

BILLETARIA

YEAR III

ISSUE 6

OCTOBER 2009



VI CIGE
Madrid 2009

Opinion

- 2 Editorial
- 3 Antti Heinonen talks to Wolfgang Söffner
Two authorities on cash management talk about the subject from the supranational perspective
- 6 The Banco Central del Uruguay's experience with varnished banknotes
Varnishing paper banknotes to protect them from soiling
Alfredo Allo. *Banco Central del Uruguay*
- 8 More efficient cash management
The importance of cash management today
Prabir Biswas. *Independent strategy advisor.*
Former executive director of the Reserve Bank of India
- 10 The restructuring of the Banca d'Italia branch network
The Banca d'Italia takes a new approach to its territorial structure
Clorinda Forte. *Banca d'Italia*

Banknotes and Coins

- 12 The Bolivian banknote family
Walter Orellana. *Banco Central de Bolivia*
- 14 The Treasury Department of the Banco Central del Paraguay
Pedro Acosta, José Antonio Meza and Fernando Miguel Villalba
Banco Central del Paraguay

Cash Activities and Technology

- 16 Mechanical banknote sorting: an empirical study
An investigation into the behaviour of banknote sorting machines
Mariano Martínez, Eduardo Kropnick and J. Darío Negueruela. *Banco de España*
- 20 *Open Main Cashier System*
Glory's small-scale banknote sorting solution
Yoshihiro Akita. *Glory Ltd*

CIGE

- 22 VI International Course on Cash Management
J. Darío Negueruela. *Banco de España*

Miscellaneous

- 21 International events
- 24 Publications devoted to cash
- 25 Central banking news
- 26 Banknote security features

Editorial

■ **J. Darío Negueruela** *Banco de España*

BILLETARIA's editorial team would like to express their thanks for the words of encouragement received from numerous readers following publication of issue number 5, in which the efforts were focused on giving an up-to-date overview of the application of polymers in the banknote industry, with a review of the experience in various countries, and opinions and contributions from a wide range of sources.

In this issue the journal returns to its normal format, whereby the aim is to offer a varied and broad view of the state of play in the industry and the concerns and challenges faced by central banks in relation to cash management. However, this thematic approach will be repeated in future issues of BILLETARIA, so as to give a fuller and more in-depth look at a particular specialist topic, although without excluding other issues.

This edition starts with an interview with Antti Heinonen, the current chairman of the CDCBG's Executive Committee and Director of the Directorate Banknotes at the European Central Bank during the period 1998-2008, conducted by W. Söffner. Antti needs no introduction as he is a well known and much admired figure in the world of cash management. His experience, dedication, relationships and knowledge place him at the top of the league among most of us working in the field and we are sure that he will continue to be our benchmark for professional standards for a long time to come. The interviewee and interviewer are both outstanding figures and it is a pleasure to be able to offer the fruits of this conversation between two such authorities here.

This edition's Opinion section includes three interesting articles: The Banco Central del Uruguay discusses its recent experience varnishing its banknotes; Prabir Biswas, who has already contributed to BILLETARIA with an article on the challenges of cash management in issue 2, reflects here on the importance of strategy in cash management, and Clorinda Forte devotes a couple of pages to explaining the interesting experience of renewal and change that is taking place at the Banca d'Italia as it reorganises its branch network. The following pages include detailed information on Bolivian banknotes and the organisation and function of the Treasury Department at the Banco Central del Paraguay.

The Cash Activities and Technology section includes two very different contributions. In one of them, the banknote and coin sorting machine manufacturer Glory presents and describes some of its products used by central banks, and also traditionally, by the banking industry. In the other, the Banco de España presents the research it conducted during the final months of 2008 and first months of 2009 in the banknote processing area. Its work seeks to throw light on the functioning of

mechanical and technical reactions of the banknote sorting machines used by central banks. The article is longer than the norm, but we feel that the novelty and rigour of the work merits its being published in all its detail. Obviously, this research does not give the definitive answer to all the questions currently of concern on this topic, but it may be considered an important and significant step in a line of research which we are sure other central banks have already embarked upon. The study's main findings point to the need to maintain permanent control and supervision of the machinery used to avoid distortions in the activity or a break in the management of the objectives set for the processing and the online destruction of banknotes. We would also like to invite any central banks that are conducting research or empirical studies along similar lines in relation to the operation and functioning of these machines to share their experience and the knowledge they have acquired in the course of their work with the international community of cash departments. BILLETARIA offers itself as a show case in which to publish and debate this work, which will undoubtedly be of benefit to all.

On this occasion it is also worth making a special note of the VI International Course on Cash Management, which was held in Madrid in early June 2009 and in which an excellent team of teachers of the highest academic and professional standing took part.

The final pages of the review deal with the usual range of topics, with details of news, events and recent publications. Here once again we would like to reiterate our call to our readers and friends that they take the initiative to share texts, images and ideas with BILLETARIA's international community. To remind our readers of this permanent invitation, this issue of BILLETARIA includes a bookmark identifying them as a BILLETARIA reader and contributor. We look forward to your help and cooperation. And we are grateful for your understanding and support.

A pensive girl / JDN



COLLABORATORS

J. Darío Negueruela Director of the Cash and Issue Department. Banco de España / **Wolfgang Söffner** Former chief cashier of the Deutsche Bundesbank / **Antti Heinonen** Former director of the Directorate Banknotes at the European Central Bank, and chairman of the Executive Committee of the Central Bank Counterfeit Deterrence Group / **Alfredo Allo** Chief of the Treasury Department. Banco Central del Uruguay / **Prabir Biswas** Independent strategy advisor. Former executive director of the Reserve Bank of India / **Clorinda Forte** Deputy Head of Division of the General Currency Department. Banca d'Italia / **Walter Orellana** Monetary Operations Manager. Banco Central de Bolivia / **Pedro Acosta** National Operations Manager. Banco Central del Paraguay / **José Antonio Meza** Director of the Treasury Department. Banco Central del Paraguay / **Fernando Miguel Villalba** Deputy Treasurer for Banks and Deposit Accounts Control. Banco Central del Paraguay / **Mariano Martínez** Head of the Counting and Sorting Unit at the Cash and Issue Department. Banco de España / **Eduardo Kropnick** Head of the Technical Advice Unit at the Cash and Issue Department. Banco de España / **Yoshihiro Akita** Manager Overseas Business Planning Department. Glory Ltd. / **Yolanda Barrera** Photographer.

Antti Heinonen talks to Wolfgang Söffner

■ **Wolfgang Söffner** *Former chief cashier of the Deutsche Bundesbank*



Antti Heinonen has been the banknote principal adviser at the European Central Bank (ECB) since November 2008 and the chairman of the Executive Committee of the Central Bank Counterfeit Deterrence Group (CBCDG) operating under the aegis of G 10 Governors, since March 2008.

He has written numerous articles on banknotes, regarding both their present and history. He holds degrees in economics and mathematics from the University of Helsinki and has held numerous positions during his extensive professional experience. In particular, these

have included the following:

He was the director Banknotes at the ECB from August 1998, and chaired the Banknote Committee (BANCO) of the European System of Central Banks between July 1998 and November 2008. He was also the chairman of the Eurosystem Cash Changeover Co-ordination Committee, which had the overall responsibility for the co-ordination of the euro cash changeover in 2002. Prior to joining the ECB, he was the chief cashier for the Bank of Finland from 1993 on, and during the same period he was the chairman of the Statistics and Banknote Handling Committee, the Banknote Printers' Conference (1996–1998) and of the Issue Task Force of the European Monetary Institute (1996–1998). Between 1985 and 1992 he was the head of Communications Department of the Bank of Finland, prior to which he worked in both the Human Resources and Planning and Monetary Policy Departments. Between 1981 and 1992 he was the secretary of the design committee for the new series of Finnish banknotes, issued in 1986–87. Between 1989 and 1995 he was the president of Finnish Numismatic Society and in 1978 that of Finnish Society for Economic Research.

