 we have summarised the flows between key network actors indicating material flows in red, cash flows in black (fees paid to the MNB; service charges of cash logistics service providers; cash handling and other settlement charges paid by households and companies) and information flows in blue. In the figure, red circles identify the points of friction and bottlenecks where we think tensions may arise between network participants and the otherwise coordinated flows diverge. Detailed charts for material, information and cash flows are presented in the Annex.

The areas marked in the figure note the **bottlenecks in which the various flows diverge**. These areas came into being mostly because the banking sector and the post office outsourced logistics services, thus an intermediary cash logistics service provider sector emerged: a network node resulted that controls a large part of the material flows.

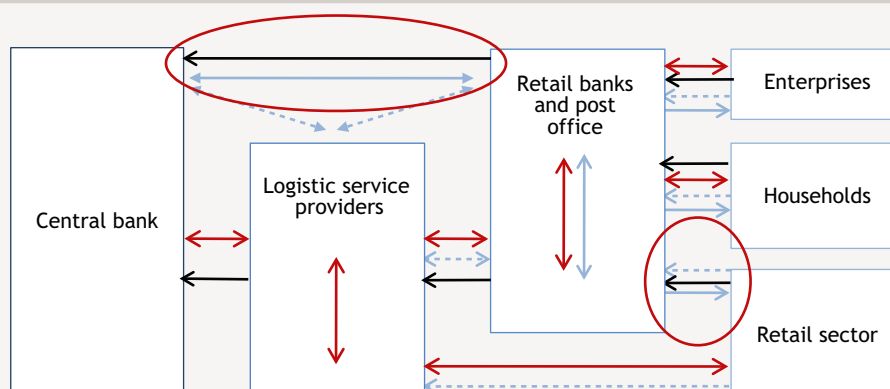
²⁵ In this respect, checkout counters are a borderline case because their existence is required primarily for the accurate settlement between the customer and seller, though of course cash handling is an important responsibility in retail facilities. In most cases, large retail chains also have contracts with cash logistics service providers, thus they are responsible only for intraday cash handling operations.

Table 3
Actors, activities and resources of the network

Actor	Activity	Resource
Central bank	Following from its key network management role: – cash related strategic decision making; – issue of cash, strategic inventory management; – withdrawal and destruction of reject banknotes; – retreat from daily operative logistics: declining level of banknote recirculation and stock consolidation.	– Accumulated specific know-how; – centralized, modern operating infrastructure – Logistics Centre; – human infrastructure: shift towards the use of highly qualified expert resources; – IT system providing real time connection with network actors.
Banks, post office	Control of network distribution and banknote recirculation by outsourcing material processes.	– Small number of human staff, primarily experts; – teller systems supporting internal distribution within the network, IT connection to MNB and service providers.
Cash logistics service providers	Activities expanding parallel with the shrinking role of the central bank: physical execution of material flow between network actors, banknote processing, recirculation and distribution in the branch and ATM networks of banks and the post office, as well as between corporate (retailer) customers.	– Operative know-how necessary for the performance and control of material flows; – extensive physical infrastructure: banknote and coin processing machines, facilities, security systems, transport equipment; – the majority of human resources work in operations; – IT connections with banks and the MNB.
Enterprises, households	They “only” use the cash in their payment transactions. Larger retail chains and other retailers have typically outsourced their cash distribution to service providers.	Specifically cash-related resources entail retailers’ cash registers but such actors typically have no resources dedicated for this purpose.

Source: table compiled by authors.

Figure 10
System of cash supply flows



Source: figure compiled by authors.

- A division of labour evolved in the network, where material flows are performed by the service providers but the MNB has relationships with the clients of the service providers, i.e., the financial institutions both in terms of fee payment and account keeping (that is, service providers will on occasion be left out of the flow of money and information). As another problem area, when determining the terms of banknote recirculation, the MNB regulates credit institutions and the post office: they are the ones responsible for compliance with the MNB rules while the regulations are effectively implemented by the service providers. Thus, because of the outsourcing arrangement, the MNB can exercise only indirect, quality assurance control over the banknote processing activities of credit institutions and the post office. The outsourcing has yet another important implication: service providers also play a key role in the fight against banknote counterfeiting as they are the only actors to check the cash collected from the customers of the banks for genuineness.
- The same “relational disturbance” is present on another vertical level: the relationship between commercial banks and the retailers that are priority, large customers is often unclear. There are also market arrangements where the bank considers a significant involvement in the cash-related activities of the retailer to be part of a complex package of services and the explicit costs of these are not communicated to the client. There are also instances where the retailer, rather than the bank, hires the logistics service provider to perform cash-related functions and the bank accepts the accounts

rendered by the service provider for the account transactions between the retailer and itself. In another common arrangement a retailer has business relations with more than one logistics provider. Thus the tangled relationship of the banks and retailers often leads to a chaotic situation in respect of information and material flows.

Because of this, the MNB continues to be the key node in the network because lines of information converge in the MNB; nevertheless, the central bank is in a difficult position because it has different types of ties to the various actors, and in terms of logistics, the service providers are in the centre of the flows.

Horizontal flows are also important for the efficiency and functionality of the system. As one of the most important consequences of the reduced operative role of the central bank, the **cooperation between the banks and the post office** (i.e., in practice the smooth operation of the interbank market) is **one of the most important efficiency consideration in the operation of the network**. If the MNB as an actor with an outstanding network position is to reduce its day-to-day operative logistical role (primarily in stock consolidation), it must have the important objective of promoting interbank trading through the shaping of the regulatory environment and through its fees policy alike. In recent years, in order to promote cooperation between network participants, the MNB has adopted the following key measures that have proven (or will prove) successful in the medium-to-long run:

- In the field of **coin logistics**, it has placed consolidation stocks with cash logistics service providers, which facilitates the equalisation of the weekly and monthly seasonal fluctuations in demand for coins. Furthermore, in its business terms and conditions it has specified central bank availability that looks to assure maximum cooperation between the actors as the MNB is at the disposal of market actors only if the aggregate volume of their stocks fails to cover the actual demand.²⁶ In any other case, the actors must manage their requirements through transactions among themselves.
- **Encouragement of container-based banknote lodgement and withdrawal through the fee policy.** As mentioned above, the minimum unit the central bank accepts or pays out is one bundle of banknotes, i.e., 1000 notes of identical denomination. Naturally, the larger the logistical units used for the material flows among actors and between actors and the central bank, the more efficient the operation for distribution purposes, and the better the fit to the internal operating processes of the MNB. To this end, the central bank has introduced logistical units consisting of 200 bundles of banknotes (containers) in day-to-day cash operations. As credit institutions and the post office tend to have cash turnover of less than 200 bundles, they are unable to make use of the free container-based transactions for lodgements or withdrawals on their own but if 2-3 entities cooperate, the units can easily be filled. Considering that container lodgements and withdrawals are free while a fee of 0.3 HUF per banknote is charged for single bundles, there is a strong financial incentive for actors to cooperate.²⁷
- By facilitating the **notes-held-to-order (NHTO)** scheme, the central bank continues to nudge cash circulation in the direction of the market. Essentially this means that credit institutions and the post office may hold cash in excess of their daily requirements without any interest loss. The greatest advantage is the increased security of supply and the greater efficiency of the cash cycle. The Magyar Nemzeti Bank considers the Dutch operating model to be the primary benchmark, where the central bank allows account holders to keep cash in their own repositories during the closing time of the settlement system. For the central bank, the cover is the amount earmarked in the subaccount of the account holder that cannot be used at the account holder's discretion (MNB, 2010).

