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Brandenburg Institute for SOCIETY and SECURITY

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BRANDENBURGISCHES INSTITUT
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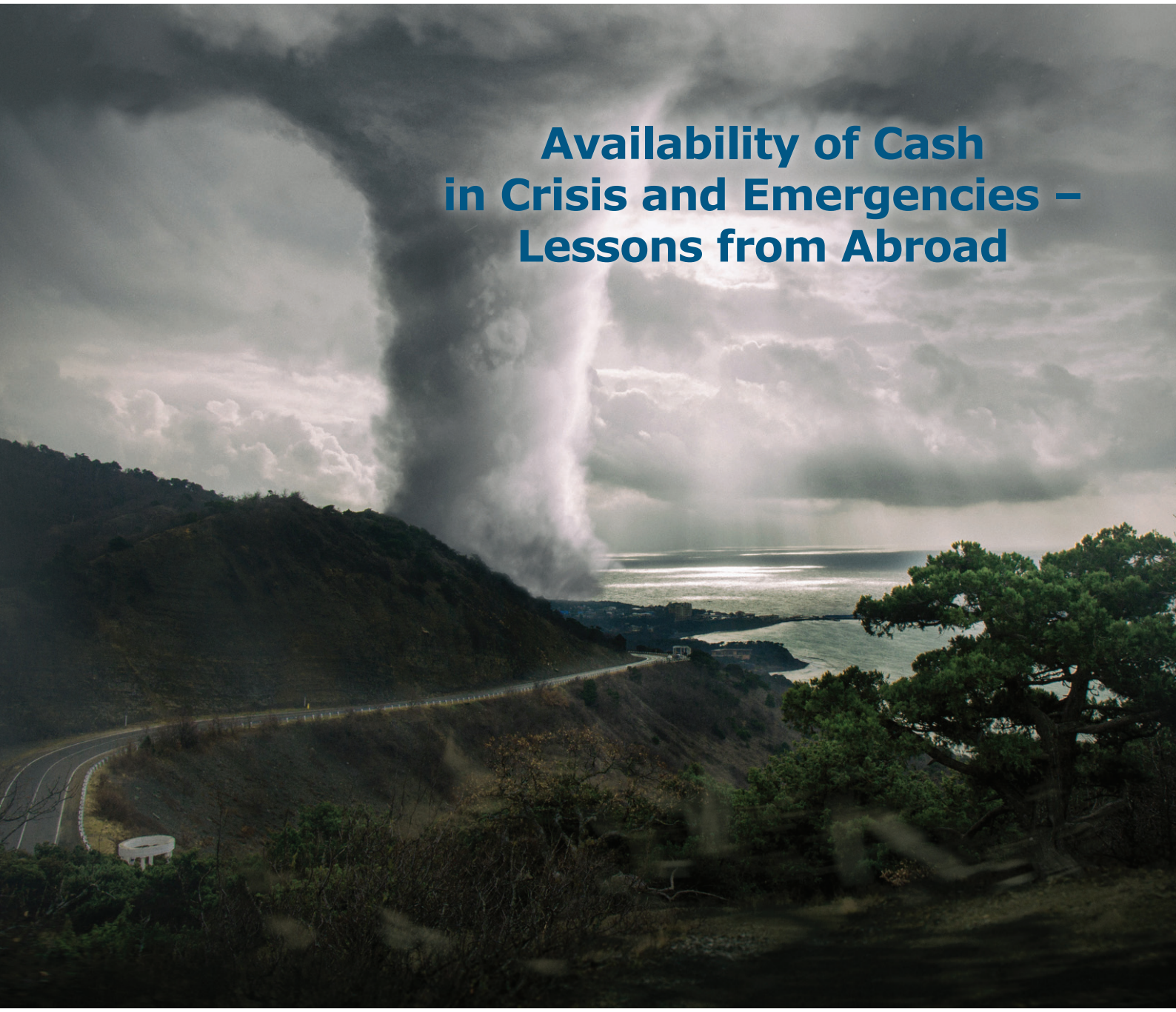
Availability of Cash in Crisis and Emergencies – Lessons from Abroad



Glöckner, Kern, Rieckmann

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BASIC

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Availability of Cash in Crisis and Emergencies – Lessons from Abroad

Paul Glöckner, Esther Kern, Johannes Rieckmann

Report

edited by

Brandenburgisches Institut für Gesellschaft und Sicherheit gGmbH
Brandenburg Institute for Society and Security gGmbH

Executive Director
Dr. Tim H. Stuchtey

Dianastraße 46
14482 Potsdam

Telephone: +49-331-704406-0
Fax: +49-331-704406-19

E-Mail: direktor@bigs-potsdam.org
www.bigs-potsdam.org

FOREWORD

In case of a natural or man-made disaster, a black-out or an outage of the IT- and communication network, electronic payment systems will no longer work. Any economic exchange in these cases will have to be done by means of cash, thereby offering retailers an incentive to not only open their doors to sell current stock but to also refill their shelves with newly ordered products. By doing so, the retail sector will provide a necessary service for society to make us all more resilient in times of crisis.

Fortunately, Germany has limited experience with a crisis of this scale. However, recent developments starting with the energy transition ending with the Russian war in Ukraine have made such scenarios more likely. With our research project BASIC, we aim to contribute to making the cash cycle more resilient. One way of doing so is to gain knowledge from other countries. In this paper, my colleagues Paul Glöckner, Esther Kern, and Dr. Johannes Rieckmann share their insights coming from studying past disasters and from interviews they held with essential actors involved in this process. We are grateful that these numerous experts took the time and effort to share their knowledge with us.

Originally, we were planning to travel to these countries for the interviews and for observing exercises etc. However, right at the beginning of the project the COVID-19 outbreak occurred, and made such trips for a long time impossible. At the same time, a pandemic is probably the only scenario in which the demand for cash (after a brief peak) for transactions is dramatically shrinking. However, even with COVID-19, there were some lessons to be learned that made it into this paper.

I like to thank the German Ministry for Education and Research for their gracious funding of this project and all project partners for helping us to understand how to keep the cash cycle going.

Dr. Tim H. Stuchtey
Executive Director

Potsdam, November 2022.

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ABBREVIATIONS

ABI	Associazione Bancaria Italiana, the trade association of Italian Banks
ATM	Automatic Teller Machines
BCM	Business Continuity Management
BCP	Business Continuity Plan
BEMs	Business Equipment Machine firms
BSP	Bangko Sentral ng Pilipinas
CBDC	Central Bank Digital Currencies
CiT	Cash in Transit
CODISE	Continuità di Servizio, the Unit for Business Continuity of the Bank of Italy
CONSOB	Commissione Nazionale per le Società e la Borsa, the Italian Security Commission
EFTPOS	Electronic Funds Transfer at Point of Sale
EVD	Ebola Virus Disease
FMS	Financial Management Service
GDP	Gross Domestic Product
GEJE	Great East Japan Earthquake
NaCSA	National Commission for Social Action
NGO	Non-governmental Organization
NSW	New South Wales
POS	Points of Sale
PSP	Payment Service Provider
RBNZ	Reserve Bank of New Zealand
VPN	Virtual Private Network
WHO	World Health Organization

1 INTRODUCTION

In recent decades, the number and strength of extreme weather events have increased. The impacts of extreme weather events include, among others, peaks in temperature on land and in the oceans, drought that facilitates fires, as well as precipitation events that cause flooding and landslides. Climate hazards severely affect human life and societies and have both economic and non-economic costs. Moreover, natural disasters often come with destruction of streets and buildings, and can adversely affect water and power supply. Critical infrastructures are consequently vulnerable to natural disasters. As well as water, food and power supply, it is also crucial that people in need have the ability to buy things they need individually and to maintain independence in spending. The provision of cash in crisis situations is key. Cash payments ensure transactions without the necessity for a functioning power supply (e.g. for card readers), as well as anonymity of payments and independence over one's own spendings.

Some countries are at higher risk of natural disasters than others and have been able to build on past experiences and lessons learned. In the process of preparing a security framework for the resilience of the cash cycle in Germany, the Brandenburg Institute for Society and Security (BIGS) was able to get insights from three international case studies. BIGS interviewed representatives from the Bank of Italy, the Reserve Bank of New Zealand, and the Bank of Japan with respect to their past experiences of natural hazards and interruptions of the cash cycle. The goal of the interviews, as well as the literature review on recommendations and lessons learned from other countries, is to gain knowledge about both processes and systems that worked, and about challenges and future outlooks. The objective of collecting this data was to incorporate these insights into the national security framework.

Key takeaways from the interviews with central banks and the literature review are shown in the following tables. It should be noted that the table does not claim to be all-encompassing in a qualitative or quantitative sense. Furthermore, no checkmark for one country does not necessarily mean that such a measure or system is not in place but rather that we did not find evidence for such a measure, or that the focus of the research in that respective country was narrower.

Table 1: Lessons learned from international case studies.

Lessons learned	Italy	New Zealand	Japan	Australia	Nepal	Philippines	Sierra Leone	USA
Demand for cash increases after crisis	Yes	Yes	Yes			Yes		Yes
Preventive measures are required	Yes	Yes	Yes			Yes	Yes	Yes
Overall coordination of all actors required	Yes	Yes	Yes			Yes	Yes	Yes
Enhanced communication between actors required	Yes	Yes	Yes			Yes	Yes	Yes
Increasing resilience of communication systems required		Yes	Yes					Yes
Cooperation of private and public actors required	Yes	Yes	Yes				Yes	Yes

Table 2: Best practices from international case studies

Best practices	Italy	New Zealand	Japan	Australia	Nepal	Philip-pines	Sierra Leone	USA
Mobile ATMs and/or flexible POS for cash distribution	Yes	Yes				Yes	Yes	
Cash transfers			Yes		Yes	Yes	Yes	Yes
Portable communication systems (e.g. satellite trucks)				Yes				
Backup generators/batteries			Yes					Yes
Installation of underground power lines or power lines off the grid				Yes				Yes
Backup IT-systems	Yes	Yes	Yes					
Backup branches with cash stocks	Yes	Yes	Yes					
Memorandum of understanding	Yes	Yes						
Household guidelines (e.g. waterproof bags for cash vault)			Yes					Yes

The paper starts presenting the outcome of the three case studies by briefly depicting the cash cycle, the structure of disaster risk management (concepts), and lessons learned. This is followed by a short presentation of the results of the literature review on lessons learned from other countries that experienced natural disasters. Because the COVID-19 pandemic has impacted countries around the globe, there is a separate chapter within the section of the literature review, which collects all impacts on the cash cycle during the pandemic as well as lessons learned gathered from the interviews and literature review. A summary of all lessons learned is listed under Chapter 4. A short outlook sums up the core findings of the paper and gives an overview of possible future research.

2 INTERNATIONAL CASE STUDIES – INTERVIEWS

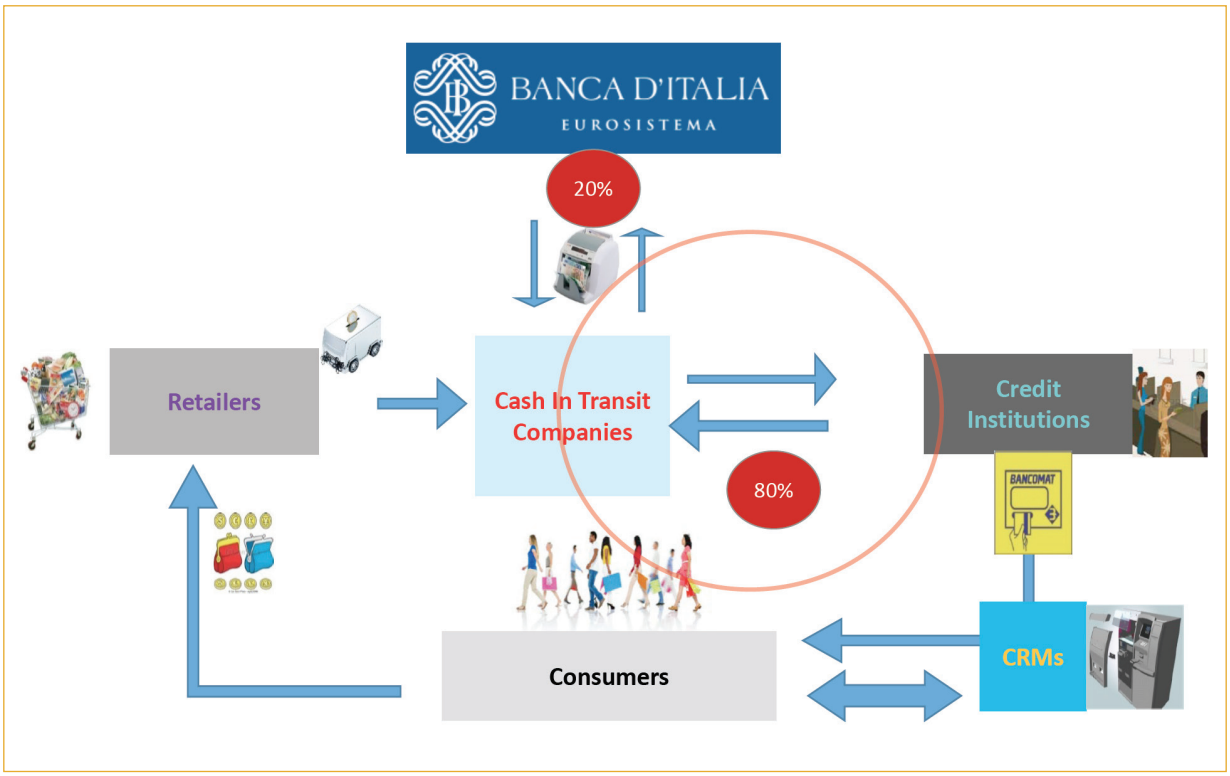
2.1 Italy

The digital interview with the Bank of Italy was held in March 2022. Like other countries, the Bank of Italy faces a shifting environment regarding the cash cycle. Changes are observable in the motives that drive people for using cash and in the share for cash usage in overall transactions. Cash in Italy is still the main payment method but like many other countries, Italy experienced development towards a higher share of cashless payments in recent years. Nevertheless, the Bank of Italy is adopting a strategy to keep cash available for the foreseeable future.