At the end of 2008, Antti Heinonen stepped down from his position as director Banknotes at the European Central Bank, a position he had occupied for over 10 years. In conjunction with this role he simultaneously served as the chairman of the Banknote Committee (BANCO), which brings together all of the heads of banknote departments at the European Union's national central banks. It was under his watchful eye that the euro was born and launched so he can safely be described as its prime facilitator.

Even now, he has still not been able to completely sever his links with the world of banknotes and he continues to advise the ECB on matters relating to the field. Over and above this, the G 10 Governors have appointed him as chairman of the Executive Committee of the CBCDG, which operates under the auspices of the Bank for International Settlements in Basel.

I first met Antti when I was asked to provide BANCO with logistical assistance for one of its meetings, which was due to be held on the premises of

the former Landeszentralbank in Hesse, where I occupied a senior position at the time. On that occasion, our exchange was limited to a brief conversation about the future of the euro and neither of us could have guessed that shortly after I would myself become a member of BANCO. My appointment as head of the Cash Department at the Deutsche Bundesbank led to us working together on a regular basis up until my retirement. I would describe my working relationship with Antti as having been extremely amicable and fruitful. I greatly appreciated the calm and confident manner in which he conducted meetings. Even in cases where we did not share the same opinion or it was difficult to reach a compromise, the nature and tone of discussion between us was always very professional and extremely cooperative so there was no room for any grudges. I think that the relationship we enjoy today is one of loyal friendship. This is borne out each time we meet or contact one another. For this reason, as the latest member of the Editorial Committee of BILLETARIA, I was very pleased to accept the honour of conducting this interview with Antti.

But now it is Antti's turn to speak. Unfortunately, due to space constraints, we have had to limit the content of the interview to just a few key points.

Q. Antti, first of all, please tell us how you became the first director of the Banknote Department of the ECB and therefore godfather of the euro banknotes?

A. Prior to the establishment of the ECB, the preparatory work for the single currency was managed by its predecessor, the European Monetary Institute. Several working groups and sub-committees reported to the Institute Council, one of them was the Working Group on Printing and Issuing a European Banknote, which was under the chairmanship of Alex Jarvis when I was the chief cashier of the Bank of Finland. In addition, I was the chairman of the Statistics and Banknote Handling Committee of the Banknote Printers Conference, which also implied regular collaboration with my European colleagues. That was the state of affairs in June 1998, when the Executive Board of the ECB appointed me simultaneously with the other ECB business area heads.

Q. Taking into account that there were very different cultures, traditions and also security features for banknote printing in Europe, I believe that you found difficult to create a common banknote.

A. The challenging task of creating a common banknote was very much done already during the time of the European Monetary Institute, when Alex was still in the driver's seat of the Working Group. Naturally, the banknotes needed to be really European, without any national or regional bias, and take into account the user requirements of different stakeholders around Europe. They were to include those machine readable security features which the national central banks used in their sorting, and they had to be capable of being manufactured by the different producers of national legacy currencies, using a variety of different technologies. A lot of innovative solutions were necessary, such as minimising the use of languages by using only the name of the currency in both Latin and Greek scripts and expressing the name of the issuing authority, the ECB, in the form of five abbreviations covering all official EU languages. Furthermore, a lot of practical issues had to be agreed upon, such as the number and value of denominations and the sizes of the banknotes.

My recollection of this time and later from BANCO is that the groups were innovative and goal-oriented, and tried to find solutions that everybody could live with. Even if the issues were very challenging, I was always confident that a solution could be found.

Q. Within BANCO the directors of cash departments and of the national central banks' printing works discuss and coordinate all problems related to cash, from production through to distribution to destruction. What is BANCO's role?

A. After the establishment of the ECB, BANCO held its first meeting in early July 1998, as one of the 13 Eurosystem committees introduced by the ECB Governing Council to assist the work of the decision-making bodies. Like the other Eurosystem committees BANCO provides expertise in its field of competence and thus facilitates the decision-making process and implementation of decisions, and it reports to the Governing Council via the Executive Board.

BANCO takes a considerable share of the ECB Banknote Director's time, because in addition to the preparation and follow-up of the 7-10 annual meetings, there are ad hoc teleconferences and more than 100 annual written procedures involving the BANCO members of the central banks. BANCO's documents are mainly prepared by ECB expert staff, and they are normally reviewed beforehand by Eurosystem working groups and expert task forces reporting to BANCO, prior to BANCO discussions.

A lot of BANCO matters have practical implications for cash management procedures in the European national central banks cash departments, and therefore it is important that the BANCO members and national central bank experts critically assess the validity and functionality of the ECB proposals before they are submitted to the Governing Council.

Q. After chairing BANCO for more than ten years, do you think that you and the national cash department heads have developed a certain corporate identity?

A. The challenging tasks have created a good team spirit and built up trust among BANCO members, and it is evident that when people from different countries meet regularly, they get to know each other better on a personal level and are ready to share information with each other. Therefore, people benefit from best practices both at the expert and management level, and a lot of co-operation has been created even outside the BANCO agenda. Therefore, in specific areas a certain corporate identity has developed, even if the Eurosystem is still young and further development will undoubtedly take place.

Q. Do you think the role of cash will change significantly in the near future? Do you see the present financial crisis having any influence on cash holding?

A. First of all, I would like to say that I do not expect a significant change in the near future. There are two things which are important for the success of a means of payment: its efficiency for the users and their confi-



Antti Heinonen (left) and Wolfgang Söffner (right) during the interview / M. Joppen

dence in the issuer. Although cash is still king, the proportion of transactions in which it is used has gradually declined in a number of countries with the continuous creation of new means of payment. However, at the same time, in countries and currency areas which have a stable currency, the role of cash as a store of value has increased. The recent past has shown that cash is one of the few things citizens trust during episodes of financial turmoil.

What the result of these various trends will be depends very much how central banks are able to make the cash cycle more efficient, by adapting to changes in the environment, introducing new technologies and taking into account the views of all the relevant stakeholders in the cash cycle.

Q. What is your opinion of the current discussion about the cost of cash and the future of cash handling due to the fact that there are vast national differences in the use of cash?

A. Normally, one of the core tasks of a central bank is to promote an efficient payment system. Therefore, central banks should consider these issues from a societal point of view. The discussion has, however, been dominated by sometimes excessively partial analyses. Even if the central bank should be neutral as regards different payment instruments it should not be indifferent, because one of the means of payment, namely cash, is its responsibility.

As mentioned earlier, efficiency and confidence are the key words in this context. The invention of ATMs has made the distribution of cash to citizens very efficient, but there is scope for improvement in the backflow of cash to central banks by shortening the cash cycle through different recycling arrangements.

Q. How do you see the role of the national central banks in cash handling?

A. It very much depends on how the central banks can best arrange a smooth supply of cash and maintain the integrity of their banknotes. Every country has its own geography, banking structure, payment habits, coun-

terfeiting traditions, etc. It is on the basis of all these that each national central bank should decide its role in cash handling.

Q. Distribution of the second series of euro banknotes is due to start in a few years' time. Can you comment on why there is a need for new designs of banknotes and what important technological changes will be made?

A. The basis for the specification of the current euro banknote series was established in the mid-90's, and one very important criterion in its development was a smooth transition to euro cash. In the meantime interesting new security features have been developed, there has been development in the cash processing and production technology, and banknotes are more widely processed by machines. In parallel, reproduction technology has also progressed and created new threats. It is to challenges of this kind to which the second euro series will respond.

Q. In Europe, banknotes are usually printed by mixture of privately, publicly and central-bank owned printing works. Do you think this situation is a hurdle for the single Eurosystem banknote tender planned for 2012 and could this affect the quality of the banknotes? Furthermore, do you have any thoughts about consolidating the number of printing works for the euro?