For the network, the NHTO scheme is a momentous measure as the central bank may improve the efficiency of the operation of the interbank market and thus the material flows of the entire network by changing the system of incentives

²⁶ Under the market coin model introduced by the MNB from 2008 on in several steps, the MNB has set maximum and minimum stock levels for each service provider by denomination based on the historical demand figures of recent years. Furthermore, through its real time IT connection to cash logistics service providers, the MNB monitors the stock levels of each actor weekly, by denomination. If it finds that the coin withdrawal and/or lodgement demands it receives can be satisfied from the stocks held by market actors, it will reject the transaction and in its website it discloses in advance the availability of each denomination for the week concerned. Thus in practice, the central bank participates only in the balancing stocks between special seasonal periods (outflow before the summer and Christmas, increased back-flow early in the year), and it replaces coins "falling out" of circulation (approx. 50-60 million pieces/year).

²⁷ In the case of lodgements, as the national bank also accepts multi-denomination containers, most banknotes arrive to the MNB in containers. In contrast, due to its own operating characteristics, the central bank supplies only single-denomination containers for withdrawals for the time being, thus containerised cash withdrawals are less frequent than single-bundle transactions.

offered to market actors. Previously, market actors optimised their cash holdings based on the interest foregone whereas under this regime they will do so based on daily and weekly fluctuations in demand. Thus the efficiency of material flows may increase.

5 Assessment of the operation of the Hungarian cash network

As we explained in the discussion of the theoretical background in Chapter 2, networks are driven by different principles and different types of relationships can be identified between the participants of the network. In this section we analyse the so-called “hard” static (configuration) and “soft” dynamic (coordination) elements and typify the relationships identified between actors, then we proceed to evaluate the constraints and future opportunities of cooperation among actors.

5.1 CONFIGURATION

Under the heading of configuration we analyse the structure of the system: the mostly static contractual elements typical for the entire network. In the course of the examination of cash supply, we overview the division of labour between actors, risk management, the organisational arrangements typical for the model as well as pooled resources.

- **Division of labour:** the role of the central bank in the cash cycle in Hungary relies on an activity-based division of labour between the MNB and other actors, where the central bank as a body managing public funds increasingly concentrates on core activities that the market cannot perform efficiently or at high quality standards. The gradual withdrawal of the central bank from active logistical operations has promoted the advancement of the market of cash logistics service providers, but these actors strengthened mostly because in order to optimise their own internal operating costs, commercial banks outsourced cash logistics not closely linked to their core operations. With the reduced role of the central bank in operative logistics and as a result of the business decision of commercial banks a new market emerged; over time, the retail trade sector also established links to that market. The reduction of the active logistical role of the central bank was certainly a major step for the efficiency of the system if we accept that market coordination is more efficient than bureaucratic coordination.
- **Risk management:** The operation of the cash network has two fundamental categories of risk: *operational risk relating to the maintenance of the continuity and robustness of cash supply and the clearly security type risks relating to the asset value of cash itself*. In the context of the first risk, the MNB launched a comprehensive project in 2008 with the purpose of identifying the operational and security of supply risks in the cash supply system of Hungary and to propose practical and regulatory arrangements to mitigate and manage the risks identified based on consultations with stakeholders. Risks in cash supply have been mapped with the participation of credit institutions, the post office and cash logistics service providers; the most important message arising from the survey is that from among cash supply functions, cash transportation would lead to a critical situation if it failed in part or in its entirety. In this context, the central bank has devised a number of preventive and risk management measures, the implementation of which is under way. As the risks relating to the uncertainty of supply are present essentially on the level of the system, and because of their magnitude they cannot be addressed by a single actor in its own, the central bank considers coordination and the implementation of the measures developed to be its own responsibility in this area.

The high asset value of the product is a special feature of cash logistics because a single container may hold cash worth several billion HUF. Consequently, cash transportation and processing involves significant (primarily security) risks, which various actors of the network manage differently. As explained earlier, the Magyar Nemzeti Bank responds to discrepancies in lodgements and counterfeit banknotes by imposing special fees.²⁸ CIT companies minimise security risks relat-

²⁸ If the source of the deficiency is not clear (e.g., discrepancies or counterfeits are found in a pooled container), the CIT charges the special fee to all the parties to the transaction.

ing to transportation by applying various defence technologies. Cash transport and processing companies must obtain insurance for their operations, which amounts to approximately HUF 420 million a year in the case of G4S (Juhos, 2010). Commercial banks take security considerations into account when designing branches and ATMs.

- **Organisational arrangements:** In the cash supply system independent enterprises deal with each other. The evolution of cross-functional groups extending beyond the boundaries of individual organisations in long-term cooperation with each other may further improve the efficiency of the operation of the network. Interbank trade is such a cross-functional cooperation, currently operating with low levels of IT support and relying mostly on interpersonal relationships. Another system of interorganisational cooperation is the Cash Forum established and coordinated by the MNB, which is a consultative body of the large actors in the cash cycle, holding quarterly meetings as a rule. However, at present its role is limited to information exchange rather than decision preparation. The quasi project organisations initiated by the MNB represent another, more efficient form of cross-functional cooperation; these are set up to elaborate then implement and monitor the details of certain efficiency initiatives of the central bank (such as the NHTO scheme, business continuity measures). These, however, are flexible and temporary organisational forms that cease to exist once the project is over. Thus at present there are few cross-functional organisational arrangements in the cash network, which has considerable efficiency reserves in our opinion.
- **Pooled resources, infrastructure:** According to Dyer-Singh (1998), relation-specific links and projects may be a source of relational rent. In the course of the efficient operation of the network, efforts must be made for the shared financing and ownership of network assets, i.e., assets used jointly by members of the network (Gelei, 2009).²⁹ The information systems used by the members of the cash network such as WebeC and VIBER are typically such network assets but a similar view can be taken of trading in the interbank market as well. Still, the operation of the latter is at present not supported by the pooled infrastructure. Coins held to order managed by the cash logistics service providers can also be considered pooled resources.³⁰ Theoretically, the central bank infrastructure is also a pooled asset, which the state finances from public funds to promote welfare objectives. Due to this latter characteristic, this is an exception to some extent but it does not preclude the possibility that in the long term market actors may cofinance the services offered by the MNB Cash Logistics Centre or some of the costs entailed in the production of banknotes and coins, in different percentages.³¹ The cash logistics system could also be improved by the establishment of additional pooled resources or the joint development of existing ones.