2.1.1 Introduction to the cash cycle and cash usage in Italy

The cash cycle in Italy is built around the Bank of Italy, commercial banks, and post offices, as well as cash in transit (CiT) companies (see Figure 1). Issuance and, in small part, recirculation is covered by the Bank of Italy. Printing is covered by the central bank while the main task of the branches are issuance and recirculation. The Carabinieri – a military law enforcement agency – cover and safeguard transportations between branches of the Bank of Italy. The bulk of transportation to and from credit institutions and post offices is covered by the CiTs. Furthermore, banks and post offices do most of the recirculation of banknotes.

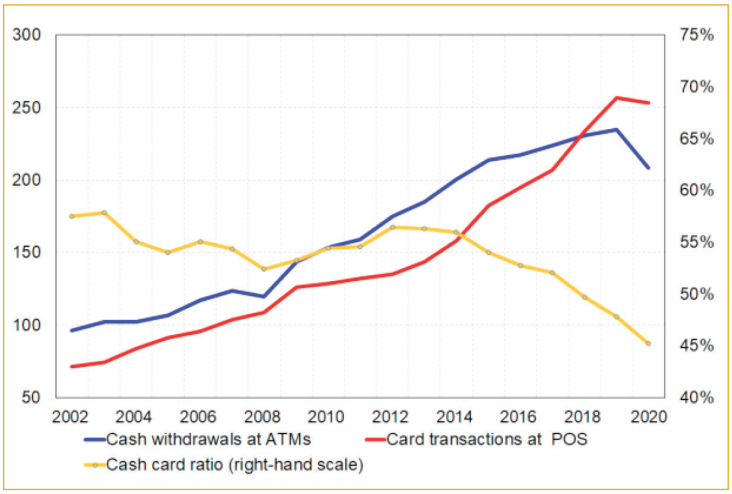
Figure 1: Cash cycle in Italy.



Source: Rinaldi (2009).

Cash use in Italy is above the EU mean. 82% of transactions are made with cash and 58% of the total value is covered by cash. Demand for cash is depending upon different motives to withdraw cash. Two important motives are the precautionary motive to keep cash for uncertain circumstances and the transactional motive for daily transactions. In Italy, precautionary and preservation of value motives for demanding cash are increasing in importance relative to transactional motives for withdrawing cash. The Bank of Italy estimated that there was a reduction in payment transactions in the retail sector but there was an increase in demanding cash for precautionary reasons. However, an overall decrease in cash in circulation is observable. One indication for this finding is the cash to card ratio that compares cash withdrawals at ATMs with card payments at points of sale (POS).[1]

Figure 2: Cash to card ratio in Italy.



Source: Baldo et al. (2021).

A specificity of the Italian cash cycle is the fact that pensions are usually paid out in cash, mostly at post offices. Therefore, there is a higher demand for cash than in other countries. To ensure the continuation of the functioning of the cash cycle in crisis situations in Italy, business continuity concepts are in force.

2.1.2 Cash cycle in crisis situations

Italy has previously experienced various crisis situations. The country faces several kinds of natural hazard, including earthquakes, floods, and volcanic eruptions. Due to geographic conditions, Italy is susceptible to natural disasters. The Bank of Italy has therefore already experienced several crisis situations that necessitated crisis management. Italy was forced to deal with severe events that had an impact on the cash cycle and was thereby able to install, reshape, and apply crisis management systems and concepts.

These crisis situations differed in their impact on the cash cycle, as they differ in duration and regional extension, and in how many companies, people and which kind of infrastructure is affected, and so forth.

Earthquake in L'Aquila (2009)

On the 6th of April 2009, the Abruzzo region was hit by an earthquake of magnitude 6.3, the epicenter being near to the city of L'Aquila. This earthquake was the third largest since 1972 and caused the death of 108 people with 1,500 injured. 60,000 buildings were damaged and roughly 67,000 people were left homeless.[2]

In crisis situations, the business continuity management (BCM) concept was considered effective and helpful to enable the maintained functioning of the cash cycle. There are two dimensions to the cash cycle. One dimension considers internal processes by the Bank of Italy, comprising recirculation of banknotes, transportation and distribution of cash between branches. The other dimension focuses on activities outside the Bank of Italy. Here, transportation between branches of the Bank of Italy and commercial banks and post offices is mainly covered by CiT companies.

2.1.3 Structure of the BCM concept

The Organizational Director of the central bank sets up the current business continuity concept for the Bank of Italy, which covers the continuity of internal processes. The Bank of Italy is also the main actor in the cash cycle. It connects actors of the cash cycle via webinars and roundtables that discuss and consider contemporary and future issues in the cash cycle.

1 Baldo et al. (2021).
2 Alexander (2010).

There is no one concept that includes all actors of the cash cycle, but every actor provides its own business continuity plan (BCP). Banks are obliged by the banking supervision of the Bank of Italy to have a BCP. If activities are outsourced to CiTs, the CiTs are obliged to have a BCP. Nonetheless, the concept by the Bank of Italy complies with the BCPs of the actors in the cash cycle. The BCP by the Bank of Italy is not shared with actors of the cash cycle and these actors share merely an idea of their concept with the Bank of Italy. Autonomy is therefore granted where no external actor can influence individual crisis management concepts on the business level. At the same time, the Bank of Italy, the CiT companies, banks, and post offices have an idea of each other's crisis management concept. Nevertheless, the Bank of Italy cannot exert direct regulatory control on banks or CiTs. There is therefore autonomy on the one hand, but also a degree of coordination between the actors. For the communication between the actors, a communication list is set up to ensure a fast access to contact persons and quick responses.

In the current concept by the Bank of Italy, as well as at the Eurosystem level, two different types of crises are defined: a demand shock (e.g. bank runs) and a supply shock. In the assessment of risks, a risk matrix is applied that considers the probability and impact of the event. What is decisive is mainly the impact, not the probability, of the crisis situation. Thus, there is planning and preparation in advance for possibly severe circumstances.

In the event of an emergency, two main processes are considered critical. The first is cash transportation and cash distribution. This includes transporting and distributing cash from and to the branches of The Bank of Italy. The second process is the availability of cash at ATMs, so as to ensure that people can withdraw cash even under complicated circumstances. However there is no hierarchical order established in advance of crucial operations that are prioritized a priori. Crisis situations can differ from one another and necessitate flexible reactions.

The goal is to restore critical processes as quickly as possible, generally within 48 hours. To maintain the cash cycle, several resources must be activated.

Three factors shall be mentioned here. Firstly, from the point of view of the central bank, it is beneficial to keep backup staff and backup branches for cash distribution. It is important to consider fallback branches in advance for each branch. Keeping personnel and branches available in the case of emergency ensures flexibility and increases resilience.

Secondly, Coban is concerned with external coordination for cash distribution in general by defining procedures that take place in cases of emergency. Coban is a committee dealing with the continuity of the banknote distribution in Italy and focusses on defining common procedures regarding the cash cycle. Coban consists of the Bank of Italy, the Poste Italiane, the trade association of Italian Banks, the Associazione Bancaria Italiana (ABI), and the Ministry of the Interior. Threats and risks to banknote distribution are analysed and measures are put in place to ensure continuity of the cash cycle. With Coban, most crisis situations in the past were counteracted. Secondly, CODISE ("continuità di servizio") was put into force in 2003. CODISE is responsible for crisis management coordination in Italy and is chaired by the Bank of Italy with representatives of the Italian Security Commission (CONSOB) as well as crucial financial operators.[3] CODISE was consulted in connection to the impact of crisis situations on market participants. Thirdly, the civil protection department works on drafts and coordination of the National Plans for risk scenarios and contributes to implementing these. The civil protection works on prevision and prevention of risks, and is the main actor in natural disaster management.[4] The cooperation between the Bank of Italy and the civil protection is settled in a memorandum of understanding.

2.1.4 Key takeaways and outlook

Experiences from past crises can have positive effects on handling crisis situations in the future. Some aspects mentioned assisted actors of the

3 CODISE (2014).
4 Civil Protection Department (o. J.).

cash cycle in this regard. Firstly, overall coordination was established that aided in structuring the cash distribution. Before this overall coordination was in place, the actors had their own BCM concepts, but these concepts were not coordinated and not in compliance with each other. These procedures are, in turn, considered in the BCM plan of each actor of the cash cycle, and the Bank of Italy does so as well.

Secondly, a particular threat was caused by unexpected closures of CiT companies since 2013. Closure of cash centers leads to disruptions in the cash distribution. The closure or outage of cash centers raises the risk of robberies and armed attacks. These risks also grow when the number of stored banknotes increases, since there is greater possible haul to steal. Nevertheless, CiT companies play an important role in the distribution of cash in Italy, while in CODISE the CiT companies were considered as only secondary.

The idea was therefore to include CiT companies in the management of crisis situations. This was achieved by signing a memorandum of understanding with post offices, banking associations, and the Ministry of the Interior. Overall, the distribution of cash was ensured in crisis situations. If some CiTs failed or outages of cash centers occurred, however, problems emerged for management systems because new flows from new CiTs might had to be managed.

Thirdly, Coban was established in May 2015. Coban consists of the Bank of Italy, the Poste Italiane, the trade association of Italian Banks, the Associazione Bancaria Italiana (ABI), and the Ministry of the Interior. As a committee monitoring the whole cash cycle, Coban helped in structuring and organizing issues with regard to the cash actors.

Fourth, a memorandum of understanding was signed with the Civil Protection Department in Italy. This department is responsible for assisting the population in emergency situations. One example for cooperation with the Bank of Italy is Naples and the risk of volcanic eruptions by the nearby Mount Vesuvius. Emergency plans have been established by the civil protection. The memorandum of understanding with The Bank of Italy ensures that cash distribution is considered in the emergency plan by the civil protection. Coordination and cooperation with other departments in crisis situations, but also in the prevention of crisis situations, play a crucial role.

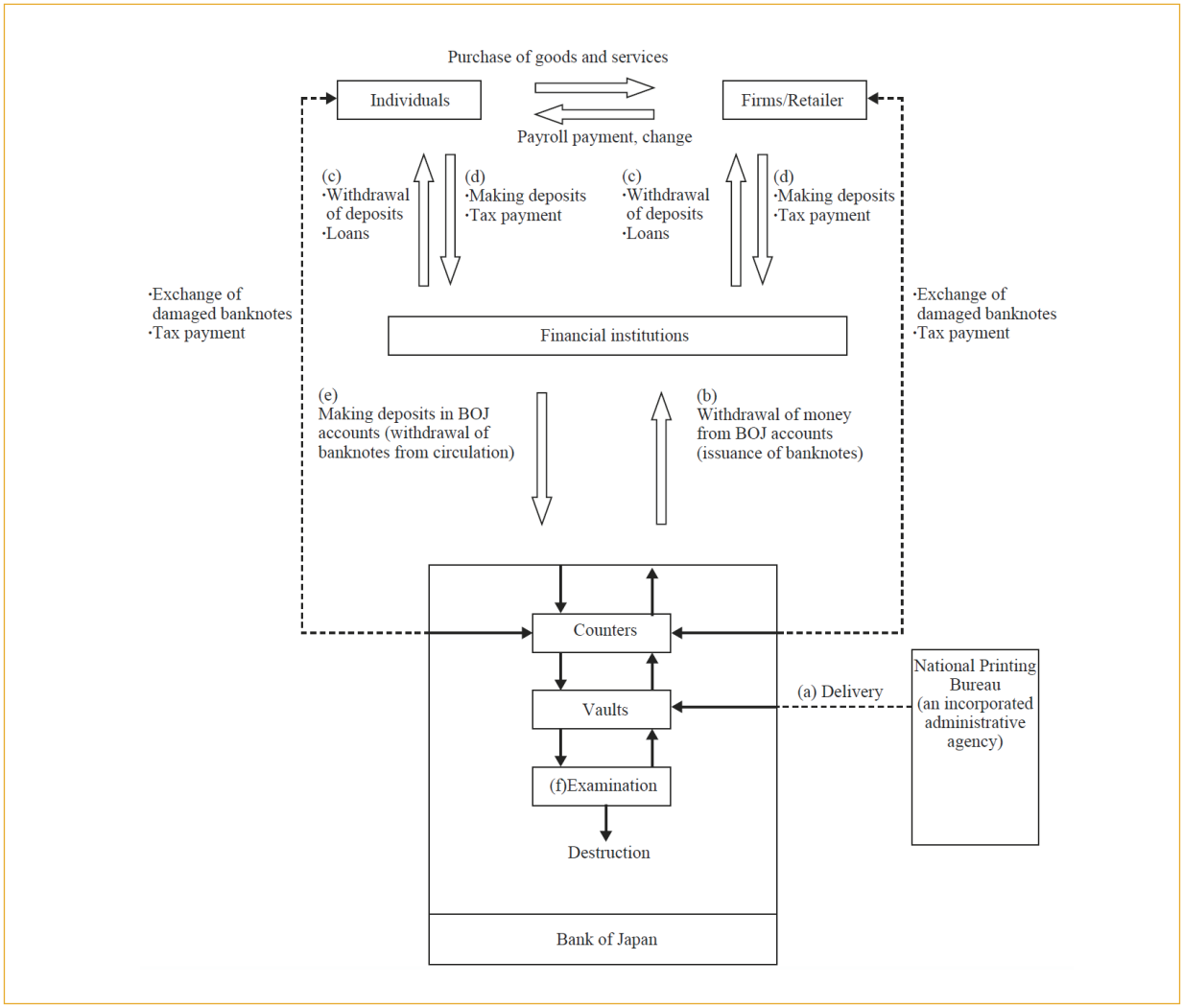
2.2 Japan

The Bank of Japan kindly provided information in the form of various documents and online sources, and by answering further or specific questions in written form.