A. Yes, there is a wide variety of printing works in Europe, and these printing works not only supply European customers but are also leaders in the world market. Here the situation has changed over the last fifty years, when some US printers, which used to have a major share in the world market, have quit.

I do not think that this variety of printing works represents any kind of hurdle for the single Eurosystem tender procedure, or will affect the quality of the banknotes. There are already several good examples of specialisation and pooling of tasks by the Eurosystem in the cash area. I do not think that banknote printing should be an exception. In the long term most printing works will probably also consider possibilities for specialisation or for pooling their resources.

Q. Antti, you were Europe's cash coordinator for more than 10 years. Can you summarise this era in a short statement?

A. It was a great privilege for me to hold this position, which makes me hesitant to issue any strong statements, but evidently the euro cash changeover was a historic event, and the developments concerning the countries which have adopted or plan to adopt the euro, and towards the harmonisation of cash management policies has been much faster than any of us could have anticipated more than ten years ago.

Q. Currently you are the chairman of the Executive Committee of the CBCDG. Please describe to readers the function and tasks of this Committee with this very awkward abbreviation.

A. The Central Bank Counterfeit Deterrence Group (CBCDG) is a group currently comprising 31 central banks which was set up at the request of the Governors of the G 10 central banks. Its mission is to investigate common emerging threats to the security of bank-

notes, and to propose joint solutions for implementation by issuing authorities.

The CBCDG supports and deploys technologies that deter the use of digital equipment to counterfeit currency, and for that purpose the CBCDG has developed the Counterfeit Deterrence System, consisting of anti-counterfeiting technologies which prevent personal computers and digital imaging tools from capturing or reproducing the image of a protected banknote. Several leading personal computer hardware and software manufacturers have voluntarily adopted the system in recognition of the harm that counterfeit currency can cause their customers and the general public.

The Executive Committee of the CBCDG provides strategic and policy direction to the work on counterfeit deterrence and oversees the operation of the projects and programmes undertaken by the CBCDG.

Q. Antti, last but not least, I am sure your wife will be happy to see you in Finland more often now than she did in the past. Do you have any specific plans for spending this newly found free time yet? For example, will you further indulge in your passion for dancing?

A. My successor Ton Roos started in November 2008 as director Banknotes at the ECB and he chaired his first BANCO meeting in December. After a smooth handover to Ton my main responsibilities are now CBCDG related and I continue as a principal adviser at the ECB on a part-time basis. It is true that I am now more often in Finland, and I have an agreement with the Bank of Finland so that I can use their facilities when I am in Finland for both CBCDG related tasks, and for fostering my long-standing interest in writing on the history of banknotes, in particular on banknote history of Finland. This has already generated a few articles in relevant publications. Thus I am still mostly involved with banknotes, although I naturally have more control over the other half of my time, which I highly appreciate.

As regards dancing, I am looking forward to the wedding of my youngest daughter, which I anticipate will involve a lot of outdoor dancing in the best Finnish/Norwegian tradition, given that the groom is from Norway.



Antti Heinonen next to the symbol of the euro and the ECB premises in Frankfurt / M. Joppen

The Banco Central del Uruguay's experience with varnished banknotes

■ **Alfredo Allo** *Banco Central del Uruguay*

The functions entrusted to the Banco Central del Uruguay include efficient cash management, maintaining the quality of the banknotes in circulation, minimising the risk of counterfeiting, and meeting the cash needs of both the public and the financial system. These functions are set in a context in which optimising costs plays a decisive role. However, reductions in the cost of banknote printing cannot be at the expense of their quality or security. Against this backdrop, in 2006 the Banco Central del Uruguay opted to coat two of the denominations of its banknotes with a flexographic varnish. The varnish is colourless and is applied at the final printing stage to reduce porosity and totally seal the banknote within a protective envelope. This protects the banknote against soiling, slows its deterioration and consequently delays its destruction.



Banco Central del Uruguay employees processing banknotes / BCU

cover a wider range of technical features than those traditionally included. Additional technical features included with a view to improving banknote quality, security, durability or design factor were thus given a weighting of 10% in the evaluation of offers.

One of the firms taking part in the 2005 call for tender offered banknote protection using a water-based varnish. The main advantages of varnishing banknotes in this way are:

- Cost optimisation. The varnish acts as a shield protecting the note against agents causing soiling and wrinkling, and also protects it against wear and tear, thus extending its useful lifetime. Applying varnish may be considered a long-term initiative, as the return on investment is calculated based on the extension of banknotes' average useful lifetime.
- The varnish is transparent under natural sunlight, ultraviolet and infrared. It therefore does not affect the general appearance of the banknote or the way in which inks react to infrared or ultraviolet detection. Nor does it affect the tactile properties of the banknote, so does not lead to doubts among users.
- The varnish provides transparent and imperceptible protection by sealing the pores of the paper manufactured from a cotton substrate, which also helps in the maintenance of the security features built-in to the banknotes. This ensures the banknotes can be read by sorting machines and ATMs, avoiding the cost of adapting software or hardware.
- Varnishing is a tried and tested system in use by numerous banknote manufacturers around the world.

Implementation of Uruguay's banknote issue improvement plan

In January 2002 the Treasury Department of the Banco Central del Uruguay consolidated the reorganisation of its processes, begun a few years earlier, with the incorporation of a BPS 1040 banknote sorter, along with a Kusters model CDS 100 shredder. As of this time, the levels of destruction of banknotes being returned to the Bank's vaults and the reasons for their deterioration began to be measured more accurately. Thus, it was found that soiling was the main culprit in the case of over 50% of the banknotes that were deemed unfit for circulation.

In order to tackle this problem it was decided that a new parameter should be included in calls for tender for banknote production so as to

2006



2000



Sample of deterioration of an unvarnished banknote (bottom) and a varnished banknote (top)

- The varnish contains only small traces of organic volatile content, making it an environmentally friendly material.

Based on its analysis of the potential benefits of the product, and the price offered in the call for tender, the Treasury Department decided to purchase 200 and 500 Uruguayan peso denomination banknotes coated with the flexographic varnish.

Sampling and data analysis

The C-series of the 200 peso denomination was put into circulation in November 2006, while the varnished 500 peso series was launched in April 2007. In order to monitor the effectiveness of the flexographic varnish, during the period between March 2008 and the end of that year, samples were taken from bundles of thousands of notes deposited by commercial banks at the Banco Central del Uruguay and the results of sorting them with the BPS 1040 machine were analysed. Processing was performed in the fit/unfit mode to evaluate the composition of banknotes put back into circulation and those that would be shredded under the banknote quality standards set by the Treasury Department.

As a consequence of the faster rotation of the 200 peso note, according to the results of the sampling performed, the conclusion was reached that almost all the circulating notes in this denomination (and therefore the notes deposited in the vaults of the Central Bank by commercial banks) were varnished banknotes. The analysis therefore focused on this denomination before proceeding to look at the 500 peso note.

The accompanying table gives the data for the 200 peso note regarding the percentage replacement of banknotes in circulation in the period between 2002 and 2008.

As can be seen from the table, the percentage replacement rate fell during the period examined, which is in line with the bank's aim of extending the useful lifetime of its banknotes. The BPS 1040 sorting machine processed the varnished banknotes very well, although it was necessary to make a minor adjustment to the software given that the sensors interpreted the increased gloss resulting from the varnish on the surface of the notes as holes. Putting varnished notes into circulation has not caused any rejection by the public, as despite the coat of varnish, the notes are identical to the previous series.

Conclusions

In order to fulfil its mission of providing a high quality currency at the lowest possible cost, the Treasury Department of the Banco Central del Uruguay has used varnished banknotes as a weapon against the main cause of deterioration of Uruguayan banknotes: soiling. The results obtained in the nearly three years the varnished notes have been in circulation have been positive on all the main points.