5.2 COORDINATION

Below we analyse the key principles that drive and coordinate the entire network. We analysed the cash logistics system with four major coordination criteria in mind: planning and management, culture and attitude, power and trust.

- **Planning and management:** At present system-level planning in the Hungarian cash logistics model is the responsibility of the central bank. The central bank involves direct stakeholder banks and logistics service providers in this planning and management process typically through the Cash Forum and project organisations set up for specific purposes. If the MNB proposes to make a strategic decision with a fundamental effect on the operation of the entire network (for instance, change in the denomination structure), it also consults every major actor in the network as well as special groups of stakeholders. These consultations are particularly useful to assure that the MNB makes the decision most desirable for the social optimum but they do not bring the controlling role of the MNB into question. This central planning and control role of the MNB is expected to remain in place in the long term irrespective of the role the central bank plays in the logistics system of the time. The MNB is the only entity in possession of the central, exclusive resources and performs the related activities (issue, regulation, monitoring, etc.) that are indispensable for the operation of the network.

²⁹ This is true only if the relation-specific investments are made mutually by each cooperating party, thus a joint commitment arises. Otherwise the party making higher relation-specific investments becomes vulnerable.

³⁰ The NHTO arrangement cannot be regarded as a pooled resource as the MNB concludes contracts with the individual banks to manage the increased risks, thus there is no (or only optional) pooling of resources between actors.

³¹ In its business continuity plan for the management of an emergency in cash transportation, for instance, the central bank already shares the costs incurred with market actors.

- **Culture and attitude:** The culture and attitude of the actors in the cash network is particularly important primarily for the *adaptation to continuous changes* and for *network learning* because, in our opinion, these two sociocultural dimensions may have a significant impact on the roles within network processes. Even though actors in the cash supply chain have different cultures and attitudes, they continuously learn from each other. This learning is attributable to working together and to technical consultations. As the Hungarian cash logistical system is a network with relatively few participants, knowledge is often passed on through the informal, interpersonal network. It is the common responsibility of the international CIT firms, banks and the Magyar Nemzeti Bank to establish a cash logistics culture in Hungary that focuses on the efficiency of the system and the satisfaction of consumer demand to a high standard. This is necessary primarily for the adjustment of the division of labour to the gradual "retreat" of the central bank from the operative area that has been ongoing since the second half of the 1990s. The continuous reduction of the operative role of the central bank demanded physical investments from the actors as well as a significant expansion of know-how and a change in attitude to be able to smoothly adapt to the changing business processes.
- **Power:** The power relations of the actors are particularly important for the operation of the network. According to Lukes (1974), power is an ability to influence the interests of another party adversely, without his consent, in order to pursue our own goals and interest. According to Cox et al. (2005), power may be present in business relations in three dimensions, which are based on the definitions of Emerson (1962) and Lukes (1974). Power is:
 - a *resource or ability* with which we can directly hinder the other party in achieving its objectives (using our dominance we force him to change/abandon the objective that is optimal for it);
 - *source of manipulation*, that is, a possibility to directly influence the goals of the other party without the physical expression of direct dominance (in many cases the sense of a threat is also sufficient for the other party to subordinate its goals to those of the dominant party);
 - *limitation of access to information* (information asymmetry, which prevents the counterparty from making optimum, informed decisions).

In the Hungarian cash network we have identified the following power nodes and interdependencies, which have a fundamental impact on the strength and manner of network cooperation:

- The *central bank* can be regarded as the *major power centre* in the cash network because it has tools guaranteed by law, highly unusual in commercial life, through which it can directly influence the behaviour of actors and control them in its own interest. As a peculiarity, the whole configuration of the network depends fundamentally on the decisions of the central bank; nevertheless, the MNB must adapt to the characteristics of the network when making such decisions. In its decision making, the central bank is not independent of network effects, it must adapt to market characteristics and processes but this "counter-effect" is considerably weaker than the dominance of the MNB enshrined in law. The use of containers in central bank transactions affords a good example for the ability of the network to constrain the power of the central bank. Banks and the post office tend to use containers with 200 bundles of mixed denomination for lodgements with the central bank because this promotes their cost efficiency and is the best fit to their internal procedures. In case of withdrawals of cash from the central bank, actors typically have not use for 200 bundles of the same denomination even if they work in cooperation with others. Thus no matter how much the central bank favours containers or, indeed, uses administrative measures to promote their use, network processes do not support their across-the-board use.
- There is a certain *dominance* in the relationship of commercial banks, the post office and *cash logistics service providers* on the side of the latter. This arises from the fact that the banks and the post office as principals outsourced almost their entire cash operations, thus in the short term they do not have the physical resources or the know-how to perform cash-related activities; furthermore, the costs of switching service providers is high and its possibility is limited due to the structure of the market. Thus at present there is a moderate dominance on the side of service providers, which in practice manifests itself mainly as a source of manipulation (influencing the services offered and their pricing).

In summary, the central bank has peak power that is unusual in business³², which it can use to directly influence the behaviour of network actors, but despite this power concentration it is still unable to act independently of network effects. The central bank exercises this power over other actors primarily in its decisions concerning regulation, control and the terms of service but it is also forced to adapt to long term market trends. At present more power concentration can be observed on the side of cash logistics service providers vis-à-vis banks but its extent cannot be compared to the power of the central bank and it can change in the medium and long run through the decisions and market behaviour of the actors.

- **Trust:** The level of trust between actors is particularly important for network coordination. In our paper we accept the risk-based approach of trust, under which *trust is a positive assumption concerning the behaviour of the other party to the effect that in the event of any change in circumstances it will not act opportunistically. Thus trust means that we voluntarily take on risk by becoming vulnerable to the other party* (Das and Teng, 2004). Based on Creed and Miles (1996), this trust can be divided into two components: *competence trust, the belief that the partner is capable of acting upon his works*, and *goodwill trust, that he has the intention to make good his promise*. Under the risk based approach to trust, the degree to which trust can play a coordination role between two cooperating parties depends on the risk level of the various business situations. According to the theory, the presence of trust is relevant in instances when risks are identifiable to the parties but they can be managed informally and they are not of a magnitude that would warrant the use of institutionalised methods³³ to handle them (Barney and Hansen, 1994).