2.2.1 Introduction to the cash cycle and cash usage in Japan

The cash cycle in Japan is organized similarly to other countries, with the Bank of Japan as central bank and cash distributing institution and with commercial banks as intermediaries, and CiT service providers. Figure 3 depicts the cycle of banknotes in Japan.

Figure 3: Circulation of banknotes.



Source: Bank of Japan (2011a).

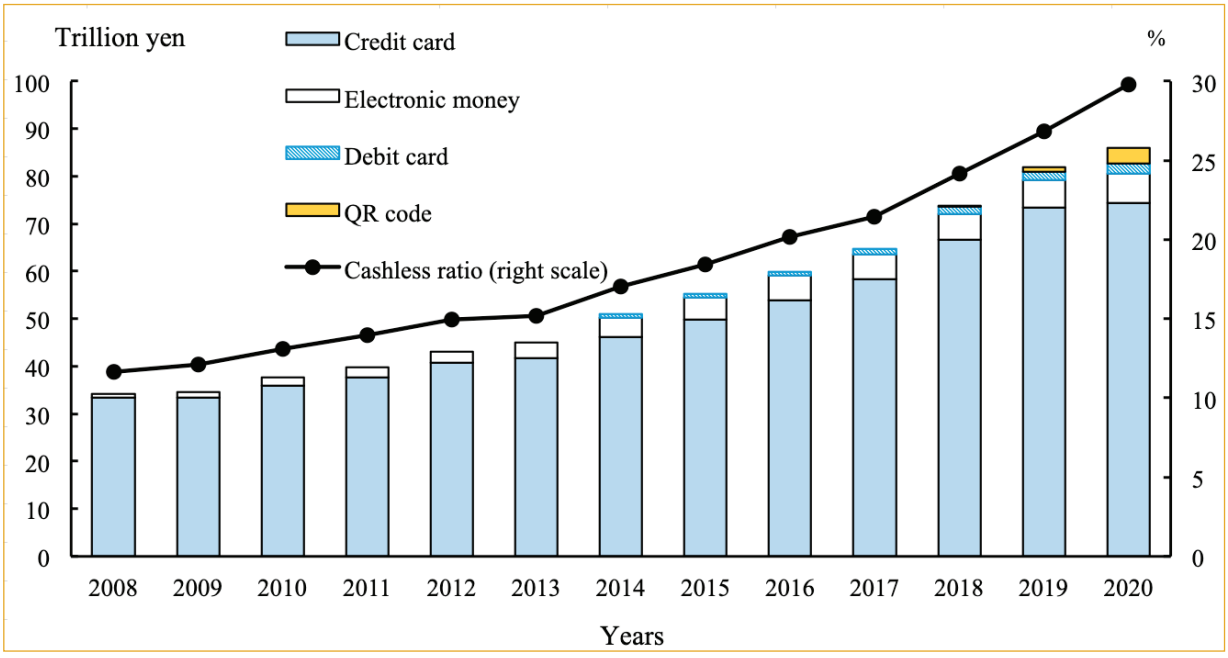
5 To write this section and the descriptions related to Japan in other sections, the authors received support from the Bank of Japan. However, the descriptions in this paper are those of the authors and any possible incorrectness should be attributed to the authors.

The banknotes are printed in "the National Printing Bureau, which is an incorporated administrative agency", and "delivered to the Bank in exchange for the cost of their production. Up to this stage, banknotes are not yet considered to be money. Banknotes begin circulating and being used as money when financial institutions withdraw deposits from their current accounts at the Bank".[6] Coins, on the other hand, "are issued by the Japanese government. Coins are manufactured by the Japan Mint, which is an incorporated administrative agency, and are issued as money when they are delivered to the Bank".[7] Transportation of cash between central bank locations is organized utilizing street vehicles, as well as air transportation.[8] Transportation from central bank branches to and from commercial banks is the responsibility of commercial banks, and organized by them.[9]

Information is communicated and shared between the Bank of Japan and financial institutions.[10]

In line with developments in many other countries, payment with cash is becoming less common in Japan. The corresponding gain in share of value of cashless forms of payment is depicted in Figure 4 and Figure 5. As can be seen, credit card payment is one of the most popular payment methods. Figure 5 shows that 65.6% of respondents in a survey conducted by the Bank of Japan in 2021 declared they used credit cards daily for transactions (besides other means of payment), while only about 9.7% stated that they use cash only. Please note that the survey allowed multiple answers, and that many respondents use multiple complementary payment methods.

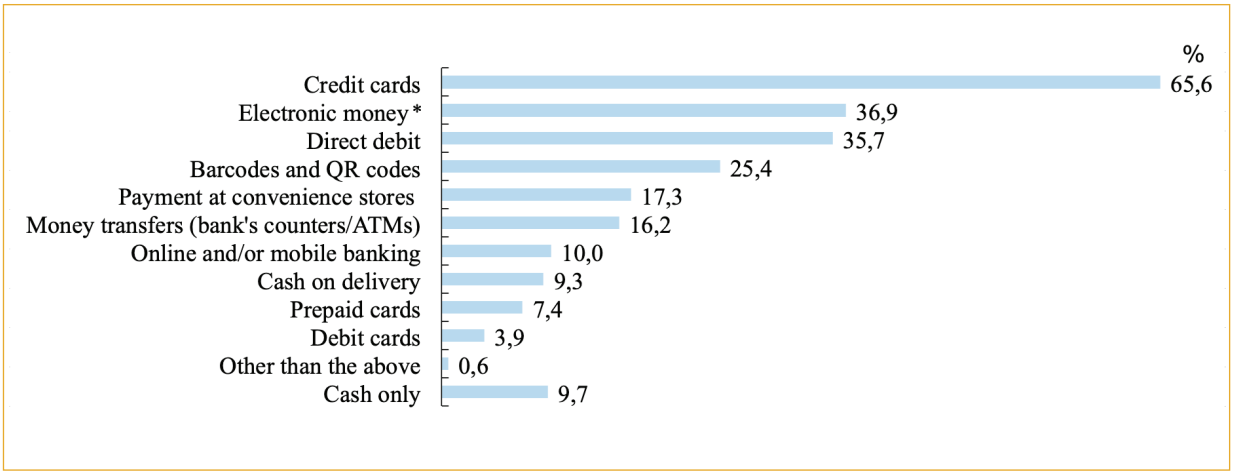
Figure 4: Gain in importance of cashless means of payment, and thus decline of cash payment over the years.



Source: Newly created figure, corresponding to "Figure 6: Amount and share of cashless payments" in Kanno (2022).[11]

6 Bank of Japan (2011a).
7 Ibid.
8 Bank of Japan (2022).
9 Ibid.
10 Ibid.
11 Kanno (2022), p.261.

Figure 5: Use of payment instruments other than cash.



Source: Newly created figure, corresponding to Figure 4 Kanno (2022).[12]
Note: Multiple answers were allowed. *Excludes use for public transportation.

Among the reasons identified for the decline of cash usage for daily life are the "growth of cashless payments and the decline in the population."[13] An increasing number of financial institutions have been reacting to that decline by "reorganizing branches and closing ATMs."[14] Currently, though, "the number of ATMs at convenience store chains is increasing, and financial institutions are maintaining the existing level of their ATM networks as a whole by sharing and complementing each other's individually reduced networks."[15] Another factor that, from the authors' (of this BIGS paper) point of view, will have a dampening effect on usage of cash is the existence of "fees for exchanging banknotes and coins for those of different denominations. The fee is sometimes elevated to a prohibitive level for low denomination coins."[16] The use of cashless transactions methods is expected to increase in the future. It is possible that, as in other countries around the world, the mix of electronic means of payment will be supplemented by new technologies and applications in the future. Existing cryptocurrencies could be joined by cryptocurrencies issued by central banks – so-called Central Bank Digital Currencies (CBDC). In Japan, "[w]hile the Bank currently has no plan to issue CBDC, from the viewpoint of ensuring the stability and efficiency of the overall payment and settlement systems, the Bank considers it important to prepare thoroughly to respond to changes in circumstances in an appropriate manner. For the time being, it is unlikely that the cash in circulation would drop significantly. If, however, this should become the case, and if private digital money will not substitute for the functions of cash sufficiently, the Bank might provide "general purpose" CBDC -- that is, CBDC intended for a wide range of end users including individuals and firms -- as a payment instrument alongside cash. Therefore, the Bank announced its approach to CBDC in October 2020, and is currently conducting experiments."[17]

Demand for banknotes, as a percentage of nominal GDP, was higher in Japan than in all other G10 national economies in 2011,[18] and banknotes and coins in circulation as a percentage continued to occupy one of the world's top positions in 2020.[19]

The apparent contradiction between a decline of cash usage on the one hand, and a high and pos-

12 Ibid., p.261.
13 Kanno (2022), p. 257.
14 Ibid, p.257.
15 Ibid, p.257.
16 Ibid, p.257.
17 Ibid, p.262.
18 Bank of Japan (2011a).
19 Bank for International Settlements (2022).

sibly increasing demand for banknotes on the other hand, is an interesting aspect, called the "paradox of banknotes".[20] Despite the fact that during the COVID-19 pandemic, "the volume of the Bank's payment and receipt of banknotes has been 20 to 30 percent lower than in 2016 to 2018"[21] – i.e., reflecting a lower use of cash for transactions – the Bank of Japan simultaneously noticed a high and probably precautionary demand for notes of high denomination, especially the 10,000 yen note.[22] In other words, the Japanese put cash in large bills in their chest of drawers – not to pay with, but because the situation seems uncertain. This paradox had been "observed globally before the pandemic", "reflecting low interest rates"[23] and thus, low opportunity costs in holding cash, besides precautionary demand. Japan has, on top of this, a high share of elderly citizens, who are – as in other parts of the world – comparatively reluctant to replace cash payment with cashless payment methods.

In summary: payment with cash is of decreasing importance in Japan, but still an important component of payment transactions. Beyond cash held for transaction purposes, it is apparently stashed away in large quantities for emergencies by many citizens.

2.2.2 Cash cycle in crisis situations

Japan and the Bank of Japan have mastered numerous crisis situations and built up a wealth of experience. The country has been affected by typhoons, earthquakes, tsunamis, an incident at a nuclear power plant, volcanic eruptions, and pandemics. The most influential crises were as follows.

In September 1959, Typhoon Vera (otherwise called Isewan Typhoon), was the impetus for the development of disaster preparedness measures in Japan. More than 5,000 human lives were lost, and the storm inflicted severe damage in the prefectures of Aichi, Mie, and Gifu. Typhoons Faxai and and Hagibis (both 2019) inflicted serious damage as well. In the last three decades, several powerful earthquakes shook the country: in 1995, the Great Hanshin-Awaji (Kobe) Earthquake; in 2004, the Mid Niigata Prefecture Earthquake; in 2011, the Great East Japan Earthquake (GEJE); in 2016, the Kumamoto Earthquake; and in 2018, the Hokkaido Eastern Iburi earthquake. The most severe among these was GEJE. With a magnitude of 9.0 and the seismic centre approximately 400 kilometres from Tokyo, it generated tidal waves (tsunamis) that devastated large areas and cost many lives. Physical damage and indirect effects hit hard and affected cash cycle actors. A major accident, including radiation leakage, occurred at the Fukushima Daiichi Nuclear Power Station. About 280 bank locations had to be closed temporarily in response to the damage inflicted by the tsunamis and the nuclear accident, and the resulting evacuation order.[24] Bank customers were relocated and needed to make cash withdrawals in other financial institutions. Cash stockpiled in the affected areas by the tsunami was soiled, damaged, or destroyed.

The Hokkaido earthquake caused an almost total electricity blackout in the service area of a power provider, which was unprecedented. Although the physical destruction was not comparable to that inflicted by GEJE, the withdrawal of cash from automatic teller machines (ATM) was as impossible as electronic payments.[25]

Pandemics included the outbreak of a new strain of influenza in 2009 (H1N1) and of COVID-19 in December 2019 in Wuhan, China, which spread worldwide.

At the time of GEJE, some financial institutions in Japan cooperated, especially neighbouring ones, by transporting account information and relevant documents. Customers of cooperating bank A, having been evacuated to places far away, were permitted to withdraw money from the cooperating bank B, despite not having an account and deposits there. Sometimes, special counters in windows were arranged for this purpose, where withdrawals could be made by relocated customers of the

20 Bank of Japan (2021a), p.5. The term „paradox of banknotes" was used as early as 2009 at a conference in Washington, D.C. in a speech by Andrew Bailey, Executive Director for Banking Services and Chief Cashier, Bank of England (Bank of England, 2009, p.8). It does not only refer to Japan.
21 Ibid.
22 Ibid.
23 Bank of Japan (2021a), p. 24.
24 Bank of Japan (2019).
25 Mito and Kaneko (2018).

cooperating bank. The process worked as follows: "(1) the paying financial institution verifies the customer's identity at its windows; (2) it contacts the account-holding financial institution where the customer has a deposit; and (3) it makes payments to the customer on behalf of the account-holding financial institution within an agreed limit".[26] This type of cooperation "contributed significantly to maintaining the functioning of the overall financial infrastructure in Japan"[27] in times of emergency resulting from severe disasters.

The need for cash in Japan surged repeatedly shortly after these crisis-ridden events. Experience showed that the value of cash paid out by the Bank's branches and local offices in the Tohoku region in northeastern Japan during the first week after the earthquake totalled approximately 310 billion yen, about three times the amount in the same period of the previous year.[28] A rather special case was an increased need for coins in the wake of GEJE: "On Saturday, March 12, the Bank's Head Office in Tokyo made the special arrangement of opening its windows to provide cash, primarily coins, to financial institutions. This action aimed to address concern about a possible shortage of coins in the Tokyo metropolitan area. The concern arose because between Friday afternoon on March 11 (when the earthquake occurred) and Saturday morning on March 12, there was a surge in the purchase of food, beverages, and other daily necessities at convenience stores and other retail stores, mainly due to the large number of people who encountered difficulty returning home following the disruption of railway operation."[29]

2.2.3 Structure of BCM concept

The Business Continuity Management concept of the Bank of Japan is mainly based on six groups of crisis scenarios.[30] Besides natural disasters such as, for instance, earthquakes, these comprise pandemics, terrorist attacks, cyberattacks, accidents involving explosions and fire, and more mundane, but at the same time more likely or frequent[31] ones, such as hard- or software failure.