Indeed, an extension in banknotes' useful lifetime has been observed, the varnished notes have been well received by the public given that the appearance is unchanged from that of the "ordinary" note, and the cost of adapting the software of the banknote sorting machine was minimal. Thus, as a starting point in the effective battle against counterfeiting, the security features must be easy for the public to recognise and analyse.

Moreover, in the Treasury Department's view, banknotes must have a rational structure which balances cost against security. Applying varnish has not substantially increased the final cost of banknotes. It is a process that has been incorporated by numerous banknote suppliers, and it has shown itself to be effective and long-lasting in relation to the maintenance and conservation of the security features designed to be recognised by the end user.

Replacement of 200 Uruguayan peso banknotes (number of banknotes)

Year	Circulating (a)	Processed	Destroyed (b)	Replacement rate (b/a)
2002	3,907,897	3,436,572	1,388,280	36 %
2003	4,524,481	1,849,525	1,828,178	40 %
2004	4,585,594	2,088,040	2,547,963	56 %
2005	4,667,203	3,426,006	1,680,443	36 %
2006 (1)	5,626,417	2,467,561	2,369,649	42 %
Average 2002-2006	4,662,318	2,653,541	1,962,903	42 %
2007	4,912,978	2,500,874	1,639,078	33 %
2008	5,809,801	4,639,000	1,880,457	33 %

(1) The issue of C-series 200 Uruguayan peso notes began in November 2006.

More efficient cash management

■ **Prabir Biswas** *Independent strategy adviser. Former executive director of the Reserve Bank of India*

Cash handling has taken on greater significance as a result of demand from the corporate sector for banks to integrate corporate treasury management with collection and distribution so as to reduce inefficiencies in the payment system and meet the ever-increasing demand for cash transactions. Attitudinal apathy among commercial banks has not helped them improve their systems and increase the effectiveness of their operations. The article enumerates steps and strategies that might be envisaged to improve cost-effectiveness by doing more with less and converting a neglected activity (cash management) into a source of additional income.

Cash management is essential to the activities of both corporations and banks

Cash management, one of the best known public faces of commercial banks, has increased its importance in recent times as banks seek to provide better customer service to the public, in response to demands from corporations on the banking system and to ensure higher returns on assets. These demands are being driven by regulatory and technological changes in the context of globalisation and the need for systems which allow centralised control.

In the same way that central banks need to formulate their strategy for currency management¹, commercial banks also need to evolve strategic plans that include strategies for handling cash and for their interaction with corporate treasury and banks, in a way that provides visibility, control and risk management capabilities relating to corporate customer's cash flows around the world. Global business models require centralised control, delivered through integrated technology and systems.

Cash management for corporate customers has to provide three basic elements:

- Efficient collection points.
- Efficient information flows.
- Efficient use of the funds once they are collected; successful cash management, therefore, depends on a common standard for information flows.

Is cash handling a routine activity?

Handling of cash is still considered a routine task², resulting in commercial banks not paying enough attention to achieving optimum levels of cash to meet demand while avoiding their holding an idle cash balance.

As a result, across the world, in almost all commercial banks (and most central banks too) a position in the cash department is considered as a routine job, and people posted there tend to feel undervalued and unmotivated. Therefore, they may tend to focus on finding a new position rather than improving the effectiveness of cash management and cash handling

The strategic plan for handling cash consists of:

- Forecasting overall demand for cash, broken down by denominations, including both coins and notes.
- An operational plan and strategy for storage, transportation and dispensation.
- Customer service.
- Security, and risk management.
- Cost effectiveness.

operations entrusted to them, although this is one of the most complicated of "supply chain management" activities. Nearly 80% of the cash department personnel in commercial banks are 45 years old or above, and their approach to cash handling often leads to an underperforming supply chain due a focus on efficiency rather than on effectiveness. This is also associated with the globalisation of supply chains, focused sources and centralised distribution, an increasing tendency to outsource, a reduction of the supplier base, and an absence of supply chain resilience. The higher age profile also tends to result in a lack of enthusiasm for innovative ideas, products and processes.

Strategic objectives

A sample survey conducted by the author in 2008 found that opinions about strategic goals also differ between banks (as well as within banks)³. About 20% of respondents considered that the most important strategic goal is reducing costs and around 15% felt that it is improving customer service. About 12% of respondents were of the view that increasing speed is the most important issue for customers. Just under 9% of the respondents felt that reliability of the supply chain is of paramount importance. Only 5% agreed that improving services and introduction of new products is vital. The remainder of the survey's respondents cited a variety of other strategic goals.

In commercial banks, apart from the attitudinal apathy, cash handling is generally regarded as a costly and risky area of work. This reluctance has resulted in many of the activities involved being outsourced, without any evaluation of the costs, benefits, and risks. On the other hand with the sole objective of increasing business, some banks have approached the issue from a marketing angle, i.e. by examining the entire range of products and the range of customers, and prescribing parameters for various services. Moreover neither the regulatory prescriptions nor the banks' own codes are reviewed and changed with time, and as such most of them far outlive their usefulness. In fact, more often than not, these outdated parameters kill innovative ideas and practices while they are still in the nascent state. For cost-effective and successful cash management, banks need to take a risk-based approach⁴ rather than their current practice of selling products on a cost-plus basis. This in turn could help banks to make better use of scarce capital.

1. Prabir Biswas, *Strategic Plan for cash management*, BILLETARIA, Year I, Issue 2, October 2007, Banco de España/Cash and Issue Department. Madrid.

2. Prabir Biswas, *Cash Management is not a routine job*. Paper presented in the Second International Conference, Models, Standards, Tendencies, Moscow, Russia, July 3 and 4, 2008.

3. Half-day Workshop on Cash Management (How to manage more customers with less cash) conducted by the Author in the 3rd Asian Cash Handling Seminar, Bangkok, November 11 and 12, 2008.

4. P. K. Biswas, *Risk Management* –VINIMAYA, Volume XX, No. 2, July – September, 1999, National Institute of Bank Management, Pune, India.

The handling of cash in commercial banks is part of supply chain management and should start with the formulation of a comprehensive policy (procedures and accounting methodologies) relating to all the operations and risks:

- Handling of cash.
- Verification, processing and sorting of banknotes and destruction of non-issuable banknotes.
- Treatment of counterfeit banknotes.
- Resource management.
- Remittances.
- Records and management information system.
- Security.
- Audit and inspection.
- Citizens' charters, codes and standards.
- Redressal of grievances and right to information.
- Contingency planning and disaster recovery management.

Banks' apathy results in a lack of innovation (both technological and strategic) in processes to meet the challenge of increasing volumes and complexities (particularly as regards counterfeit banknotes) in cash handling management. Any innovation needs knowledge, and all the more so in relation to process innovation affecting functions, logistics, business models, and processes. Without knowledge within an organisation or a firm, it is not possible to design and create processes that will work. Sadly, most of the managers in cash departments shun such innovations and rather prefer to continue with the existing methods. In the survey cited above, only 24% of the respondents felt that they were able to reduce costs through innovations. "Innovation is like virtue; it is important, we would like to have more of it, but few people know how to get it and even fewer know how to keep it."

Once a comprehensive policy has been formulated and standards have been set in a quantifiable manner, the next stage is to ensure these standards are achieved without adding any incremental operational risk. In an automated working environment this is not difficult, and what is required is periodic updating of internal checks and controls to ensure operational risk is managed. Risk management is not simply risk avoidance, but managing risk adequately. Operational risk management is a process through which risks are identified and quantified. To that end, banks need to make resources available to those areas of cash management that will increase their ability to meet the customers' needs, rather than subordinating this need to cost reduction priorities. Acceptance of coins, exchange of soiled and mutilated banknotes, etc., definitely add to the cost of operations, but in a remote area, or even in a metropolitan city, they meet customers' needs.