In our case, the relevance of trust in the operation of the network is reinforced by a number of factors. On the one hand, the competence trust in cash itself, and indirectly in the central bank as a public actor is high to start with. This is necessary for the appropriate operation of the system as cash can act as a medium of payment because economic actors trust that the money given/accepted as payment actually represents its nominal value. If that trust is undermined (e.g., in an extreme case of counterfeiting or at times of hyperinflation), actors start using another medium (currency, precious metal, other valuables) instead of the local currency.

There are interorganisational and interpersonal trust ties between network actors. In interorganizational cooperation the competence trust tends to be high as work in the network is distributed on the basis of knowledge. The stability of the competence trust level is also underpinned by the strong legal environment: the activities of the various actors are heavily regulated by contracts and licences – e.g., the operating licence of cash logistics service providers, their mandatory liability insurance, the terms and conditions of banknote recycling. As a result of intensive regulation, the level of opportunistic behaviour is generally low as the system threatens with severe sanctions (e.g., special fees) if someone violates the “community rules”. In addition, competence trust also plays an important role in the day-to-day settlement of accounts among banks and the post office, which is practically one of the pillars of interbank cash trading.

In contrast, the level of goodwill trust is low in the relationship between cash logistics service providers, and often also between service providers and banks, which is understandable to some extent as providers are keen competitors to each other; between banks and providers the raising of the quality of services and the concomitant costs of service represent constant sources of conflicts. Another friction point and frequently a source of mistrust between service providers and banks is the difference between the levels of optimisation of their operation: banks only optimise for their own operating costs and the interests of their clients whereas service providers optimise for the whole system as they work with a large number of principals. Thus it is possible that in the course of the operation of the service providers the interests of a particular clients suffer, which may cause breaks in the relationship and in the medium term it may reduce both goodwill and competence trust. Most network actors have no confidence in the accuracy of the settlements of the other actors despite strong quality assurance rules, which is another clear goodwill trust issue in the network. This problem with trust often causes inefficiencies in the cash cycle because a service provider will not accept a bundle of banknotes coming from a competitor and purchased in the interbank trading system or acquired in the course of supplying a retail chain, and it reprocesses such bundles to check for genuineness and completeness. The dominance of the service providers is also conducive to the reduced goodwill trust of their principals, the commercial banks as in practice the parties have significantly diverging views of the extent to which such dominance is exercised.

³² We consider the power of the central bank in the cash network to be special because this power is enshrined in law, thus its level remains constant both in the short and long term. In contrast, in business relationships the power situation can generally be changed by the parties in the long term.

³³ Stipulated guarantees, sanctions, monitoring committees, etc.

In addition to interorganisational trust, interpersonal trust is also an important pillar of the operation of the network, particularly in cases where the operative processes have little background support. Interbank banknote trading is also a good example here because actors tend to rely on their “tried and tested” relationships and they will turn to different actors only if they are unable to satisfy their needs through that informal channel. Similar interpersonal bonds assist in the preparation of central bank decisions, where actors often have informal discussions on system-level strategic issues before the actual proposals are worded.

Having reviewed the key guiding principles of the network, now we go on to typify the relationships between network actors, which will help us assess the behaviour of the participants of the network.

5.3 SYSTEM OF RELATIONSHIPS OF NETWORK ACTORS

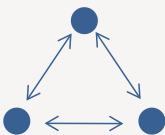
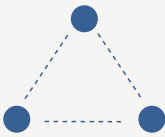
According to Håkansson and Persson (2004) and Lazzarini et al. (2001), there are basically three types of relationships in the operation of a network:

- *sequential* relationships assuring direct, unidirectional flows, which link participants vertically;
- *reciprocal*, intertwined relationships, where there are bi- or multidirectional effects and interactions between actors;
- *pooled*, weak relationships, where several actors use the same resource or output during their operations.

Table 4 systematically presents the typical examples, by the above typology, of the types of relationships mentioned in our cash network. By their nature, these relationships also mean dependencies between network actors.

The data in Table 4 reveal that there are a number of connecting links between network participants. In this lattice of network, the central bank plays a central role in terms of control and cash logistics service providers in terms of the coordination and management of material flows. The number of relationships relying on the use of pooled network resources is small, which hints at the existence of potential efficiency reserves. However, a relatively high number of forms of reciprocal relations between the parties can be identified, thus this can be considered a tightly integrated network containing strong ties.

Table 4
Types of interorganisational interdependencies in the cash network

Pictogram	Type	Network example
	sequential	- Daily distribution of cash among network actors: the actors may obtain cash in addition to the amount currently available to them from the central bank only, and they can lodge the “surplus” and withdrawn and/or unfit notes and coins only with the central bank.
	reciprocal	- Division of labour between the central bank, service providers and banks and the post office in the recycling of banknotes and coins; - sharing and transfer of know-how between network actors; - operation of banknote trading and coin logistics between banks, the post office and service providers; - medium and long term effects of the central bank’s regulations and strategic decisions in the network; - relationship between retail chains, banks and service providers.
	pooled	- Use of the service infrastructure as a pooled network resource; - use of the WebeC system connecting the central bank, banks, the post office and service providers in the information flow between actors; - use of notes-held-to-order and coins-held-to-order schemes as a special pooled infrastructure.

Source: table compiled by authors.

5.4 INTERPRETATION OF EFFICIENCY IN THE OPERATION OF THE CASH NETWORK

Following the discussion of the actors in the network, the activities and links between them, now the operation of the network needs to be assessed from the aspect of efficiency. The meaning and interpretation of this analytical dimension for networks is not trivial. To make matters more complicated, cash logistics is a service, the quality of which can never be assessed objectively as it depends on the subjective evaluation of the user; consequently, both quality and the required use of resources to produce that quality is rather difficult to quantify.