Four fields of activity are regarded as being of critical importance: acceptance and functioning of cash payments, settlement of current deposit and lending transactions, the monitoring of the settlement systems, and requests for special financial measures.

Measures to ensure the continuity of critical operations include the establishment of the dedicated Disaster Management Team; supply of financial institutions with cash; replacement of cash – notes and coins – damaged in the disaster; ensuring stable operation of BOJ-NET (the Bank of Japan Financial Network System, a computer network operated by the bank for online transfers and Japanese Government Bonds settlements, and communication with other financial institutions); special measures to support financial institutions as needed (particularly those in the disaster areas), including monetary policy (as, for instance, monetary easing); public releases regarding the Bank's operational status and the stability of financial markets; and rescheduling of the otherwise usual on-site examinations at financial institutions.

The central actor within and around the Bank of Japan during a crisis event is the Disaster Management Team. Activated as quickly as possible, its main functions include damage assessment and information gathering regarding the operational status and capabilities of financial and other relevant institutions. The team is established and headed by the Governor of the Bank of Japan.

While for the time being, this is not related to the BCP of the cash cycle, the Bank of Japan, along with the financial sector and other relevant actors – in the form of so-called street-wide exercises – conducts exercises with emergency drills annually in September. The purpose of these exercises is to ensure the functioning of the financial mar-

26 Bank of Japan (2011b), p.14.
27 Ibid.
28 Ibid.
29 Ibid.
30 Bank of Japan (2003).
31 This being said, there are no assumptions known to the authors regarding likelihoods, location or timing of crises events in documents provided by the Bank of Japan, with the exemption of an assessment voiced in 2019 in a speech given by Deputy Governor of the Bank of Japan Masazumi Wakatabe (Bank of Japan (2019): "The probability that a massive earthquake may occur in the Nankai Trough off the Pacific coast within the next 30 years is estimated to be 70-80 Percent."

ket transactions and back office operations under stress. The first of these was already practiced in 2010,[32] and they have evolved since. Today, for instance, details on the nature and extent of the damage assumed in the implemented drill scenarios is not disclosed in advance to the participants, but rather on the spot as the exercise unfolds. In this way, the exercises are closer to reality and more effective. Including the domestic level, but going beyond within the G7 framework, these exercises have been complemented by cyber drills. According to the authors (of this BIGS paper), in the future, such exercises could serve as a model for other countries and be extended to ensure the functioning of the cash cycle.

Resources covered for maintaining the cash cycle include both back-up IT systems (i.e. a backup computer centre) as well as physical back-up sites (i.e. office space). Reserve and fallback solutions are immediately available in case of disruptions of supply with electric power (emergency generators, and fuel for these), telecommunications, water, and food. In terms of human resources, staff assigned as a pre-planned and precautionary measure are required to reside in or stay at accommodations near the main site of the Bank of Japan at all times. Therefore, in case of an incident and the resulting disruption of traffic and public transportation, or at night time or during weekends and bank holidays, the Disaster Management Team can be assembled immediately.

2.2.4 Key takeaways and outlook

The multitude of challenges Japan has faced in the past allowed a lot of learning from experience. Below, we briefly describe some of these lessons learned.

Stockpiling cash at home, which is advised in crisis preparedness brochures in many countries, can, in case of disaster, also be detrimental: "After the earthquake and the tsunami, the offline electronic purse systems (…) carried on working so long as there was power and the backup battery systems or generators were working (…). In fact, it was the people who kept their money in cash who suffered greatly: lots of people n Japan – especially older people – keep their life savings in cash in their homes. This is all well and good until a tsunami destroys your home and washes your money out to the sea."[33]

This had an impact on the cash cycle in Japan with increased pressure on maintaining cash processes. After a large-scale disaster, "withdrawals of cash by depositors tend to increase because of the need to have cash on hand to pay for daily expenses and heightened anxiety about the future."[34] To put it more succinctly: "When disaster strikes in the 'cashless' era, there's no substitute for old-fashioned money."[35] Moreover, a significant amount of banknotes and even coins are soiled or burned in disasters, and need to be screened and exchanged.[36] On the other hand, the feared radioactive contamination of cash in the Fukushima area turned out to be rare and weaker than expected, presumably because cash is mostly stored in purses and safes.

After the GEJE in 2011, it turned out that hazard maps, especially near the coast,[37] had to be updated, and the damage scenarios assumed in the BCM of financial institutions so far needed to be adapted – or rather, upscaled in terms of severity and scope of constraints on the "the availability of (1) facilities and equipment such as headquarters, offices, and computer centers; (2) infrastructure such as electricity, water, and gas; and (3) human resources such as the management and employees."[38] The combination of the severe earthquake with its further devastating consequences, namely tsunamis and the nuclear incident at Fukushima, "caused an unprecedented level of devastation over a wide area. Electricity supply was constrained for an extended period, and transportation services were disrupted for a number of hours. Trading activity in some segments of the financial markets surged temporarily. The impact of the disaster was

32 Sayanagi & Watanabe (2015).
33 Schneier (2011).
34 Bank of Japan (2011b), p.4.
35 JapanToday (2019).
36 Bank of Japan (2011b), p.8.
37 Bank of Japan (2019), p.10.
38 Bank of Japan (2011b).

especially severe as various disruptions and constraints occurred simultaneously across a wide area."[39] To the same end, even in everyday operation, "an increasing number of financial institutions have introduced dual operation, under which not only main offices but also backup offices conduct part of their business operations."[40] These crisis situations affected the cash cycle. More precisely, severe and long-term power shortage conditions in 2011 turned out to pose a challenge to banknote operations.

Due to overburdening of the telecommunication infrastructure, it appeared difficult to confirm the safety and well-being of staff of the Bank of Japan directly after the disaster incident.[41] The division of functions and tasks between headquarters and branch offices had to be reviewed in order to increase future resilience.[42] Relationships between institutions and actors in the sector and beyond ("local governments, financial institutions, utility firms as well as monetary authorities, including the Bank's branches"[43]) should be established and maintained "in normal times"[44] in order to enable swift cooperation in times of crises.

Successful testing of the BCM of every single individual financial institution does not ensure that the whole financial sector, and particularly the infrastructure it relies on, will continue to function as a whole in real crisis. For instance, "while business continuity arrangements may call for employees to work at home and remotely access IT facilities from home in emergency situations, it is an open question whether the telecommunications capacity would be sufficient to handle the high concentration of traffic caused by a number of financial institutions taking similar actions simultaneously."[45] On the other hand, attending work in person was not always possible. Disruptions, delays, and adjustment of schedules in public transportation affected timeliness of staff attendance for work.[46]

Nevertheless, agreements and arrangements for disaster management response must be taken into account. Business continuity arrangements and the underlying assumptions and scenarios need to be aligned across all actors: "It is also important to confirm that there is no significant gap with the counterparts in their business continuity arrangements and assumed emergency situations."[47]

Disruptions in traffic and infrastructure also affected fuel supply. Fuel shortages must therefore be expected, affecting the operation of emergency generators. The underlying reasons include interruption of operation of refineries (e.g. due to fire), damaged transportation infrastructure, destroyed or damaged tanker trucks and other transportation vehicles as goods wagons, and damaged or otherwise (e.g., due to electricity blackouts) inoperable gas stations. Another factor of influence is excessive demand and panic buying.

Lastly, besides increasing climate risk, increasing cybersecurity threats are a concern and need to be included in emergency scenarios.[48]

39 Ibid, p.26.
40 Bank of Japan (2019), p.9.
41 Bank of Japan (2012).
42 Ibid.
43 Bank of Japan (2019), p.11.
44 Ibid.
45 Bank of Japan (2011), p.8.
46 Bank of Japan (2012), p.48.
47 Bank of Japan (2019), p.11.
48 Ibid.

2.3 New Zealand

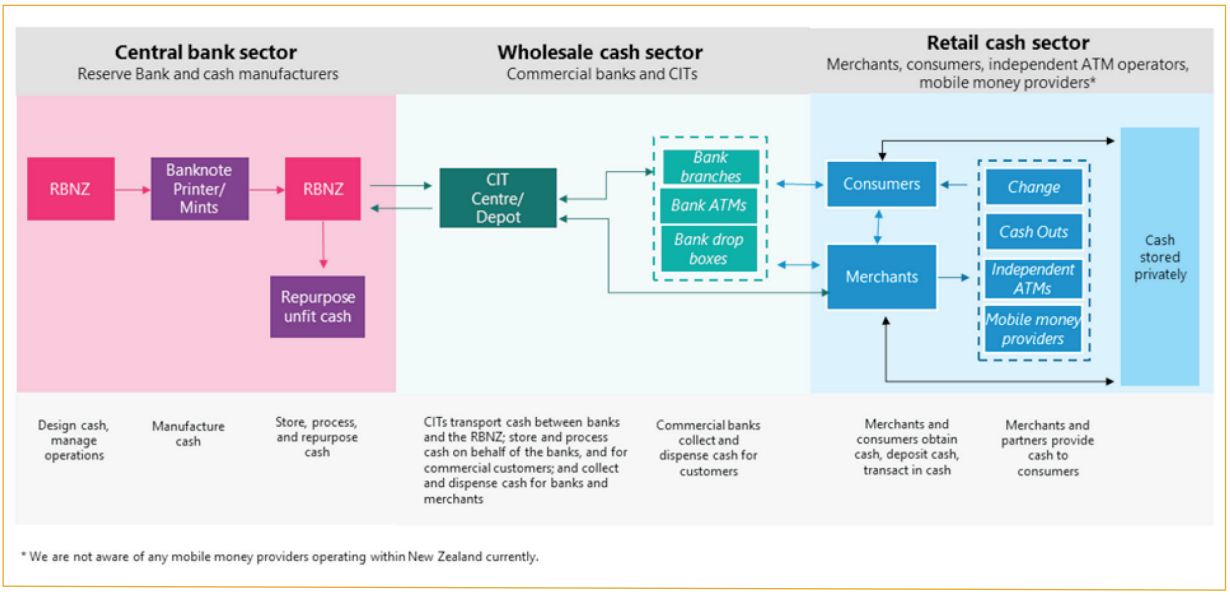
The interview with the Reserve Bank of New Zealand (RBNZ) took place digitally in March 2022. Further to this, we received written input from a former staff member of the RBNZ, who was involved in the crisis management in the aftermath of the Christchurch earthquake in 2011. As a disclaimer, it must be stated that the RBNZ is currently in the process of a major public consultation on the issue of the "The Future of Money". This process started in fall of 2021. The aim is to achieve a fit-for-purpose cash system. There are three distinct work programmes: redesign of the cash system, response to digital innovation, and central bank digital currency.[49] This process will be ongoing for the next few years and must be considered in the reading process.

2.3.1 Introduction to the cash cycle and cash usage in New Zealand

The New Zealand cash system consists of six main actors, which can be divided into three sectors:

- Central bank sector
- Wholesale cash sector
- Retail cash sector

Figure 6: The cash system in New Zealand.



Source: RBNZ (2021b)[50]

The **central bank sector** consists of the RBNZ, which has its headquarters in Wellington, and is the only actor with the legislative mandate in New Zealand to issue banknotes and coins. Therefore, certain tasks can and have to be undertaken by the RBNZ, such as the design and manufacturing of new banknotes and coins as well as demand forecasting and operational planning. The RBNZ accepts and sells cash from the five largest domestic banks.

49 RBNZ (o. J.).
50 RBNZ (2021b), p. 8.

The **wholesale cash sector** consists mainly of the CITs and registered banks.

- RBNZ's five domestic cash customers (major banks), and in turn their customers, including minor banks, retailers, and individuals;

- Two major CiTs which provide domestic transportation, handling and vaulting services for banks, retailers, RBNZ (on occasion), with several smaller CiTs servicing retailers and other smaller cash customers. Our interview partners described them as the ones that "effectively do the operational doing in our cash system".

The **retail cash sector** consists of:

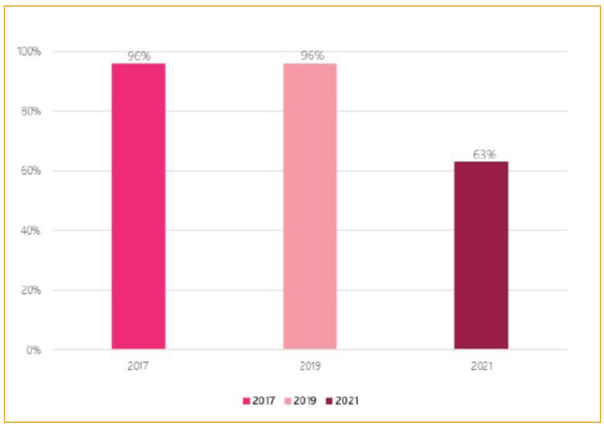
- Three major Business Equipment Machine firms (BEMs) which provide and service high-speed cash processing, ATMs, and retailer cash processing equipment, together with some smaller suppliers;

- Two independent ATM networks (providing basic ATMs generally located in hospitality and accommodation settings, or on behalf of minor financial institutions)

- Retailers (and their customers)

Similar to other modern economies, New Zealand is experiencing a decrease in cash demand as well as cash usage. New Zealand experienced a sharp decline in the percentage of people using cash for everyday purchases such as groceries or petrol – from 96% in 2017 and 2019 to 63% in 2021. Additionally, there are fewer frequent users of cash.

Figure 7: Cash users in New Zealand.