Conclusions

The banks need to understand that, in a global competitive environment, they need to transcend the traditional pattern of isolating each function, so as to pursue "cross-functional objectives". Restructuring the bank and redeploying resources should, therefore, focus on recruitment, rewards and training of personnel at every level.

Banks should also internally audit these standards (both external and internal) and how these are complied, monitor the risks, and recommend steps to manage risks better.

Banks should refrain from offering free or subsidised services indiscriminately. In a competitive world banks tend to offer free or subsidised services to attract customers, but often find it hard to continue doing so over the long term either because of pressure on their bottom line or because of regulatory interventions. It is important to bear in mind that once customers become accustomed to receiving something for free it may be difficult, if not impossible, to persuade them to pay for it later on.

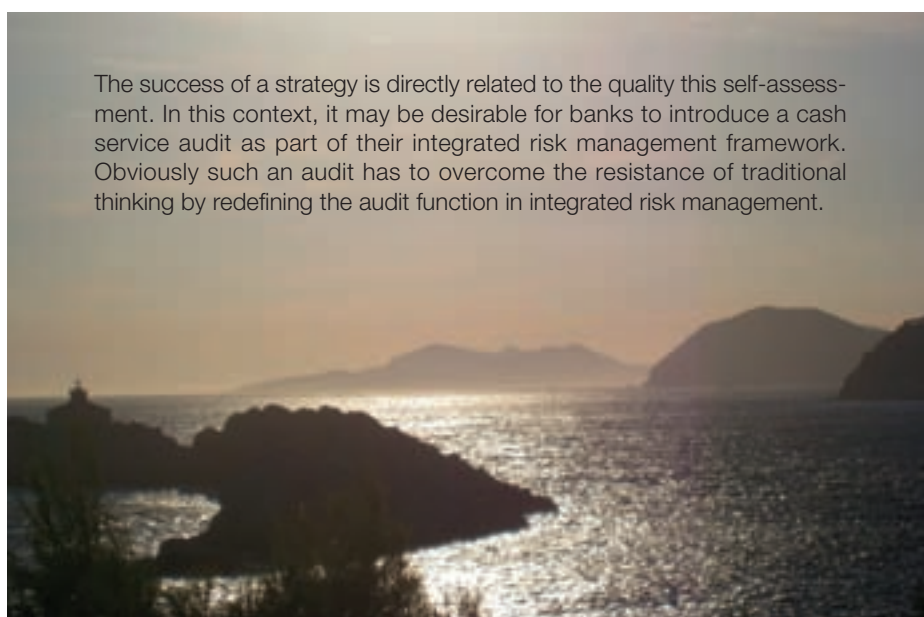
Banks have never seriously attempted to make the public understand in a clear and transparent manner what it can expect from them. When things go wrong, banks try to take advantage of the terms and conditions, which the customers might have accepted in a hurry and without perhaps paying full attention to them, or without understanding their implications fully. While there could be general awareness about what banks do, the public is not sufficiently educated about banking.

There is an urgent need to change the regulations as well as the regulatory system if customer service is to be improved. It is essential to shift the focus of regulation from monitoring actions to monitoring outcomes and the process of monitoring should be made transparent through public disclosure. The regulators should also focus on assessing the competence of banks to develop systems to ensure proper customer service as well as the ability of the banks to use their systems.

Successfully defining service standards and meeting these standards every day in every transaction is essential. If there are no measurable norms, there are bound to be delays and/or errors and these will lead to customer dissatisfaction. It is equally important for banks to monitor outcomes by obtaining customer feedback. Such feedback is routinely obtained today by banks in the form of customer surveys, marketing and sales feedback, market segment strategies, and obviously these have not helped. What banks need is a clearly defined and transparent customer satisfaction process that is linked to the banks' operating strategies and plans. Banks have their limitations, and it will not harm them if they make their customers aware of and educated about them.

Banks need to understand that strategic plans are part of an overall creative process offers an opportunity for self-assessment in a formal and systematic way.

The success of a strategy is directly related to the quality this self-assessment. In this context, it may be desirable for banks to introduce a cash service audit as part of their integrated risk management framework. Obviously such an audit has to overcome the resistance of traditional thinking by redefining the audit function in integrated risk management.



A journey without clocks / Y. Barrera

The restructuring of the Banca d'Italia branch network

■ Clorinda Forte *Banca d'Italia*

In September 2007 the Banca d'Italia embarked on a restructuring of its branch network to transform it from a province-based organisational model to a regional one. The new network has 20 branches located in regional capitals, which perform the whole range of activities traditionally assigned to the network, together with a number of other branches located elsewhere in the country carrying out a smaller set of tasks.

The main features of the new model

Like other central banks in the Eurosystem, the Banca d'Italia has streamlined its branch network to adapt it to today's domestic market and regulatory framework. This reform was driven by the need to adjust the Bank's functions to developments in the economic, financial and institutional scenario. Therefore, some of the key drivers were:

- The introduction of the euro as a single currency, with a single monetary policy at Eurosystem level.
- Increasing competition in the financial markets.
- The development and combined use of information technologies and telecommunications.

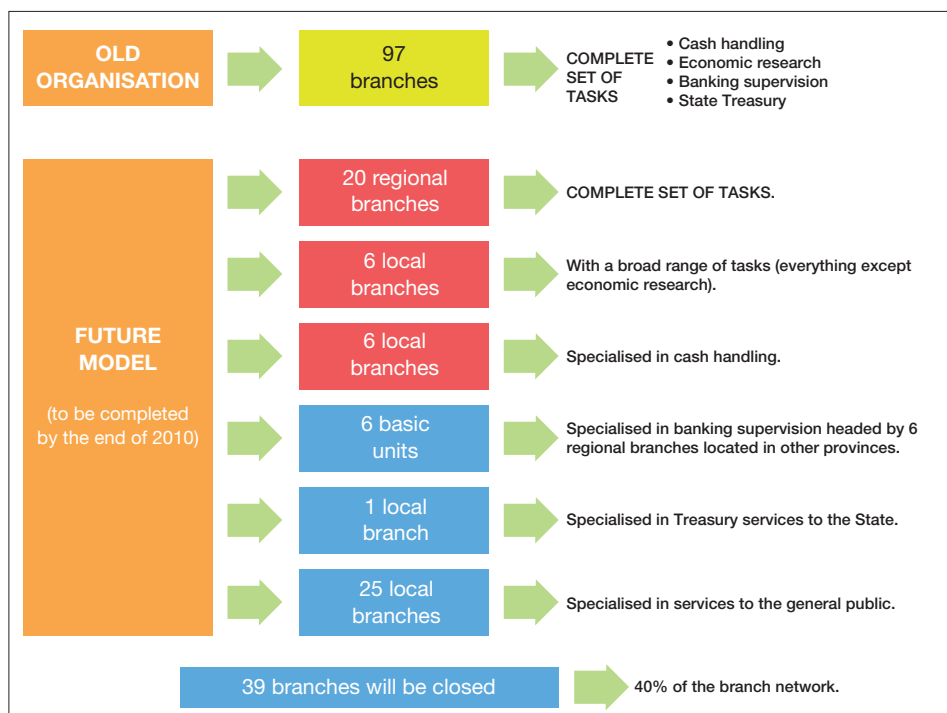
Compared with the previous model, which comprised 97 branches located in 95 of the country's 103 provincial capitals, all of them performing the same set of functions, the current plans envisage the total number of

branches being cut to 58. In order to provide an effective service these branches will specialise or perform different functions in each case. The plan's aims are therefore strengthening the bank's institutional activities, ensuring its presence throughout the country with a reorganised network, and enabling services to be provided in innovative ways.