In the economic sense we might say that efficiency is the measure of the value of the output produced through one unit of resource use and we consider those actors and systems efficient that can create higher-value or more output with the same amount of resources. In the case of networks, however, this output-oriented assessment can be of limited use only as both the use of resources and the output are difficult to measure and define. On the level of a single actor or group of actors we still find quantifiable and measurable objective indicators; however, it is exactly the number of actors in the network and the complexity of their relationships that renders quantitative measurement and comparison difficult. Therefore, still remaining within the IMP approach, we must differentiate between the dimensions of micro- and macro-level network efficiency. Håkansson and Snehota (2006) understand micro-efficiency to mean attempting to evaluate network operation starting from the level of various selected network actors, summarizing costs and benefits measurable on their level. In our opinion, however, the efficiency of network operation is much better measured by assessing the entire system from a macro aspect. Thus, in our view, the assessment of network efficiency is meaningful and relevant using the following criteria:

- *balance and smoothness of flows between actors;*
- *internal ability of the network for adaptation and learning;*
- *relationship of the network and its environment – external adaptation, dependence on other networks;*
- *management efficiency (who manages network processes and activities and how).*

5.4.1 Evaluation of the operation of the network from the aspect of cost

In 2010 the Magyar Nemzeti Bank, under a project covering almost the entire financial sector, reviewed the social costs of the various modes of payment (see Turján et al., 2011). The methodology they used quantified the total social cost of the mode of payment concerned: it measured the revenues and expenditures arising at the actors participating in the various chains of payment using activity-based cost calculation, then filtered out the effects of fees and revenues relating to flows between the actors. Data for the survey was provided, inter alia, by the largest commercial banks, the post office, cash logistics service providers and the central bank itself, while corporate and household data was obtained for a representative sample. Thus, even though the estimation of the number of cash payment transactions and of its costs to households and businesses, as well as the cost allocation used by banks and the post office involves uncertainties, it is safe to say that we have a relatively reliable, accurate estimate for the social costs of the operation of the cash sector, the results

Table 5
Social cost of cash payments in Hungary in 2009 - expenditures, costs and fees relating to cash transactions (without seniorage) in million HUF

Actors		Private costs	Paid fees	Own private cost	Received fees	Net private cost
		(1)	(2)	(3)=(1)–(2)	(4)	(5)=(1)–(4)
1.	MNB	7.16	0.00	7.16	0.21	6.95
2.	Payment service providers	76.84	9.98	66.86	59.72	17.12
3.	Cash logistic providers	16.02	0.01	16.01	14.74	1.28
4.	Enterprises	144.14	46.75	97.39	0.00	144.14
5.	Households	37.39	17.42	19.97	0.00	37.39
6.	Public sector	1.94	0.52	1.42	0.00	1.94
Total		283.49	74.67	208.82	74.67	208.82

Source: Turján et al. (2011, p. 37).

of which are shown in Table 5. Naturally, on their own the findings of this survey provide no more than a snapshot of the operation of the cash network as we have no data series that would facilitate longitudinal analyses, thus such an analysis is only a possibility for the future. Nevertheless, these figures are extremely interesting because if we compare them with the outcomes of the macro level network efficiency evaluation, the directions of efficiency increase as well as the level of benefits to be expected may also become visible.

The so-called aggregate own private cost, net of fees, represents social cost, i.e., the implementation of cash transactions cost 208.82 billion HUF, or 0.80% of the annual GDP in 2009. A dominant part of social costs and expenditures relate to businesses and households (56.2% in aggregate) and payment institutions and cash logistics firms (the two sectors together: 39.7%), while the remaining 4.1% is shared between the central bank and the state. The analysis of the data reveals that while in the configuration and coordination of the cash logistics network the MNB, banks, the post office and logistics service providers play an outstanding role, most of the social costs are borne by households and businesses. From this we may conclude that on the level of society a shift towards a cash-free payment infrastructure, operating at higher fixed costs but considerably lower variable costs than cash, would definitely result in an efficiency increase.

In order to obtain an impression of the potentials of the increase of network efficiency, we first analyse the macro efficiency of the network using the criteria specified by Håkansson and Snehota (2006), then we identify the factors currently limiting cooperation between actors.

5.4.2 Evaluation of network level efficiency

• *Balance and smoothness of flows between actors*

Our analysis of network flows identified three main points of friction in the interactions of actors: First we should point to the altered role perception of the central bank, more specifically its retreat from operative activities. This forces market actors to adapt as they must establish the infrastructure and possess the competences previously held by the central bank. Naturally, the central bank may not make decisions independently of the other actors. When dividing activities it must take into account market conditions and it may share or delegate certain activities to credit institutions or the post office if they are sufficiently prepared to perform them. We might say that the “allocation” of logistics activities between the central bank, commercial banks and logistics service providers generates a friction surface in the network by continuously reorganising flows between the actors. Naturally, in the long run these changes do not prevent effective operation but in the short and medium term they may cause systemic tensions.

From the aspect of balancing flows between the actors, friction is generated by the attitude of commercial banks and the post office to focus exclusively on their core activities of banking and postal services. When these outstanding network intermediaries almost totally outsourced their cash-related activities to service providers, they suffered considerable loss of competences in the long run. However, their legal responsibility has remained in cash recycling and customer service while they are unable to perform such functions on their own. Furthermore, it is unclear how the banks monitor the service providers’ work and the content of the contractual relationship between actors is also heterogeneous. Excessive dependence of the principal on the infrastructure and performance of the service providers is problematic not so much for daily operations but rather in respect of the ability to respond to potential systemic problems.

The loss of efficiency resulting from the limited cooperation between the banks and the post office on the one hand and service providers on the other hand is also a source of friction; as a result, for reasons of monitoring or distrust, activities are often unnecessarily duplicated in the course of the material flows between actors (e.g., reprocessing of bundles of banknotes received from another service provider), or actors are unable to make full use of the benefits offered by containerization and the notes-held-to-order scheme in their relationship with the central bank and they often trigger unnecessary deliveries.

• *Internal ability of the network for adaptation and learning*

The adaptation requirement is an important feature of the operation of the network primarily due to the change of the activity profile initiated by the central bank. The review of the operation of the past 10-15 years reveals that learning

by the central bank was motivated mostly by international benchmarks. However, to assure effective regulation the MNB must always be aware of the market's operative processes and the capabilities of network actors, which requires openness and continuous adaptation from the central bank as well. Naturally, the degree of adaptation of the central bank cannot be compared to that of market actors. When allocating responsibilities, the central also adopts measures to share know-how as the development of various development projects promotes mutual learning. Market actors have successfully adapted to the changes initiated by the central bank in recent years as there have been few problems or interruptions in daily operations. As a result of the measures of the central bank, the sector of cash logistics service providers experienced particularly extensive improvement and learning, and commercial banks opted for a special form of adaptation by resorting to outsourcing. In their case the question is how they intend to adapt in the long term to the reduced role of the central bank. Will they continue to outsource cash operations or will the new market arrangements (notes-held-to-order, coins-held-to-order, real time IT connections, specification of the terms of banknote recirculation) encourage them to insource some of the activities.

- *Relationship of the network and its environment – external adaptation, dependence on other networks*

In the context of the relationship of the network and the environment, two priority factors need to be examined: the interest rate environment and the ability to adapt to various shocks. In recent years, Hungarian interest rate levels have been constantly high as compared to European countries, thus, understandably, in their cash logistics operations bank have tried to minimise their interest losses incurred through the holding of stocks, which they achieved through intensive transportation operations in their distribution system. The question is where the switch-over is between transportation costs and inventory holding costs manifested in the loss of interest income. If interest rate levels were to remain permanently low in Hungary, market actors might be encouraged to substantially revise their own distribution strategies.