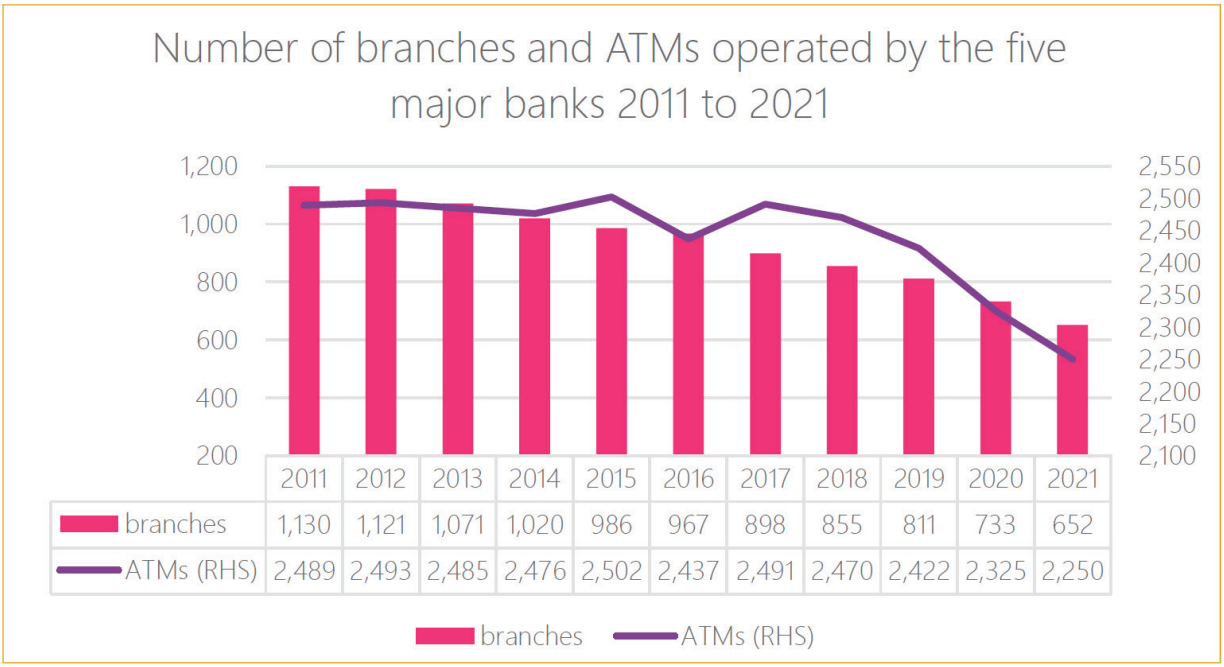
Source: RBNZ (2022).[51]

In terms of preferred ways to pay, a majority of New Zealanders favours debit/EFTPOS[52] cards, at 51%. Only 14% prefer cash to other payment methods.[53] 89% use their debit/EFTPOS cards to pay for everyday items, while 60% do so with cash and 51% using a credit card account.[54]

There is also a decrease in the number of branches and ATMs, at least by the five major banks. This means that access to cash is more limited than ten years ago. However, a huge majority of 80% states that accessing cash is still very easy or somewhat easy.[55] This figure might change if the number of branches and ATMs declines even further. This was also a notion raised by our interview partners, who stated that New Zealand is at a "tipping point arguably on physical cash."

51 RBNZ (2022), p.5.
52 Electronic funds transfer at point of sale – EFTPOS is an Australian system similar to debit cards. One of the key differences is that it cannot be used for online purchases. Additionally, while debit cards running on a Mastercard or Visa payment system can be used quite globally, EFTPOS cards can only be used in Australia and some selected places outside. For more information, see Gee and Borman (2021).
53 RBNZ (2022), p. 9.
54 RBNZ (2022), p. 7.
55 RBNZ (2022), p. 15.

Figure 8: The reducing bank branch and ATM network in New Zealand from 2011 to 2021.



Source: RZNB (2021b).[56]

Due to the transactional cash usage decline, the Reserve Bank of New Zealand Act 2021 expanded the mandate of the RBNZ. This means a recognition that the RBNZ has an "enhanced role as system steward, responsible for ensuring that New Zealand's money and cash system remains fit-for-purpose and continues to effectively service the needs of the public, particularly in a future of lower cash usage and new forms of money and payments."[57] The act also introduced a new financial stability objective for the RBNZ: "protecting and promoting the stability of New Zealand's financial system."[58] Our interview partner stated that they view the role of the RBNZ as ensuring that people have a choice in payment methods and, in particular, that those reliant on cash still have access. They are therefore aiming to have an efficient distribution system in place.

2.3.2 Cash cycle in crises situations

New Zealand has experience with natural disasters, in particular earthquakes. The following section will cover in more detail the Christchurch Earthquake in 2011. This was one of the most severe earthquakes in New Zealand, with major impacts on cash operations. The country also experienced a cyberattack on its systems in 2021, which will be briefly discussed.

Christchurch Earthquake 2011

Between 2010 and 2012, Christchurch, the second largest city by urban area population in New Zealand, experienced a series of earthquakes. The most severe hit the city on 22 February 2011. More than 180 people died, making it the fifth deadliest disaster in New Zealand's history. The epicentre of the earthquake was almost directly beneath Christchurch and was shallow.[59] As an immediate response to the earthquake, demand for cash surged for about ten days. Over that period, the RBNZ, together with commercial banks, flew a significant volume of cash to Christchurch. The cash cycle faced several challenges due to the earthquake.

Firstly, Christchurch was not assessed as a particular seismically active area. In contrast, Wellington, the base of the only branch office of the RBNZ, is located on a major fault line. The RBNZ, as well as

56 RBNZ (2021b), p. 13.
57 RBNZ (2021a), p.12.
58 New Zealand Government (2021), 9(1).
59 Australian Disaster Resilience Knowledge Hub (2011); Misachi (2017).

major businesses, consider a major earthquake in Wellington as one of the foremost risks. Therefore, the RBNZ has cash reserves located outside of Wellington and preparations in place regarding how to send money in case of an earthquake. In the case of Christchurch, there were no special plans for how to supply cash in the case of an earthquake. This led to a logistical challenge.

Secondly, the population needed cash to pay for essential transactions, e.g. buying food, water, petrol, and medical supplies, since electronic retail payment systems did not function for the first 24 hours. Even after the restoring of the systems, people feared that there would be another outage. This meant a surge in demand for cash for about two weeks.

Thirdly, properties in the central business district experienced severe damages and the whole area was declared a red zone due to the risk of potential collapsing buildings. However, those banks that stored most of the available cash were in this area. Furthermore, some branches in the suburban areas could not open due to security reasons or lack of staff availability. For this reason, most operational ATMs ran out of cash very quickly. Luckily the cash centers of the two CiTs did not experience any severe damages and remained operational.

Fourthly, the immediate road conditions in Christchurch were very poor. In many areas, there was "liquefaction". Due to the considerable shaking, mud and water rose to the surface, making roads almost impassable. Security companies estimated that it took them three times longer than normal for any given journey.

Fifthly, the population did not have information about which bank branches and ATMs were still open for business or operating.

Cyberattack 2021

The RBNZ experienced a cyberattack on their system in early 2021. This meant a disruption of the regular system of communication with major banks or the respective CiTs on behalf of the banks. There was therefore an interference with cash orders and logistics arrangements for a short period of time. An alternative system had to be put into place on very short notice.

2.3.3 Structure of BCM concept

The RBNZ operates in the context of crisis management on a resilient organisations model. They adapted this to their needs, thereby taking more of a system view than an organisational view. This comes from the belief that crises do not come "in one size and shape." For this reason, they look at the system at large, rather than only individual scenarios. This includes arrangements about the right communication channels and network access for key decision makers. Additionally, there are considerations about the availability of police and technology providers, and also cargo capacity. Overall, the RBNZ operates under the framework that it has "zero tolerance of not being able to distribute cash to meet the needs of the public."

The RBNZ considers the main sort of (and worst-case) scenario the loss of their cash facility; normal cash staff being unable to assist or logistic links to and from Wellington being unavailable. There was a realization after the Christchurch earthquakes that this represents a serious concentration risk and alterations were made in response to this, such as having stockpiles in various other locations. The RBNZ instructed the staff at these locations according to their expectations of what actions must be taken in crisis situations. A Business Continuity Test programme ensures staff members know what to do and that their systems and tools work as expected.

In the event of a crisis, it is most essential for the RBNZ to still be able to issue cash. There are two critical infrastructures for this. The first is the ability to transact with the corresponding entity through the national payment infrastructure run by the central bank. The second is secure communication between the banks or the CiTs with the RBNZ for placing orders and arranging logistics. There are redundancies in place for both systems. Furthermore, the BCP considers aspects such as the security of the cash facility and access to it.

As part of the crisis management, the RBNZ established an industry forum with senior members of

the major actors of the cash cycle (RBNZ, the five major banks, the two CiTs, independent ATM operators, technology providers). This is an important entity that has become more institutionalized over the years. The forum comes together every couple of months to discuss matters of mutual interests. Additionally, there are working groups that focus on particular issues. Part of this forum and the working groups is to think and discuss scenarios collectively. The aim of this is not so much to find common risk assessments and likelihood impact, but rather to find a common language and understanding.

As one interview partner put it, "it's been about having a conversation using common language, having a common understanding of OK, so if the normal freight availability is not there to move cash around the country, what impact does that have? How do you think about that commercial bank from your BCP scenario? What extra things do we need to put in place? Or what should we be thinking about to manage that type of scenario?" According to them, this regular exchange substantially improved coordination between the major actors. The RBNZ acts as the key coordinator in these settings.

Furthermore, there is now a cash system-wide crisis response arrangement in place. Therefore, when a crisis is initiated, representatives from all the major actors come together and meet regularly to respond to the situation at hand. Additionally, there is a multilateral MoU among all major actors. The document established an understanding regarding the COVID-19 crisis and sets out clear expectations for all parties. This will also be expanded to cover "all hazards all risks." This will include the possibility of making decisions on which ATMs are serviced or loaded if one of the two CiTs faces constraints. It also includes commerce and anti-competition issues. The Commerce Commission, which has responsibility for maintaining competition, was involved in the drafting of this MoU to ensure it did not fall foul of anti-competition requirements. The overall aim of the MoU is to support communication and decisions that lead to the most favourable outcome for the cash system at large in crisis situations. Beyond this, the RBNZ does not have any authority to demand BCPs or specific measurements of the other actors.

The BCP is responsible for crisis communication with the public. There are pre-scripted messages by the communication department for various scenarios that can be easily adapted for relative immediate response.

There are emergency exercises in place for various objectives. These range from tabletop exercises to actually running through different scenarios. One part of these emergency exercises is that the RBNZ regularly checks if the institutions that hold reserves stocks for crisis situations understand the protocol and instructions. Within the resilience working group of the industry forum, there are also tabletop exercises to think through various scenarios.

The RBNZ also runs an annual survey among main actors to assess the level of resilience of the cash system across several metrics. The resilience working group of the industry forum has developed a common methodology for monitoring and managing resilience and risk. There are five categories: participant commitment, supporting the industry, monitoring system performance, managing risk, and crisis readiness.

2.3.4 Key takeaways and outlook

Several lessons were learnt after the Christchurch earthquake.

Firstly, supply of cash is a crucial operation after a natural disaster or other emergency, as essential commerce needs cash to continue operating.

Secondly, cash is an immediate priority and not one that can simply wait for a few days. This need must be better recognized and prepositioned within the BCP. Before Christchurch, the maximum recovery time for cash operations was two weeks. This was reduced to four hours (in the case that Wellington is not affected). In the case of Christchurch, the former staff member pointed out that the earthquake occurred at 1pm. By 3pm, only two hours later, two banks contacted the RBNZ that they wanted to collect cash in the afternoon and fly it out to Christchurch that evening. This shows how quickly ATMs were running out of cash.

Thirdly, the chances that electronic retail payment methods stop working in the aftermath of emergencies are very high. This creates a vulnerability that must be taken into account. In particular, cash operations must work so that people can continue to provide for themselves.

Fourthly, a concentration risk in RBNZ cash operations was identified. A similar event occurring in Wellington as in Christchurch would have serious implications for cash operations in New Zealand. This concentration risk was addressed. Among other things, cash is stored in bulk in other strategic locations and there are arrangements in place to distribute cash if normal RBNZ staff and facilities are unavailable to perform their duties.

The cyberattack led to the insight that more redundancy is necessary for the critical systems for the cash operations.

As stated in the beginning of this chapter, the RBNZ is currently in the process of a major public consultation on the "The Future of Money". This centres primarily around the question of central bank money in physical and digital form. The discussion goes beyond the question of the cash distribution. There are debates about the importance and features of central bank money, but also what it means for the RBNZ if physical cash as the only retail form of central bank continues to decline.

This decline has potential implications on areas such as supply chains and decreasing capacities of the business-as-usual system, for example by CiTs. There is increasing likelihood that sudden demands of cash, such as in crisis situations, can no longer be handled. With regards to ongoing technology developments, the RBNZ views this as an opportunity to increase the efficiency of the cash cycle.

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3 INTERNATIONAL CASE STUDIES – LITERATURE REVIEW

3.1 Regional and local crisis situations

Not only Italy, New Zealand and Japan struggle with emergency situations off different kinds. Many other countries face challenges induced by hot weather, high precipitation events, heavy storms, earthquakes, and volcanic eruptions. Some countries are reliant on external international aid while others can finance increased demand for help. Countries also differ in their level of technological sophistication. Responses by the cash cycle to disasters therefore also differ. It is not the objective of this chapter to focus on the differences; rather, it is important to extract recommendations, lessons learned and best practices from different countries with various experiences that can be useful to consider for the national security framework. The literature on lessons learned and key takeaways in the US are more extensive, meaning this chapter is longer and contains more information.