When fully implemented, the new branch network will consist of 20 branches located in the regional capitals, each of which will perform a full range of tasks, namely: economic analysis, statistical surveys, banking and financial supervision, collection and treasury services for national government, along with other services for users (including both professional and private customers). Those branches will also act as a contact point with local market operators and authorities and will play a coordination role with other branches established in the region. Additionally, 6 out of these 20 regional branches will head specialised banking and financial supervision units, structures that by definition will not have the status of branches but nonetheless are necessary in view of the strong presence of financial intermediaries in local markets. These units will facilitate direct contact between the Banca d'Italia and the intermediaries under its financial supervision. Along with the regional branches, the plan provides for the establishment of a further 38 branches, divided into the following groups:

- Six branches performing a broad range of activities, covering all the activities carried out by regional branches except those of economic analysis and statistical surveys. These branches will be located in regions where there is a significant demand for the Bank's services outside the region's capital.
- Six branches specialising in cash handling to supply of cash services to professional customers (banks, the Post Office and cash-in-transit companies). These branches will carry out lodgement and withdrawal operations, and sorting and on-line shredding; the delivery and receipt of banknotes from/to other departments of the Bank and all related activities (internal cash handling, data reporting on shredded banknotes, treatment of suspect and counterfeit banknotes, etc.).
- Twenty-five branches specialised in providing services to users, mainly aimed at serving the general public. These services include State treasury services, services relating to the Interbank Register of Bad Cheques and Payment Cards, and the Central Credit Register.
- One branch, in Rome, specialised in providing Treasury services to the State.

Banca d'Italia: towards a new organisational model.



Bank's services even if the Bank does not have a branch nearby. Between September 2007 and mid-July 2009, 26 branches were closed, and a further 13 branches will be closed by November 2009.

To support the decision-making process regarding the streamlining of the branch network and differentiating the functions to be performed by the Bank at local level, background analysis has been undertaken examining the features of domestic local markets – such as the distribution and number of banknotes, the volume of currency flows involving professional customers, etc. – and, more generally, looking at the demand for the Bank's services in local areas.

The reshaping of the branch network also brought about a comprehensive review of the investment policy for banknote sorting equipment. This has also entailed a renewal of the stock of sorting machines. Thus, although the total production capacity was considered adequate, the need to significantly improve average levels of automation was identified as being necessary in order to allow significant cost savings to be achieved.

The objective of enhancing efficiency is also reflected in the review of the tasks carried out by the branch network to streamline and support operational procedures and bolster infrastructures. This has also called for significant analytical efforts and has led to the adoption of various measures in the fields of internal regulation, procedures and management policy. These measures are aimed at enhancing the timeliness of the operational processes by reducing administrative burdens, increasing the use of electronic communications and centralising a significant share of self-administration tasks at regional branches and head office in order to benefit from economies of scale and scope.

The evolution of cash business

Traditionally the Banca d'Italia is a wholesale supplier of cash services for professional clients, which it does free of charge. In recent years ongoing developments at Eurosystem level and an increased emphasis on the supply of effective and efficient services to professional clients have made a comprehensive review of the current organisation of cash activities necessary. In this context, the restructuring of the branch network has entailed significant changes in the organisation of the cash business with a view to containing costs while achieving a higher quality standard from the services delivered. As a final result of the reform, cash handling for professional users will continue at 31 of the Bank's branches. These are: 19 regional branches, six branches offering a broad range of services, and a further six branches specialising in cash handling.

The six branches specialised in cash handling (referred to as cash centres here), are aimed at serving professional customers based on a "customer care" approach. These have been assigned to local areas taking into account both local transport facilities and connections, and the logistics of the Bank's premises, as well as the volume of currency flows. Given that it is anticipated that business volumes will increase and there will be a higher degree of specialisation and automation, the cash centres will have longer opening hours for customers and will be equipped with high productivity sorting machines and new integrated sorting and box-packaging systems. All in all, a higher level of automation, due not only to the widespread use of on-line shredders on sorting machines but also to the use

Geographical distribution of the new branch network.



of bundle shrink-wrapping machines, will allow the elimination of intermediate visual checks to confirm the quantity of sorted banknotes or to ensure that the packaging is correct.

Cooperation

The planning and implementation of this reform is taking place at a time of profound changes in the economic and financial scenario both nationally and across the Eurosystem. This fact makes the challenge all the greater and requires cooperative efforts involving all the different actors concerned (central banks, other authorities, market operators, etc.) to prevent any inconsistencies or inefficiencies arising as a result of the changes, whether driven by national or external factors.

The implementation of the reform of the Banca d'Italia's branch network is running smoothly and all the competent structures within the Bank are participating. As concerns cash services, the future volume of business will depend on various factors: the strategies pursued by market operators, the net outcome of the reduction in the number of branches, and the role that will be taken on by those branches specialising in cash handling, and last but not least, it will depend on the public's behaviour towards cash as a payment instrument. In this regard, therefore, Banca d'Italia needs to create favourable conditions for the channelling of cash towards the branches specialised in cash handling.

The Bolivian banknote family

■ **Walter Orellana** *Banco Central de Bolivia*

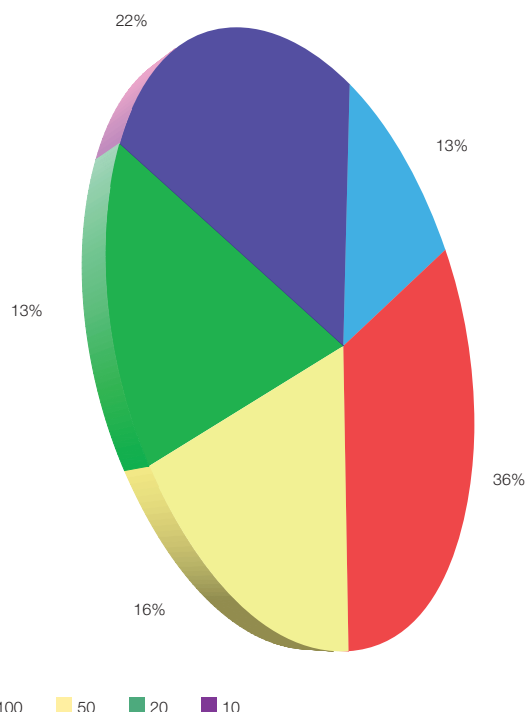
As a result of the process of hyperinflation Bolivia experienced in the first half of the nineteen eighties, on 28 November 1986, Law 901 was passed, creating the boliviano as the new currency unit, thus replacing the Bolivian peso, and striking six zeros from the national currency. The one million Bolivian pesos note was thus converted into one boliviano. Moreover, the Banco Central de Bolivia (BCB) was established as the sole banknote and coin issuer for the boliviano, which came into circulation on 1 January 1987.

Since the boliviano's creation the design of the family of banknotes has remained unchanged. The front of the notes bear portraits of notable national figures from various different walks of life (Franz Tamayo, Melchor Pérez de Holguín, Pantaleón Dalence and Cecilio Guzmán de Rojas), while the reverse shows a series of sculptural or architectural works (the image of a monolith from the Tiahuanacota culture, view of the Tower of the Society of Jesus in the city of Potosí, Casa Dorada de Tarija and view of the monument to the heroines of Coronilla de Cochabamba). Including outstanding figures from the cultural field marked a change from the tradition of representing national worthies and heroes involved in winning the country's independence and building the Republic.

The family of banknotes initially included seven denominations: 2, 5, 10, 20, 50, 100 and 200 bolivianos. The banknotes for the 2 and 5 boliviano denominations were replaced by coins of the same denomination in 1989 and 2001, respectively.

As at 30 June 2009 the issue of banknotes stood at 198.35 million units, with a value of 14,791.35 million bolivianos. Of the total banknotes issued, 36% are in the 100 boliviano denomination, which is the most widely used. This is followed by the 10 bolivianos banknote, which accounts for 22% of the total.