The ability of the network to respond to various external shocks (e.g., sudden spike in households' demand for cash) is difficult to assess because, fortunately, with the exception of the run on Postabank in 1997, there have been no events to "test" the response to a demand-side shock in practice.³⁴ Having consulted the banks, the post office and cash logistics service providers, we venture to say that a demand shock may force actors to reconsider their present operations but they would be able to manage this. Naturally, this kind of ability to respond is also present in the inventory policy of the central bank, thus it is safe to say that the network would probably be able to handle demand-side shocks. Supply-side shocks have relatively low relevance in the system as the central bank is able to assure steady cash supply through its inventory policy (based on security of supply considerations) and the flexible adaptation of banknote printing capacities to demand-side requirements.

Of the so-called internal, network shocks we consider the permanent dysfunctions of actors with a key role in the supply of cash to households and businesses to be relevant. The greatest risk is the interruption of the operation of service providers resulting in dysfunctions in the cash operations of banks with large branch networks and of the post office. The central bank has identified this potential source of risk to be a systemic problem and it has devised a business continuity arrangement relying on the cooperation of the actors, the police and the MNB.

- *Management efficiency (who manages network processes and activities and how)*

The centre of network control is essentially the central bank, even though in terms of logistics its influence extends only to commercial banks, the post office and service providers with which it has direct relationships. There are two main centres of control: the central bank in terms of network coordination and cash logistics service providers in terms of operative logistics. In respect of information and cash flows, commercial banks and the post office also participate in the management of logistics operations, thus this activity is rather complex.

³⁴ In the course of the economic crisis started in 2008, demand for cash produced a sudden and perceivable jump on two occasions: in October 2008 and March 2009, but this mostly concerned foreign currencies. The "additional" volume growth generated by the payments of the real yields of pension funds in 2011 is also worth noting. The network handled these incidents well, coordination between the central bank, the banks, the post office and service providers was efficient; consequently, services to households were undisturbed. Citizens and enterprises did not notice the additional efforts required from network participants.

We have identified the following main conflicts of interest between parties, which make the management of the network more difficult and pose challenges to regulation by the central bank:

- The fundamental conflict of interest between **the central bank and commercial banks** is that while the latter strive to satisfy the requirements of their own clients as much as possible to hold their stand in competition, the former has an interest in the efficient operation of the entire system and in enforcing considerations of social welfare. Raising quality requirements and wholesale logistics are priorities in the strategy of the central bank, for which commercial banks are not necessarily willing to expend additional resources because they cannot foresee their own benefits from it. This is so particularly because in the budgets of commercial banks, cash logistics related transactions are negligible on the revenue side, while cash supply services are less differentiated in terms of quality thus they are not products to win customers with. As another important consideration, while the central bank has an interest to curb the use of cash for welfare reasons (Bódi-Schubert, 2010; Odorán and Sisak, 2008), citing social welfare costs primarily, commercial banks, based on the costs they incur, do not see cash being more expensive than other modes of payments; furthermore, their clients also insist on the use of cash.
- Between **CITs and commercial banks** there may be conflicts of interest for reasons of optimisation. For instance, commercial banks optimise the operation of ATMs by weighing the interest loss on the cash stock in the machines and the fees paid to the CIT for cash removal. If the interest rate is sufficiently low, the bank will find it worthwhile to maintain a lower ratio of cash removal. In addition, CITs as primary logistics providers have an interest in radical technological change, the costs of which they pass on to their clients, the commercial banks.
- **Between commercial banks**, competition engenders mistrust. Each bank considers its own commercial interests first and foremost, which reduces their willingness to cooperate. For instance, this is why the coin market and sophisticated interbank trading has developed only with difficulties.

The central bank may lower the above-mentioned barriers by stating, in a clear-cut and firm strategy, the directions of development of the cash logistics network and simultaneously trying to highlight its benefits to the individual actors.

In summary, the analysis presented in this chapter reveals that **there are three issues in the focus of the efficient management of the cash supply network**:

- in a process approach: cash and material flow processes diverge, creating critical points, which at times hinder the smooth execution of processes;
- in a system approach: the infrastructure and organisational routines required for the smooth implementation of horizontal transactions are deficient, the interbank market needs to be developed;
- from a network aspect: cash supply is a business activity requiring medium level of trust, thus in addition to formal co-ordination, social capital and a sufficient level of trust must also be established between the actors.

5.5 RECOMMENDATIONS FOR IMPROVING THE EFFICIENCY OF THE OPERATION OF THE NETWORK

At the end of our analysis, relying on its conclusions, we aim to put forth additional opportunities to improve the efficiency of the system. All our recommendations stem from the two efficiency considerations already mentioned: (1) shortening the supply chain and mitigating the effects of bottlenecks, and (2) actions to facilitate horizontal flows and to increase their efficiency.

1.a. Vertical processes would be shortened and the effects of bottlenecks would be mitigated most if **cash processing itself were to be “brought forward” in the entire cash supply process through appropriate technologies**: thus this could be performed by actors on the vertical level where it is most efficiently done, thereby reducing movements between the different levels of the distribution network.

- One solution can be the use of **branch-level recycling machines** that would facilitate the sorting of banknotes. Market actors use machines certified by the central bank. Even though the development of automatic cash processing machines is extremely expensive, their branch level application could reduce transportation costs. Naturally, this could increase the efficiency of the system only if the market actor is balanced, i.e., it can redistribute the cash collected between its own business units.
- Another solution could be **teller automation**. In case of commercial chains with high cash volumes (e.g., hypermarkets), cash processing would occur at the checkout counter when cash is used for payment.
- **Cash-in automation** would allow the increase of the quality of cash-in related services and the improvement of the efficiency of the system. The connection of cash-in and cash-out transactions at ATMs and their incorporation in a single system would reduce the replenishment frequency of ATMs by CITs as CIT firms would need to reckon only with the difference between cash deposits and withdrawals.
- Under another possible arrangement to increase network efficiency, the **central bank could release all of the banknote recirculation tasks to banks and the post office**, maintaining no capacities for such activities and focusing only on regulation and quality assurance in its daily operations. Thus the MNB would shift from the current strong division of labour model to the delegating model.

1.b. The efficiency of vertical flows can also be improved through the fee and business policies of the central bank and of commercial banks. On the one hand, the central bank can encourage the further cooperation of market actors through its own fee policy and through restricting its availability. On the other hand, commercial banks and the post office may encourage their household and corporate clients to reduce cash use by pricing cash services based on their real costs.