3.1.1 Australia – Bushfires and wildfires

Australia faced an unprecedented bushfire series in 2019–2020. Before the start of the fires, Australia experienced its hottest and driest year on record.[60] In January 2020, reports stated that in southeastern Australia, bushfires merged and created a "mega-fire" spanning approximately 1.5 million acres. This was just one of about 135 bushfires in the most affected area of New South Wales (NSW) at this point.[61] In that area alone, 26 people died, nearly 2500 homes were destroyed, and 5.5 million hectares of land burnt. From 1 July 2019 to 31 March 2020, NSW had more than 11,400 bush and grass fires, which burnt 6.2% of the state. Insurance costs are around NZD 1.8 billion (around € 1.12 billion).[62]

Not only did the bushfire series have severe consequences for humans, wildlife, and nature, it also exposed two critical vulnerabilities, discussed below.

During the bushfire series, the most affected areas experienced a series of power blackouts and failure of telecommunication, often at the critical moment when the fire was approaching.[63] This demonstrates a vulnerability of phone and internet networks, when modern societies are dependent on these infrastructures. In the case of crisis communication, how do you warn/inform people if neither their TV is working due to power outage nor their warning apps as there is no signal? Furthermore, how do people access essential goods if electronic payment methods are not working due to network outages? There is also the problem that telecommunication towers are normally located on higher grounds, because the best signal reception is there. However, in the case of fires, this is precisely the most vulnerable place.

Fires can lead to severe blackouts that may have serious consequences. However, electricity is key in fighting bushfires, as in other disasters. This is particularly true for "remote communities [who] rely on it to power water pumps for firefighting and drinking water. It powers the communications and broadcast infrastructure that keeps people informed and in touch. Without it, people can be stranded, panicked, and left exposed to the rapidly changing conditions."[64]

60 Binskin, et al. (2020).
61 Neuman (2020).
62 Australian Disaster Resilience Knowledge Hub (2020).
63 Nogrady (2020).
64 Ibid.

3.1.2 Nepal – Earthquake

In April 2015, a severe earthquake struck close to the city of Kathmandu in central Nepal. 9,000 people died and thousands were injured. Additionally, 600,000 buildings in Kathmandu and nearby were either damaged or destroyed. The area experienced several aftershocks in the following days and weeks.[65] ATMs and cash grants played a critical role in the disaster response. There was a logistical challenge to transport aid items into the affected areas since they were often in remote mountain sites. However, in many areas there were still functioning markets. Therefore cash grants or cash transfers were the most appropriate disaster response to help the affected population in an efficient way.[66]

3.1.3 The Philippines and Pakistan – Typhoon and floodings

In November 2013, typhoon "Haiyan" hit the Philippines severely. It was estimated that around "[…] 16 million people were affected, 4.1 million people were displaced and 6,300 people lost their lives."[67] The Philippines is one of the most countries most vulnerable to natural disasters. The country is exposed to heavy storms and rainfall, droughts, landslides and earthquakes.[68] This is due to its geographic location in the middle of the Pacific Typhoon Belt, its composition of over 7,000 islands and its vulnerability to climate change.[69] The Central Bank of the Philippines, Bangko Sentral ng Pilipinas (BSP), is the sole issuer of domestic currency. Banknotes and coins are circulated in the economy through the interaction of the BSP with commercial banks.[70]

Increases in demand for cash were not only found for the COVID-19 pandemic. In cases of natural disasters, the deposit liabilities of commercial banks in the Philippines are rising. A possible explanation for this finding is precautionary keeping and withdrawing of cash in cases of emergency.[71] A review of cash management in response to the typhoon Haiyan was elaborated by extracting information from 58 respondents from 38 organizations and filtering best practices and lessons learned. In the weeks after the typhoon hit, a cash working group as well as a cash coordinator was put in place. Both were evaluated as beneficial in the process of decision-making and implementing cash transfer programmes. The cash working group was able to connect executing agencies and private companies in cash distribution by raising awareness about what services are available and highlighting needs in respective communities. The advisor responsible for the private sector, the cash coordinator and the private sector network was not able to function effectively in response to the typhoon but is considered of great added value for future responses to crisis situations.

In May 2021, the Philippines joined a simulation to test cash transfers in shock responses. The goal was to target and pre-register especially vulnerable groups. These groups consist of agriculture and fisher households that live in risk areas. Often these groups have lower income and savings. The simulation resulted in the recommendation to achieve a memorandum of understanding with the Department of Social and Welfare Development to gain access to poverty registries to directly target vulnerable groups.[72]

A similar response and an analogy to the case of the Philippines was found in Pakistan regarding the transportation of mobile ATMs. Pakistan has experienced severe floodings in the past. One of the most destructive occurred in 2010. Floods resulting from severe monsoon rains in the summer of 2010 affected about 20% of the land area of Pakistan. The province Khyber Pakhtunkhwa was hit hardest, with more than 90% of the casualties – almost 2,000 human lives were lost in the country overall – occurring there. About 20 million people were directly affected by loss of property, destruction, and impacts on livelihoods.[73] A consequence

65 Rafferty (2022).
66 Willitts-King & Bryant (2016).
67 Smith (2015), p. 8.
68 Bayangos et al. (2021).
69 Ibid.
70 Glova & Hernandez (2022).
71 Bayangos et al. (2021).
72 Auerbach (2021).
73 Singapore Red Cross (2010).

in the aftermath of the flood was difficulties for the local population in obtaining sufficient cash. Mobile ATMs were transported into the disaster area.[74] This procedure was repeated in the Philippines in 2015 and the Caribbean in 2017. In 2015, the Philippines was hit by typhoon Goni. 33 people were reported dead with another 24 injured and 5,742 houses damaged.[75]

3.1.4 Sierra Leone – Mudslide and outbreak of the Ebola virus

In 2017, 1,140 people died due to a mudslide in Regent, a town in the west of Sierra Leone and about six miles east from the capital Freetown.[76] Sierra Leone faces challenges due to dry seasons from December to April, which can come with bushfires and water supply shortages. From May to November seasons with intense rainfall follow, bringing floods and landslides.[77] External funding by the World Bank or the USAID via the cash transfer program processed funds into a national account managed by the National Commission for Social Action (NaCSA) or by national NGO country offices. These funds were then forwarded firstly to a national account held by Payment Service Provider (PSP), and secondly to district-level accounts by the PSP. PSP roaming agents then distributed the cash to people at pre-specified collection points.[78] A brief meeting one week after the event focussing on cash transfers helped decision-making on key parameters for implementation within one week. Data used for formulating a response included the number of affected households, knowledge about the existing payment structure, and a quick analysis of the appropriate levels of benefit.[79]

The Ebola virus outbreak in Sierra Leone was fierce, with great impacts on human as well as economic resources. Crucial for the response to the Ebola Virus Disease (EVD) crisis was a common response plan that helped coordinating stakeholders, discussing responses, and establishing agreements for standard procedures. Moreover, delivery agencies were able to use existing infrastructure, such as that for distributing cash.[80] The report by the Catholic Relief Services Sierra Leone Program showed advantages in cash provision to people during the crisis, stating that cash transfers were hugely important. Previously positioned pay points in adequate numbers helped to shorten the distance for people to access cash. Moreover, the waiting time at pay points was significantly reduced, which was seen as an improvement according to surveyed participants in the study. However, if these transfers are not followed by additional support (nutrition, further financial management, etc.), already severe situations might be exacerbated. In this regard, coordination between state and private actors was a crucial factor.

A key lesson learnt was that the coordination of state and private actors, for example the coordination with SPLASH Mobile Money Limited, a private company providing a mobile payment system, helped conducting payments in remote regions.[81] Moreover, experience from Sierra Leone showed that it needs stable infrastructure to give out mobile cash transfers instead of purely cash-based payments for frontline response workers. Installing a functioning system for transferring these payments was essential to ensure strikes by frontline workers were suppressed. Nevertheless, the conversion from these mobile transactions to cash to the frontline workers was made available by a functioning network of mobile payment agents.[82]

3.1.5 USA – Hurricanes

The United States of America has had to cope with many weather and other disruptive incidents in the past. Below we list a selection of these, and resulting lessons learned. Major incidents in the recent two decades included a power outage that affected several states on August 14th and 15th 2003; Hurricane Isabel on September 18th and 19th 2003 in

74 Cash Essentials (2016).
75 NDRRMC (2015).
76 Sesay & Bradley (2022).
77 Morath et al. (2020).
78 Sandford et al. (2020).
79 Ibid.
80 Ibid.
81 Bockarie & Koroma (2018)
82 Worldbank (2022).

areas on the East Coast (especially D.C., Virginia, North Carolina and Maryland); Hurricane Katrina in 2005; Hurricane Sandy in 2012; and Hurricane Harvey in 2017. Consequences and implications of these disaster situations were manifold.

"Widespread power and telecommunications outages after Hurricane Katrina hindered electronic transaction processing"[83] and required "manual processing" in some cases.[84] Public and commercial transportation were affected, and had an impact on work attendance of staff and on emergency power generators. Water supply relying on the electricity grid was affected: "In Detroit and other cities, problems with water supplies necessitated the closure of buildings, even those with backup power."[85]

Disruptions and outages in power supply also affected communication. "The failure of steam generators in New York City caused a number of organizations to shut down. Most importantly, we saw a number of instances where telecommunications services were affected by insufficient backup power."[86] Problems in communication systems occurred also occurred for other reasons; for example, emergency generators sometimes lacked fuel.[87]

Rented offices often did not provide adequate electricity back-up, but "did not have anything more than emergency lighting for evacuation purposes."[88] In some cases, "the telecommunications systems leading into and out of their building worked, their voice and data telecommunications systems did not" because there was no backup power for in-house telecommunications systems.[89] It transpired that more than a few "cell phone towers are located on buildings that did not have emergency backup power."[90]

83 FFIEC (o. J.), p.11.
84 Ibid, p.12.
85 Federal Reserve Bank (2003).
86 Ibid.
87 Board of Governors of the Federal Reserve System (2006).
88 Federal Reserve Bank (2003).
89 Ibid.
90 Ibid.
91 Board of Governors of the Federal Reserve System (2006).
92 Ibid.
93 Sparks (2020).
94 Federal Reserve Bank (2003).
95 Ibid.

Key insights

These challenges had to be counteracted and key takeaways are summarized in the following discussion.

The "unprecedented destruction and aftermath of the hurricane"[91] showed that "the scope of some institutions' disaster recovery and business continuity plans" had been exceeded. Multiple banks were either destroyed, significantly damaged, or "under water for weeks", including their ATMs and therefore the supply with cash.[92] One important lesson taken from the experience regarding the cash cycle was that disaster preparedness needs to plan for a cash-only environment due to disruptions of power and telecommunications hampering all electronic payment forms. Contaminated cash could be "literally laundered (...) at a laundromat to get it usable."[93]

Emergency power generators turned out to be a better choice than other electricity back-up strategies: "For example, the sole use of batteries as backup proved wholly inadequate, particularly for aspects of critical infrastructure, such as telecommunications switches. In most cases, banking organizations had provided for sufficient backup power to continue critical operations, such as payments, call centers, data processing and key management activities. Many had established backup power for key geographically dispersed retail branches".[94]

Due to backup power at main offices, larger branches, data centres and operations facilities of banks, "the business of banking largely proceeded without interruption, although retail banking (taking deposits, making loans and dispensing cash) was disrupted at affected branch offices."[95]

Power outages can also affect transportation, staff availability and physical security for several days. "Although much of the Washington, D.C., area lost power for as long as eight days, the Board was not affected and our critical business functions continued to operate."[96] Moreover, power outages necessitated the closure of public transportation and installations apart from critical functions. For reasons

of employee safety, "only emergency and critical staff" should be asked to attend work, while some critical staff might have to spend the night in their offices.[97] Another solution was seen in "reserving accommodations at hotels that have emergency power systems" in the vicinity for critical staff, since transportation was disrupted and unreliable.[98]

Bank employees should have the possibility to access systems remotely using VPN.[99] (This, obviously, only helps if digital communication is functional.)

As telecommunications and particularly cell towers were impaired after Hurricane Katrina (and, for instance, no outgoing calls were possible in the New Orleans code numbers area for weeks), it became a challenge for banks to locate or contact their evacuated employees. Those of one bank were scattered to 13 states.[100] Locating missing personnel was difficult under communication disruption conditions.[101]

Emergency situations like these require planned privileged access to emergency systems. Use of existing emergency systems "such as the Government Emergency Telecommunications Service for landlines and Wireless Priority Service for cell phones"[102] had been restricted "to the largest systemically important financial institutions until Katrina". Now, members of all state banker associations can get a card and access.[103]

Furthermore, security aspects are important to consider in this context. Temporarily heightening security as a precaution, or "to close some retail branches whose security monitoring systems were impacted by the outage in order to assure the security of cash, other assets, and personnel" is necessary.[104]

Sharing timely and accurate information was identified as being crucial whenever critical infrastructure was disrupted and the public affected, for example regarding the cause of the disruption (for instance, a weather event rather than terrorist attack, as spreading rumours might cause unnecessary anxiety). "This includes careful coordination of messages between federal and state authorities about steps being taken to protect the public and resolve the problem."[105]

Crisis communication protocols should be activated immediately after an incident. Periodic conference calls of the "Federal Banking Information Infrastructure Committee, made up of the federal and state financial regulators and a representative from the Homeland Security Council" and the "Federal Financial Institutions Examination Council, made up of the federal regulators of depository institutions" throughout the day on the status of the supervised institutions worked well.[106]

Banks and cash-dispensing infrastructure was affected to a certain extent. Only a few dozen banks had to close to all of their operations due to the power outage, and this affected "predominantly small, regional and community organizations and foreign banking organizations".[107]

Depositing cash and checks in envelopes in ATMs generated problems in the disaster situation. High amounts of cash were lost due to destruction as well as raided ATMs. Deposit-imaging allows at least recording the deposited amounts, giving the possibility to access customer and account information more quickly.[108] This was especially important since customers could not get account information when computers were down due to flooding or other destructive circumstances.