Breakdown of issued banknotes



Data from end June 2009

The incidence of counterfeiting in Bolivia is slight, with around 60 counterfeit banknotes being detected per million notes in circulation. Analysis of counterfeit samples reveals that there are as yet no good quality reproductions of the security measures. Most counterfeit notes are printed on poor quality bond paper using the offset process. There are also small quantities of banknotes washed with chemical products onto which higher denomination banknotes are printed. Lastly, banknotes where the obverse has been separated from the reverse, such that only one of the faces is legitimate, have been seen, although in much smaller quantities.

Features of the 100 boliviano banknote

Design and printing substrate

The 100 boliviano note has a portrait of the historian Gabriel René Moreno on the front and the main courtyard of the Universidad Mayor, Real y Pontificia de San Francisco Xavier, in the City of Sucre, on the reverse. The main colour of the banknote is red, with a lighter hue on the obverse.

Like the banknotes in other denominations, it is 140 millimetres long and 70 millimetres wide. It is printed on top quality one hundred percent cotton paper specially manufactured for banknote production, with a weight of 95 grams per square metre.

All denominations of banknote have the text "LEY 901 DEL 28 DE NOVIEMBRE DE 1986" intaglio printed on them.

Printing techniques

Four different printing techniques are used in the manufacture of the boliviano banknotes:

- **Intaglio.** On both the obverse and reverse of the banknote. The relief is perceptible to the touch in the portrait of the historical figure, the tactile mark for the visually impaired on the obverse, the work of sculpture or architecture on the reverse, the text "BANCO CENTRAL DE BOLIVIA", and in the letters and numbers of the face value printed on both sides.

- **Offset.** The security backgrounds on the front and back, rainbow printing, and the see-through register.

- **Screen printing.** Used to apply the iridescent strip which runs vertically up the back of the 200, 100 and 50 boliviano notes.

- **Letterpress.** Used to print the horizontally aligned nine-digit sequence number shown on the obverse, which is repeated twice in black.

Security features

As new series of banknotes were issued, further security measures were added. The security features of the H series are as follows.

- **Watermark.** This reproduces the image of the historical figure printed on the banknote and the denomination, in vertically aligned 4 millimetre high characters. This is visible when the note is held against the light and is included on all the banknotes.

- Security thread.** This is embedded vertically in the paper in the centre of the far left of the banknote. It can be seen when the note is held up against the light or under ultraviolet light. It includes the initials "BCB" and the value of each banknote. It stands out clearly on the 50, 100 and 200 boliviano banknote as a continuous fluorescent, metallic, windowed thread. It is 2 millimetres wide and the characters of the inscription are 1.6 millimetres tall. The security thread in the 20 boliviano note is narrower (1.2 mm wide, with a character height of 1 mm). The 10 boliviano note does not include a security thread.
- Fibres.** Small threads distributed randomly across the front and back of all denomination banknotes. They can be seen with the naked eye (red, blue, yellow and green fibres) and under ultraviolet light (invisible fluorescent fibres).
- Intaglio printing.** Deep, multicolour intaglio printing is used, with a marked relief and three colours in the case of the 200, 100, 50 and 20 boliviano notes. A single-colour is used for the 10 boliviano denomination.
- See-through register.** Each denomination of boliviano notes has a geometrical figure printed on the obverse which aligns perfectly with a similar figure printed on the reverse. This can easily be observed by holding the banknote up to the light.
- Latent Image.** The obverse of each denomination contains an image concealed in relief with the initials "BCB", which can be seen by tilting the note. The characters are approximately 5 mm tall.
- Tactile marks for the visually impaired.** Different marks are applied in high relief, depending on the denomination of each banknote, so that the blind and visually impaired can distinguish the value. The 200 boliviano banknote has three vertically arranged parallel bars, the 100 boliviano note has two vertical bars, and the 50 boliviano note has a single

vertical bar. The 20 boliviano note has three horizontal bars and the 10 boliviano note has two horizontal bars.

- Metallic ink.** A geometrical figure is printed on the obverse of the 200 and 100 boliviano notes in metallic ink.
- Iridescent ink.** The 200, 100 and 50 boliviano banknotes have an iridescent strip on the obverse, which has the value of the note and the initials "BCB" superimposed on it. The strip is a gold colour and 15 mm wide, making it easily identifiable to the public.
- Fluorescence.** The coat of arms of the Republic of Bolivia, the denomination, the serial number and the signatures of the BCB authorities are printed on the obverse of each note in fluorescent ink.
- Microprinting.** The text "REPÚBLICA DE BOLIVIA" is printed on the obverse of each banknote in characters so small that to the naked eye it looks like a line.

Statistical data as at June 2009	Bolivianos	Euros
Value of banknotes in circulation (millions)	14,791.35	1,490.75
Average value of banknotes in circulation	74.57	7.52
Number of banknotes in circulation (millions)	198.35	
Banknotes in circulation per inhabitant	19.39	
Value of banknotes in circulation compared to GDP	12.3%	

Technical features	
Substrate	Cotton paper 100%
Weight of substrate	95 g/m ²
Dimensions	140 x 70 mm
Dominant colour	Red



The Treasury Department of the Banco Central del Paraguay

■ Pedro Acosta, José Antonio Meza and Fernando Miguel Villalba *Banco Central del Paraguay*

The Treasury Department of the Banco Central del Paraguay (BCP) reports to the National Operations Directorate. Its main functions are the custody, issue, exchange and destruction of cash, and in particular its responsibilities include:

- Ensuring an adequate supply of high quality notes and coins. To do so, it uses estimates of the requirements for banknote and coin stocks and of the banknotes that need to be replaced following the destruction of poor quality notes.
- Preparing statistical data for decision-making relating to the country's economic and monetary policy.

The BCP does not have any branches. All its activities are conducted at its headquarters in the City of Asunción. The distribution and supply of the country's banknotes and coins is ensured by the support of commercial banks with networks of branches throughout the country.

Organisational structure

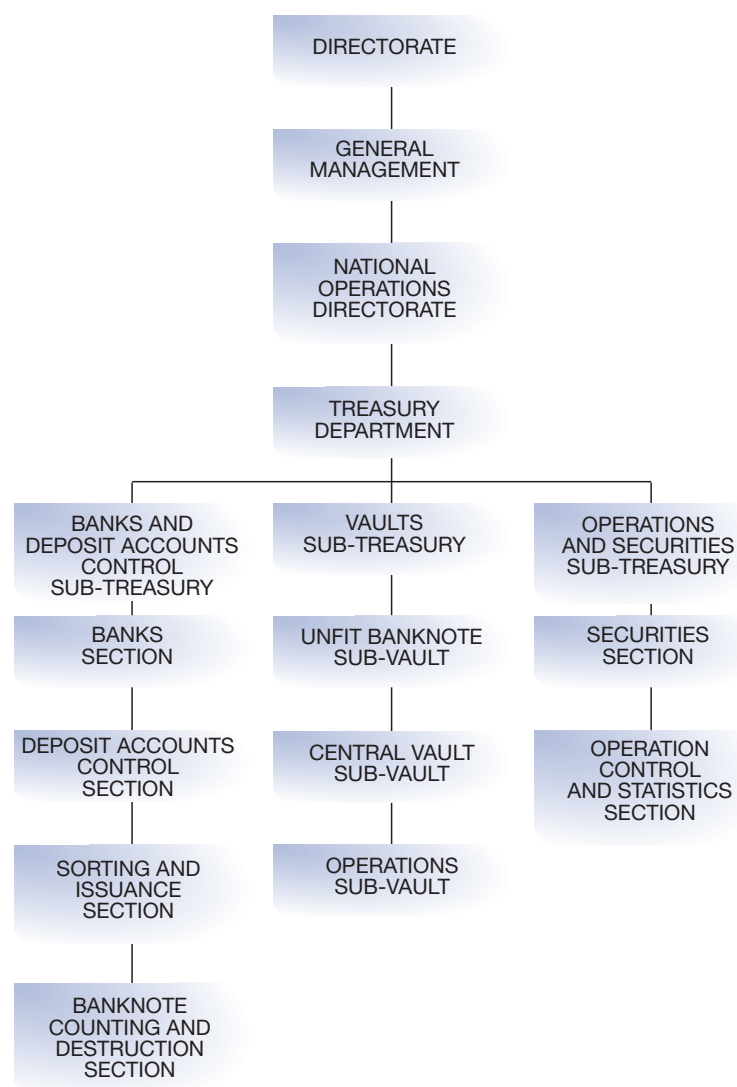
The Treasury Department is subdivided into three Sub-Treasuries each responsible for different functional areas: Banks and Deposit Accounts Control, Vaults, and Operations and Securities.