- We have seen that ATMs play an important role in the availability of cash, thus the optimisation of their replenishment is a key issue in cash supply. Commercial banks often advertise their account packages by the ability of account holders to withdraw cash from domestic ATMs free of charge once a month. This encourages the clients of banks to withdraw a large part of their income once a month, in a large single amount, from an ATM. From the aspect of cash logistics, this results in cash withdrawal peaks. This monthly seasonality (cash withdrawals are characterised by an annual seasonality because the amount of cash withdrawn from ATMs rockets before holidays) would be prevented by the **abolition or revision of the cash withdrawal fee**. A fee policy may be appropriate whereby, similarly to telecommunications firms, commercial banks offer “pooled” packages, in which the per transactions cost to the client decreases as the volume of transactions increases (possibly unlimited free cash withdrawal upon the payment of a flat amount). It would also be a step in the right direction if cash withdrawals were not priced based on the number of transactions but based on the amount of cash withdrawn, encouraging clients to take smaller amounts.
- The incentives provided by legislation are important tools in the hands of the central bank to enforce its policy. On the system level the fee policy can be refined even further: if it provided incentives to maintain quality, it would remove additional burdens from the central bank in its monitoring function. We consider that **quality dependent central bank fees** would be an appropriate tool for this. This would mean the introduction of different categories of banknote and coin quality (based on various criteria) and the Magyar Nemzeti Bank could set the fees payable to the central bank by category. This would encourage market actors to comply with quality requirements as best they can.

2. Our recommendations for improving the efficiency of horizontal flows:

- a) One avenue of improvement of interbank trading is the establishment of a **multilateral trading** system. At present, interbank trading works on a purely bilateral basis, where commercial banks select their counterparties based on their personal order of preference. In a multilateral trading system, banks with excess cash would establish a pool from which banks in need of cash could obtain cash easier and faster. The organisational background to multilateral trading would be the establishment of a group in which every commercial bank could participate through a representative.
- b) **Notes-held-to-order stock to be kept by cash logistics service providers.** Primarily for settlement, control and trust considerations, the MNB placed the buffer banknote stocks for the smoothing of weekly seasonality with commercial

banks and the post office, even though in practice they are managed by the service providers. However, this model can be used only to a limited extent by smaller commercial banks and cooperatives and the differences of the banks' limits also presents occasional problems in stock consolidation. In the future it may be worth considering a stock arrangement that would be managed by service providers in a consolidated manner, similarly to the coin stock, and the central bank would contract with the service providers rather than with individual banks for the NHTO scheme.

- c) The increased efficiency of the logistics system would be promoted by the ***standardisation of logistical minimums***. This would simplify uniform packing and increase the physical size of the unit of cash to be transported (and its value as well). In addition to affecting economies of scale relating to transportation, the standardisation of logistical minimums would further reduce the role of the central bank in the cash logistics material flow.
- d) For cash logistics service providers a kind of ***specialisation*** within the industry may be the answer to the keen competition among cash-in-transit companies. Specialisation is noticeable in the strategy of JNT as coin logistics has become increasingly emphatic in the cash logistical activities of the company. Cash and banknote logistics diverge as their transportation entails different requirements.

6 Summary

In our paper we have looked at the sector of cash supply services, essentially performing a public service, using the approach applied to business networks. Our approach proved interesting exactly because of this duality: we adapted a commercial logic to an activity which has a primary welfare function (the sufficient availability of cash) and the efficiency of the system supporting this is only a secondary requirement. We assumed that **network thinking** may help the central actor of the network to resolve the conflict: **the efficiency of the system can be improved** though cooperation based on mapping the interests of actors and designing appropriate incentives **without compromising the welfare objectives of the central bank**. Our study was prompted by the model change of the past decade in the Hungarian cash supply system, whereby the Magyar Nemzeti Bank gradually outsourced its cash supply functions to market actors. Thus a new industry emerged, that of cash-in-transit companies; designing an incentive system for them is an interesting management task.

In the theoretical part of our paper we showed how the conflict can be resolved using the fundamental approach of business administration. We regarded cash as a product the use value of which is guaranteed by the central bank through regulation while its place and time value depends on cash logistics. Thus the role of supply chain management as the activity aimed at optimising logistical processes and integrating actors becomes more important in value creation. Then we quickly arrived at the cash supply network: we showed that there are not only unilateral but also reciprocal interdependencies between actors as well as dependencies involving more than two actors. **Consequently, cash supply must be regarded not only in a process approach but also in a system approach.**

In the body of our paper we modelled the operation of the network in our own analytical framework: its actors, the processes and the relationships between them. In compliance with network theories, our analytical framework encompassed the various elements of the network structure – actors and processes – as well as the guiding principles between the elements – the formal principles configuring the network and the dynamic informal coordination. **Based on the analysis, we identified three central issues for network development: the more efficient implementation of processes through the closer integration of cash and material flow, the optimisation of the system through the increased efficiency of the interbank market, and the promotion of networking by strengthening the trust between actors.**

In accordance with these three requirements, we have put forth recommendations, which relate to the further optimisation of the cash supply process through logistical solutions and the fee policy. We also put forward ideas for the stimulation of the interbank market and the increase of market focus. In our opinion, the tool set available to the central bank – the possibility of legislation and the role of information node – is very valuable, laying the ground for effective network management.

In a broader context we showed that the tool set of network management may be particularly useful in the delegation of state activities to the market as it offers the central actors the possibility to manage and stimulate market actors from the outside. Thus the principle of market efficiency can be exploited over bureaucratic coordination without jeopardizing the interest of welfare. **We consider that the use of the network approach and of the tool set of network management in respect of other public services is worth considering for all central public actors that consider the competitiveness of the public sector to be their objective.**

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8 Annex

Table 6
Classification of banknotes by quality

Quality characteristics	Fit banknote		Unfit banknote		
	Can be recycled in ATM	Cannot be recycled in ATM	Worn, genuine banknote	Counterfeit, tampered, suspect banknote	Genuine banknote withdrawn from circulation
0. withdrawn from circulation					X
1. genuine	X	X	X		X
2. satisfies legislative sorting criteria	X	X			
3. processed by certified banknote handling machine	X				