Accessing account and customer information was a particular challenge. "In response to hurricane Katrina's devastation, the Financial Management Service's (FMS) US Debit Card program (…) distributed over 11,000 debit cards worth approximately $22 million to evacuees in shelters in Houston, Dallas and San Antonio, Texas."[109] Using these cards tackled the following potential issues. Firstly,

96 Ibid.
97 Ibid.
98 Ibid.
99 Sparks (2020).
100 Ibid.
101 Board of Governors of the Federal Reserve System (2006).
102 Sparks (2020).
103 Ibid.
104 Federal Reserve Bank (2003).
105 Ibid.
106 Ibid.
107 Ibid.
108 Kitten (2006).
109 J. P. Morgan (2005).

some evacuees had no means of identification, "and were having problems cashing checks."[110] Secondly, avoiding the need to carry cash around until needed decreased the "risk of loss or theft. With a PIN-protected debit card, cash is withdrawn only when it is needed and a replacement card is available if the card is lost or stolen."[111] Lastly, payment at merchants whose products and services are deemed detrimental in an evacuation situation ("such as liquor stores, guns shops and casinos"[112]) can be blocked. Staffing such a distribution can be done in cooperation with personnel from banks, local police, emergency administration, and the Secret Service.[113]

Lastly, a process that helped maintaining the cash cycle was the borrowing of cash between branches of fellow banks based on trust and personal relationships. It allowed resumption of operations even without "wire ability": "Having good friends in the banking business makes all the difference in the world."[114]

3.2 International crisis COVID

On March 11, 2020, the World Health Organization (WHO) declared the outbreak of a novel coronavirus, also known as COVID-19, to be a pandemic.[115] In July 2022, there were at least 559,469,605 confirmed cases worldwide and over 6.3 million deaths.[116]

In addition to the catastrophic health and economic consequences, the COVID-19 pandemic had an impact on the cash cycle. In some countries that had already experienced other natural disasters and disruptive events, the SARS-CoV-2 pandemic is considered as had having the greatest impact on the cash cycle so far, for example in Italy. One distinguishing characteristic of this pandemic compared to other natural disasters is its long length.

The pandemic had various impacts on countries and societies. It is not possible to discuss here all measures and methods applied in the cash cycle in response to the outbreak of the coronavirus. However, some important points are highlighted that were observable in many countries and provide interesting conclusions for a national security framework.

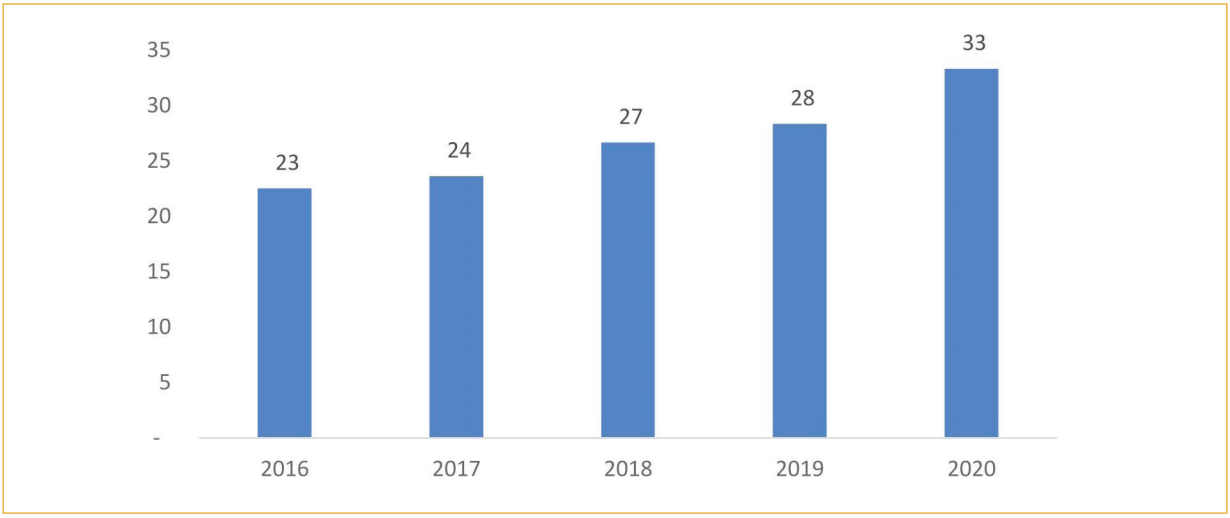
3.2.1 Cash usage vs. Cashless payments

At the beginning of the pandemic, many feared that the virus could be easily transmitted through bank notes and coins. For this reason, many countries had campaigns run by, for example, supermarkets to pay with card instead of cash. It is expected that the outbreak of the coronavirus will overall "[…] likely lead to a further decline in cash usage."[117]

In some countries, such as Italy and the Philippines, it could be observed that reduced demand for cash during the COVID-19 pandemic due to increasing shares of cashless transactions was offset by cash demand due to precautionary motives. Even though the economy was struck by the pandemic, currency in circulation continued to grow.[118] Figure 9 shows the volume of withdrawal of 1000-Piso banknotes in the case of the Philippines that, which are thought to be used as a store for value. The volume increased considerably in 2020. Rising demand for cash, in turn, raises the pressure on the provision of cash. Cash is predominantly used in the Philippines and is likely continues to be very important to the country. A "[…] removal of cash altogether or a restriction of its holdings […] could result in the financial exclusion of the most vulnerable segment of Philippine society."[119]

110 Ibid.
111 Ibid.
112 Ibid.
113 Ibid.
114 Sparks (2020).
115 WHO (o. J.a).
116 WHO (o. J.b).
117 McKinsey & Company (2020).
118 Glova & Hernandez (2022).
119 Dakila (2022).

Figure 9: Total volume of withdrawals of 1000-Piso banknotes.



Source: Glova & Hernandez (2022), p. 8.

The mix of payment methods was also affected by the COVID-19 pandemic in Japan. "Restrictions on social and economic activities"[120] in conjunction with the expansion of e-commerce resulting from lockdowns and social distancing, and advancement by campaigns for cashless payment run both by government and private service providers, are considered to have reduced use of cash in Japan.[121]

The "paradox of banknotes" mentioned above in the section regarding Japan "has become more pronounced since the pandemic". Reasons include: "opportunities to pay in cash further declined due to the economic downturn and the increase in cashless payments amid stay-at-home consumption, while precautionary demand surged due to the extremely uncertain situation brought about by the pandemic."[122]

New Zealand experienced an initial significant demand in cash in March 2020. The RBNZ issued about five times the amount of cash by value compared to the same period in the previous year. Despite this, the RBNZ stated in a COVID-19 special report that the pandemic was an accelerating factor in the ongoing trend of decline in cash usage as well as number of branches and ATMs.[123]

3.2.2 Logistics and supply chains

Depending on the cash system at hand, there was a fear that long and major interruptions of supply chains could have an impact on the availability of cash. For example, in the case of New Zealand, there is an outsourced supply chain. The country has no national mint or print works. This happens offshore. However, the normal commercial logistic arrangements were shut down. Therefore, there was a need for different logistic arrangements. Furthermore, banks were asked to take additional inventory to bolster the cash system's resilience even further, which they did.

In Italy during the pandemic, new challenges arose. Uncertainty about economic development in Italy led to a reduction in cash usage. In response to that, Coban decided to establish a monitoring centre that analysed weekly data on cash withdrawals at ATMs, as well as cash processed and distributed by the CiTs. The number of cash handled by CiTs dropped by 30% in the observed period compared to the same period in the year before. During that time, banks decided to open on two or three days during the week and chose different days for opening but expected the cash transport services to occur within 24 hours, in accordance

120 Kanno (2022).
121 Ibid.
122 Bank of Japan (2021b), p.6.
123 RBNZ (2021a), p. 6.

with their service level agreements with CiTs. In this situation it was not possible to cover the costs with adequate return since banks required less cash but expected transportation services with the same frequency. For this reason, an economic imbalance occurred within the CiTs. The challenge emerged to take different needs from different cash actors into account. In reaction to that, Coban decided to fix the time in which services by CiTs from and to banks are done in a common temporary service level agreement. The services needed to be done within 48 hours, typically at three specific days a week.

A key lesson learned from the experience was to have specific procedures determined before crises hit. This was especially helpful during the SARS-CoV-2 pandemic, where procedures that were established in the beginning of the pandemic can be applied again in later stages. These procedures need to be defined and determined in a joint manner to meet the needs of the cash actors.

3.2.3 Personnel

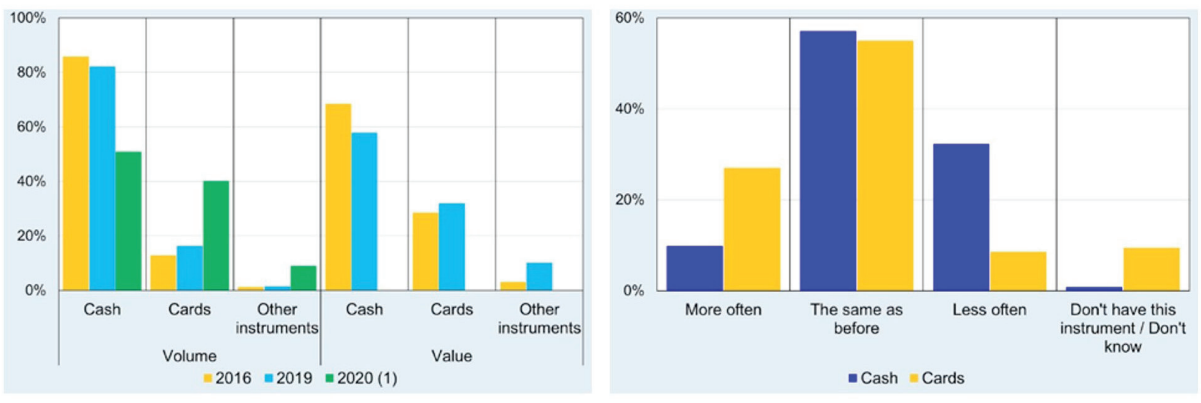
One important factor to be considered regarding the COVID-19 pandemic is personnel. In some countries, fears of an immense shortfall of staff did not become reality. However, in other countries such as Italy, personnel in companies became an important factor to consider during a crisis. Due to the length of the emergency and several health-related issues that endure, the pandemic is different from other crises Italy experienced with strong impacts on companies due to staff shortages. However, with measures dropping and new variants arising, this is again on the agenda of many central banks.

Another challenge arose during the pandemic in Italy. Although cash usage decreased (see Figure 10, which depicts the change in usage of different payment methods during the SARS-CoV-2 pandemic), the health crisis led to shortages in staff, which created problems with maintaining the functioning of the cash cycle. Again, the Coban was a crucial dimension in cash distribution during the pandemic and was further expanded. The protocol was updated and new procedures were put in place.

3.2.4 Political and macroeconomic implications

Several actions have been taken to counteract the adverse impacts of the COVID-19 pandemic on a national and even international level. In the US, the American Rescue Plan Act came into force in March 2021;[124] in Europe the PEPP was introduced in March 2020,[125] and in several other countries cash transfers and other public programmes took place in response to the pandemic. In Sierra Leone, a 'contingency fund' was set up for crisis situations after the pandemic outbreak. This fund aims to finance emergency cash transfers in crisis situations, thereby installing financial aid before the next crisis hits.[126]

Figure 10: Change in usage of different payment methods during the pandemic.



Source: Coletti et al. (2022).

124 The White House (o. J.).
125 ECB (2022).
126 Bowen (2021).

4 LESSONS LEARNED AND BEST PRACTICES

4.1 Interaction and control

Being prepared to temporarily engage in a cash-based economy can be strongly beneficial during crisis situations. In many disasters, be it the bushfire series in Australia, hurricane Katrina, or the earthquakes in Christchurch, electronic payment methods were temporarily not available. Stores were open to a certain extent, but people had to pay in cash. However, this meant that cash must get to affected areas as soon as possible after disasters and people must have information about where to access cash. Based on these experiences, lessons can be learned and best practices are established in different sectors of the affected cash cycle. The following chapter sums up lessons learned as well as best practices and subsumes them under three categories: communication and information systems (IT), coordination and cooperation, cash distribution, and infrastructure. Lessons learned and best practices can be assigned to one of these categories and are extracted from the interviews and the literature review.

4.1.1 Communication and information systems (IT)

Working channels for crisis communication are needed, even in the case of blackout or lack of mobile signal. In the case of the bushfires in Australia, telecommunication providers rolled out satellite trucks, portable reception towers and restored disable mobile base stations.[127] However, these are short-term fixes. The resilience of telecommunication stations must be strengthened overall and there is a need for more back-up channels, for example satellite communication.

Resilience in the IT structure of the cash cycle can be achieved through different pathways. For the Bank of Italy, there is a backup plan in place that can be activated if threats to IT systems emerge. Furthermore, there is testing and preparations for crisis situations. The actors of the cash cycle in Italy conduct exercises on a regular basis, for example simulating a cyberattack.

Enhanced back-up preparations also proved their value in earthquake and tsunami disasters in Japan. This applies to computer systems (including back-up data "on deposits, loans, credit transfers, and other core services"[128] saved redundantly in distant sites), and headquarter installations, "to maintain the payment and settlement functions even in times of disaster."[129]

A critical system for all central banks is the communication system between the central bank and commercial banks or CiTs to order cash and arrange logistics. After the cyberattack on the RBNZ, the bank established a second system to which it can now switch seamlessly. This creates a redundancy to make sure that cash operations still can function, even if one of the systems fails. Furthermore, staff members are now increasingly trained in cyber hygiene measures.

Italy and the US concluded that larger amounts of stocked cash could increase the risk of robbery. The US experienced a large amount of cash vanishing due to destruction and raided ATMs. Therefore, higher security measures need to be taken into consideration in transportation and storage of cash.

4.1.2 Coordination and cooperation

Communication also necessitates coordination and cooperation between the actors to enhance flaw-

127 Hunter & Samios (2020).
128 Bank of Japan (2011i).
129 Bank of Japan (2019f).

less interaction. It turned out to be very helpful in Italy to have a pre-determined group that discusses issues concerning the cash cycle. Coban in Italy meets on a regular basis to highlight current issues and keep each other updated on when resources for disaster response may have to be activated in the future.

CiTs are the operational backbone of cash operations in (probably) all developed economies. This was realized during the COVID-19 pandemic. Government regulations that recognize the CiTs as essential workers must be in place.

A review of the disaster management in the Philippines after typhoon Haiyan hit the country revealed that coordination and communication between governmental structures and private entities are key to disaster management. The review recommends implementing pre-crisis level agreements with aid agencies that provide development aid and financial service providers.[130] This coordination and communication before the onset of this crisis was also pronounced in the disaster management in Japan.[131]

Coordination also necessitates special permits for critical actors. Cash deliverance as a critical part of disaster response should be protected in crisis situations. Pre-registering cash delivery trucks as an emergency vehicle might avoid delays in those vehicles being permitted access to roads in disaster areas by the relevant authorities. This necessitates pre-crisis coordination, exchange, and agreements on the part of private companies and respective authorities. Subsequently, it might be beneficial to define priority roads for cash delivery before the crisis hits. These roads need to be restored primarily if this level of destruction has occurred.[132]

So-called street-wide exercises, based on predefined scenarios and repeated regularly, which include institutions from the overall financial industry as well as nonfinancial firms – particularly those providing social infrastructure (such as public transportation service and telecommunication providers) – would be effective.[133] To enhance disaster preparedness, it has proven effective to practice "implementing the drill scenarios, including the details and extent of damage, without advance disclosure to the participants, but presenting them with the information on the spot."[134]

Cooperation is not only profitable between public and private actors but also among private actors. The example of Japan shows that mutual support and assistance among financial institutions has proven its worth, including providing cash[135] and fuel for emergency generators. In view of "the expected magnitude of damage (…), an individual institution alone cannot make adequate preparations, or even if it tries, it will be too costly compared to their management resources".[136] Creation of regional councils, the enhancement of a framework for a "market-level business continuity plan"[137] on three financial markets (money, securities and foreign exchange), the immediate sharing of damage assessments and situations, and coordination in "changes to trading practices for the market to function smoothly" are takeaway points from past experience.[138]

The need for flexible cash resupply necessitated the Bank of Japan to introduce "a framework enabling financial institutions to receive cash from another nearby branch of the Bank when a branch of the Bank or an office of a financial institution which has a current account at a branch of the Bank is affected".[139]

130 Smith (2015).
131 Bank of Japan (2012b) & Bank of Japan (2012c).
132 Bank of Japan (2019).
133 Bank of Japan (2011h).
134 Bank of Japan (2019e).
135 Ibid., chart 13.
136 Ibid., p.9.
137 Ibid.
138 Ibid.
139 Ibid., p.10.

4.2 Implementation

4.2.1 Cash distribution and cash storage

Natural disasters can have various effects on the cash cycle, which, in turn, have impact on cash distribution, cash management and storage at cash centres, CiTs, central banks and in households.

One finding observable in many countries is that after most emergencies, demand in cash increased significantly in the days that immediately followed. Relevant actors need to be aware of this rise in demand and prepare for counteractive measures. Preparations must happen beforehand in order to match rise in demand. If heavy weather events are forecasted, there might also be an increased demand for cash before the event occurs. If adequate measurements and instruments are in force and there is communication to the people working there, an increase in demand for cash is observable. For example, in the US "ATMs saw high use for several days before Harvey hit."[140] Extra cash should be positioned "at ATMs and branches well in advance of storms and afterward as well", "especially if power and phone outages were prolonged."[141]

Foto © Nils Thies/Bundesbank

140 Sparks (2020).
141 Ibid.

An important part of distributing cash to people in need are ATMs where people can withdraw the cash they need for transactions. One solution is to provide generators and mobile ATMs to supply the population in cases of emergency.[142] Generators help to maintain basic business processes and mobile ATMs can react to shifting demand in a more flexible manner. Mobile ATMs were transported into regions struck by disaster in Pakistan, the Caribbean, and the Philippines. In Italy, Mondialpol introduced the mobile cash centre in 2017. Armoured trucks can be used as mobile ATMs and for picking up deposits from retailers.[143] If processes are not automated and there is a need for additional staff, this must be considered. The Bank of Italy gives out provisions that enable banks to replenish their ATMs with additional staff. Similarly, after the storms hit in the US, banks were advised to invest in mobile ATMs to secure better provision of cash to affected areas and people.

Not only is the provision of cash important. Regulations, rules, and bureaucracy can cost time, which is a valuable good in crisis situations. Several methods can be applied to save time in these processes. One important example from the US shows that cash distribution without fastidious verification of identification can be beneficial. Cash was handed out without account information or any "proven connection to the bank with only hand-scrawled IOUs [abbreviation for the phrase "I owe you"] for documentation."[144] A common problem for people who are displaced or evacuated is that they are not able to identify themselves or do not carry their debit or credits cards to access cash at ATMs. To provide them with cash, it turned out feasible to distribute debit cards in the evacuation shelters, "preloaded with $2,000; those funds were immediately available to the cardholder through cash withdrawals at any ATM and purchases at any retailer that accepted MasterCard."[145] Japan shares this experience. If certificates or bank passbooks are lost, identification of people can be sufficient so that affected households effectively get a grip on some cash. Moreover, it has been suggested to rely on fingerprints for identification.[146]

In the US, some ATMs became inoperable during disasters stemming from hurricanes but some were able to keep working with back up batteries.[147] Overall, these disasters did not lead to huge disruptions to the financial market. However, opening hours by reserve banks had to be extended to fulfil the needs by affected customers.[148]

In Japan, long-term constraints on the supply of electricity necessitated the enhancement of in-house power-generating capabilities in financial institutions, namely power standby units and sufficient stocks of fuel for these.[149]

Additionally, if there is a possibility to maintain liquidity in the cash cycle by recycling cash through ATMs, there is faster economic recovery. According to the Overseas Development Institute, a British think-tank, cash provides stimulating local multiplier effects and can "provide up to 2.7 times the purchasing power of other forms of aid disbursement."[150]

ATMs have a social utility beyond cash; they can build resilience in a society facing disasters in several ways. People can stock up on cash before disasters strike and, in some cases, even buy insurance. Furthermore, if identity documents are lost, through biometric authentication, individuals can still receive cash aid by the government or aid organizations. Additionally, in the instance of Nepal, if ATMs are linked to remote video-tellers or have second screens, they can be used as educational tools. After the earthquake in Kathmandu in 2015, the Nepali government used ATMs to distribute information on how to build back better. In India, the government uses ATMs to educate people on financial literacy.[151]

142 Chantiri (2020).
143 Cash Essentials (2021).
144 Sparks (2020).
145 J. P. Morgan (2005).
146 Bank of Japan (2011b), p.8.
147 Federal Reserve Bank (2003).
148 Ibid.
149 Bank of Japan (2011b), p.24
150 Shepherd-Barron (2019).
151 Ibid.

If there are still functioning markets, simplified procedures for cash access, cash transfers or cash grants are often a very efficient tool in disaster response. Firstly, cash allows people to maintain choice in an otherwise disastrous situation. They can decide for themselves if and how they want to spend their money. Furthermore, it is often cheaper and logistically easier to distribute cash than food distribution or other aid items.[152] We found improved access to cash to be especially, but not exclusively, helpful in Nepal, Japan, Sierra Leone, and the Philippines.

Another solution is to keep cash in stocks for emergency situations. In the preparation process for crises, the Bank of Italy built up several redundant systems (logistics, power supply and IT). These systems, however, can only cover part of the failing systems. For example, only parts of the total amount of cash stock can be hold in backup stock. With respect to the central bank, the Bank of Italy keeps two backup branches for each branch that can be activated in cases of emergency. These backups are defined in advance. Moreover, the respective cash actors are informed about these backup branches. The Bank of Italy holds banknotes in stock at each branch. These logistic stocks would last for over half a month. Furthermore, two power supplies are installed at each branch to ensure continuing businesses if blackouts occur. Analog to Italy, the Bank of Japan also keeps stocks of cash at each branch of the central bank to supply cash to isolated regions in a timely and effective way. Similar experiences were observed in the US and New Zealand. In New Zealand, the issue of a concentration of cash holdings in storage was addressed by storing cash in alternative locations such that if one store is affected, redundant systems can counteract the difficulties.

If shortages in regular cash distribution appear and the other services, such as post offices, are efficiently delivering, it might be beneficial to include these actors in supplying cash. Japan is able to fall back on post offices to send cash via registered mails "[…] which is likely to reach you fairly quickly as long as transport network is functioning."[153]

If the frequency of cash deliveries has to be reduced, it might be necessary to request financial institutions to recycle banknotes and coins as much as possible.

Concerning the storage of cash in private households in the US, people are advised to keep their cash in waterproof bags to avoid contamination and pollution by water and dirt.[154]

Moreover, the factor of human resources plays a role. Rotational precautionary housing in nearby hotels for core emergency staff can enhance planning and logistics under conditions of prolonged disruption of public transportation.[155]

4.2.2 Infrastructure

Communication systems and business processes need power to run and maintain basic procedures. In high-risk areas for bush or wildfires, power lines should be underground or off the grid. This not only helps to prevent power outages in the case of fires, but over-ground power lines have been responsible for fires in the first place, such as in California.[156] In Australia, there are currently experiments with stand-alone power systems that are disconnected from the central grid in critical moments. These systems use a combination of solar panels, batteries, and a back-up generator. First tests showed that these systems, also called "microgrids", "avoided more than 200 hours of outages compared with houses still connected to the central grid."[157]

152 Creti & Jaspars (2006).
153 JapanToday (2019).
154 Sparks (2020).
155 Ranghieri & Ishiwatari (2014).
156 Nogrady (2020).
157 Ibid.

5 OUTLOOK

The aim of the paper was to sum up and structure collected data and information on best practices and lessons learned in crisis situations in different countries. Recent developments and analyses show that extreme weather events will occur more frequently in the upcoming years. The number of floodings, hot weather events, earthquakes, volcanic eruptions, and landslides, and their effect on critical infrastructure is increasing and has significant impacts on social, political, and economic life. Cash is an important factor to consider when it comes to strengthening and improving disaster response, as it offers possibilities to people in affected areas to consume what they need most while not being reliant on functioning electronic payment systems. Redundant and resilient systems in the infrastructure for the supply of cash is an important part of disaster responses. This paper showed that there are various mechanisms and applications in place in different countries that are already applied in disaster management. However, changing circumstances necessitate constant adjustments in responding to crises. We did not analyze in detail the special case of an overall and longer lasting blackout. Some mechanisms and processes for short-term outages were discussed in this paper. However, preparations for longer lasting cross-regional blackouts have not been presented here. A specific examination of these severe circumstances, consequences, and possible reactions with respect to the cash cycle is open for future research. Moreover, this paper did not analyze possibilities, costs, and problems of coordination between central banks or between cash actors from different countries.

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ABOUT THE AUTHORS

Paul Glöckner studied Economics and Politics at the University of Potsdam and Economics of the Middle East at the Philipps-University in Marburg focusing on economic, political and econometric issues. During his time in Marburg he was able to study a semester abroad at the Hebrew University of Jerusalem. Since March of 2021, he has been working as a Junior Research Fellow at BIGS. His focus is on socioeconomic analysis on the resilience of the cash cycle in crisis situations, on the examination of feelings of insecurity, fear of crime and prevention of crime on a local and regional level as well as econometric analysis with regard to different economic and societal topics.

Esther Kern joined BIGS in August 2019 as a Research Fellow. She works in national as well as European projects on various societal, security policy and economic issues related to technology and security. Her research focuses on particular on cyber and space security. In her bachelor's degree, Esther studied political science and history at the Albert-Ludwigs-Universität Freiburg and in Connecticut, US. Subsequently, she earned her master's degree in North American Studies at the John-F.-Kennedy-Institute at Freie Universität Berlin with a focus on foreign and security policy. Esther gained first working experiences among others at Stiftung Wissenschaft und Politik – German Institute for International and Security Affairs and the American Institute for Contemporary German Studies in Washington D.C. Prior to joining BIGS, she worked as a project manager for an European election campaign.

Dr. Johannes Rieckmann holds a degree in economics and studied at universities in Bremen and Paris. He received his PhD in development economics from the University of Göttingen. After working for management consultancies in Hamburg and Brussels, he worked as a PostDoc in the Development and Security Department of the German Institute for Economic Research (DIW Berlin). Since August 2015, he has been a Senior Research Fellow at the BIGS. His research interests include economic issues of secure telecommunications and cybersecurity, economic costs of extremism as well as violence against first responder forces, regulatory policy related to the provision of protection by public and private service providers, and improving the resilience of cash supply and logistics in the event of a crisis.

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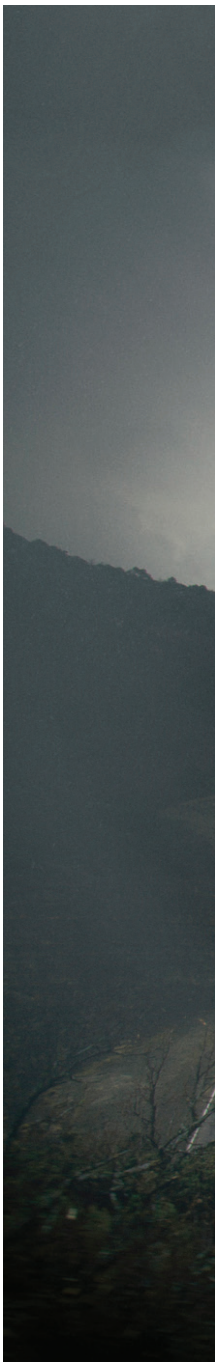
Brandenburg Institute for Society and Security
Executive Director: Dr. Tim H. Stuchtey
Dianastraße 46 . 14482 Potsdam
Tel.: +49-331-704406-0 . Fax: +49-331-704406-19
E-Mail: info@bigs-potsdam.org . www.bigs-potsdam.org



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