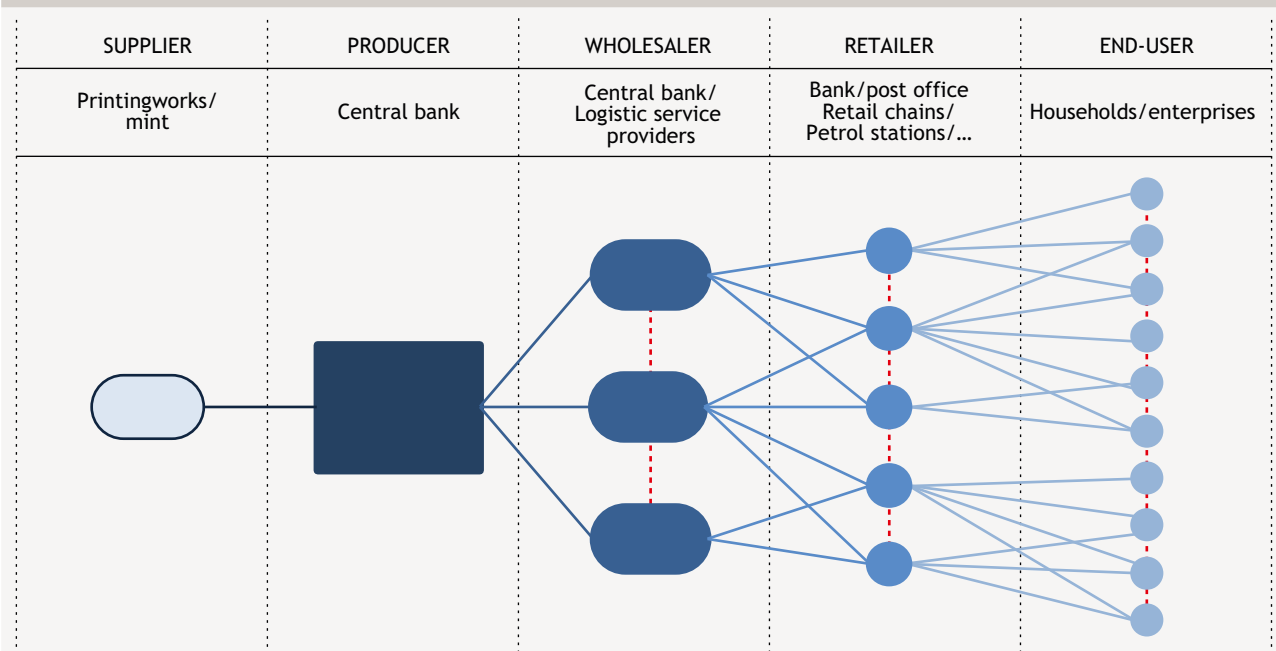
Source: Based on MNB Decree No. 11/2011 (IX. 6.).

Table 7
Classification of coins by quality

Quality characteristics	Fit coin	Unfit coin		
		Worn, genuine coin	Counterfeit, tampered, suspect coin	Genuine coin withdrawn from circulation
0. withdrawn from circulation				X
1. genuine	X	X		X
2. satisfies legislative sorting criteria	X			

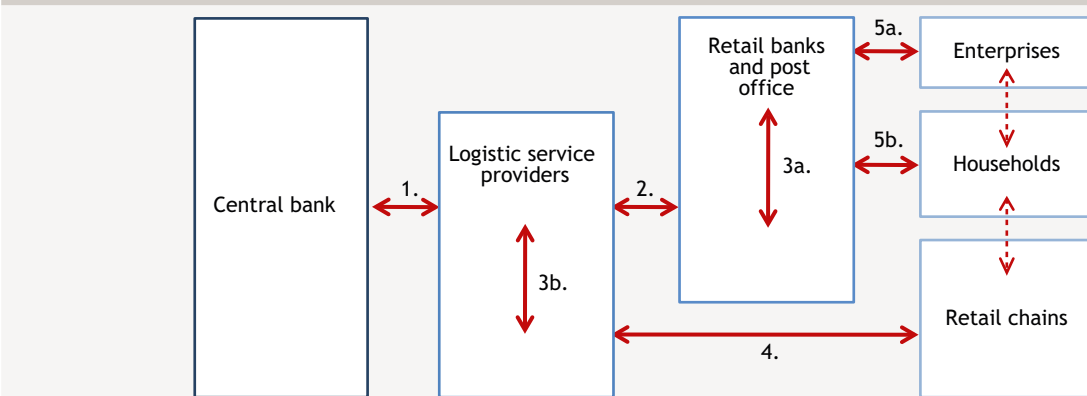
Source: Based on MNB Decree No. 12/2011 (IX. 6.).

Figure 11
The cash supply network



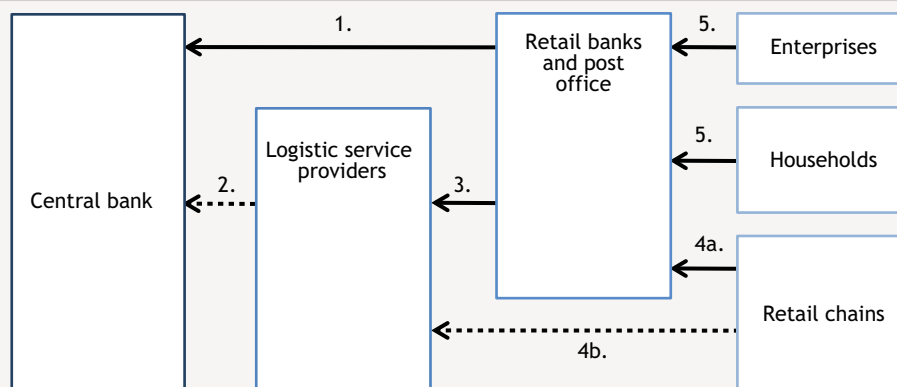
Source: figure compiled by authors.

Figure 12
Material flow in the cash logistics network



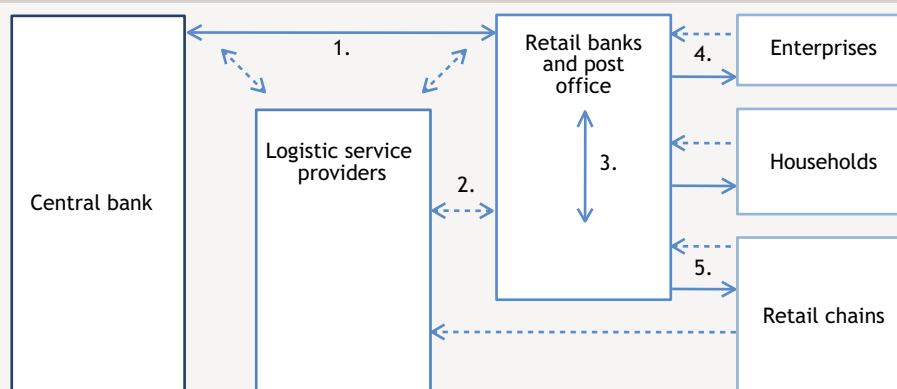
Source: figure compiled by authors.

Figure 13
Flow of cash in the cash logistics network



Source: figure compiled by authors.

Figure 14
Flow of information in the cash logistics network



Source: figure compiled by authors.

MNB Occasional Papers 104.

Network-based analyses of Hungarian cash supply

July 2012

Print: D-Plus

H-1037 Budapest, Csillaghegyi út 19–21.