The **Banks and Deposit Accounts Control Sub-Treasury**, together with the Vaults Sub-Treasury, schedules and implements banknote and coin issues, sorts banknotes returned by banking institutions, and destroys poor quality notes. It also responds to banks' requirements to deposit and withdraw cash. Additionally, it is also responsible for the management of the current accounts of the cash desks receiving public, legal and other deposits. Finally, it is responsible for carrying out the area's administrative tasks.

The Vaults Sub-Treasury takes part in scheduling the printing of banknotes, minting of coins, and banknote and coin issuance. It also schedules the activities of counting, sorting and destroying damaged or worn banknotes, in coordination with the various sectors involved, and operates the supply of banknotes and coins to the various different agents in conjunction with the sub-vaults.

The BCP does not have its own banknote printing works or mint for coin production. The printing of banknotes and minting of coins is contracted out to prestigious international manufacturers through international calls for tender. The Sub-Treasury is responsible for receiving notes and coins from suppliers and storing them in the relevant sub-vault. It also supervises movements of cash between the various vaults.

The main role of the **Operations and Securities Sub-Treasury** is the custody of the various types of documents and securities sent to the vault for safekeeping. These securities include monetary regulation instruments, treasury notes, and other public securities. The unit is responsible for controlling and issuing certificates withdrawn by financial sector institutions, in accordance with the standards and procedures in force, and for handing over these securities when so required by their depositors. This Sub-Treasury is also responsible for controlling operations taking place in the Treasury Department and for performing the role of administrator of the system



recording banknote and coin operations. It also prepares the Department's statistics on the reception of new banknotes, the issue and destruction of notes, and exchanges of worn or damaged banknotes. It keeps the register of circulating banknotes and coins up-to-date and maintains the registers of the stocks held in the various vaults, with breakdowns by banknote denomination and condition.

Regulations concerning banknote quality

In December 2008 the Directorate of the BCP passed a Regulation on Deposits and Withdrawals of Banknotes from the Treasury (*Reglamento para Depósitos y Extracciones de Billetes de la Tesorería*). This Regulation envisages the implementation of a visual guide establishing the banknote sorting and presentation criteria to be followed by financial institutions making deposits at the BCP. Thus, banks deposit banknotes sorted into separate denominations, distinguishing notes that are fit to return to circulation from those that are in poor condition.

The BCP counts a randomly selected fraction of the banknotes it receives. Before the guide was passed, institutions deposited banknotes unsorted and the BCP counted and sorted them all.

The aim of the new criteria is to improve the quality of the banknotes in circulation. During sorting banknotes are assigned a score on a scale of 1 to 9 in terms of quality and texture parameters. Compliance of deposits by financial institutions with these standards is verified by the BCP.

Communication

This year the BCP has launched an advertising campaign focusing on:

- **Demonetisation of old 50,000 guaraní banknotes.** The BCP has redesigned this denomination of banknote so as to replace the old

series. The advertising campaign sets out their features and the periods established during which the withdrawn banknotes may be exchanged. As of 4 October 2009 old banknotes of this denomination will cease to be legal tender and may only be exchanged for a period of three years at the BCP or through its duly authorised agents. At the end of this period these notes will cease to be legal tender.

- **Incorporation of a new denomination of banknote.** An education campaign is scheduled to start in November 2009 to inform the public about the issue of a new denomination of banknote, the 2,000 guaraní note. This is a unique event as the new banknotes, as well as having a denomination that did not previously exist in the banknote family, are produced using a polymer substrate.

Statistical data¹

Banknotes issued	2006	2007	2008	2009
– Amount	906,150.0	1,283,500.0	1,812,499.5	49,000.0
– Volume	47.4	34.2	33.9	4.3
Banknotes deposited by institutions				
– Amount	358,262.9	603,975.6	766,905.8	451,192.2
– Volume	23.1	32.4	40.7	19.0
Banknotes destroyed				
– Amount	358,259.6	601,491.6	406,212.8	345,067.5
– Volume	23.1	31.0	14.3	12.7

1. All figures refer to the end of each financial year, except in the case of 2009 where they cover only the first five months of the year. Amounts stated in millions of guaraníes and volumes in millions of notes.



Premises of the Banco Central del Paraguay in the City of Asunción / BCP

Mechanical banknote sorting: an empirical study

■ Mariano Martínez, Eduardo Kropnick and J. Darío Negueruela. *Banco de España*¹

Issuing banknotes is one of a central bank's basic functions. This task involves meeting the country's demand and guaranteeing the integrity of the currency in circulation. Among a number of other related tasks the generic term "issue" includes the activities of counting, processing and sorting banknotes, primarily involving the counting, balancing, analysing, sorting, packaging and destruction of banknotes. This activity has therefore become the filter through which banknotes returned to the central bank must pass. It is a process in which they are checked, possible counterfeits are detected, and those banknotes which are in an unfit state to be reused, having deteriorated to a point where they do not meet the minimum quality standards for them to be returned to circulation, are withdrawn. Until just a few years ago, banknotes were sorted by hand, which was a labour-intensive process. However, to address the process of the expansion of banknote activities in central banks, and the ever more active role these institutions play in the cash cycle, and consequently, the sharp rise in the number of banknotes withdrawn from circulation, profound changes have been necessary in the way they work, leading to intensive mechanisation and automation of these activities. This has reached the stage where, today, the majority of the world's central banks use automatic banknote sorting and processing machines.



Banknote processing room at the Banco de España in Madrid / BILLETARIA

remain concerning the behaviour of the machines and their sensors under a range of different circumstances and with various types of banknote.

In order to seek to answer these questions, the Cash and Issue Department decided to carry out a field study on the consistency and rigour of automated banknote processing. A variety of exercises were undertaken in order to analyse and evaluate the differences in banknote sorting that arise when the sorting machines are used. The aim was to obtain an individualised estimate of the factors with an impact on banknote processing, and thereby, make progress towards achieving greater efficiency in cash management. This article presents a summary of the work carried out and the main conclusions which may be of interest to central banks when adopting decisions concerning banknote sorting.

Objectives and methodology

The study sought to find answers to questions such as:

- Does banknote condition affect the performance of the sorting machines?
- Can two identical machines sorting the same banknote behave differently?
- Do the environmental conditions affect the outcome of mechanical sorting?

The Banco de España performs all of its banknote sorting activities using automatic processing machines, and is entirely convinced of the advantages of the automation it has implemented, and the huge gains in productivity and efficiency achieved. However, a number of questions

1. This article would not have been possible were it not for the work carried out over the course of several months by a team of staff at the Banco de España's Cash and Issue Department. The tasks of sorting and selecting batches of banknotes and operating the sorting machines were performed by the members of the department's processing area. The statistical processing of the information was carried out by José M. Cao and the results were reviewed by Fernando León. The study was coordinated and directed by María Luisa Leyva.

- Does the orientation in which banknotes are fed into the machine affect the results of the sorting process?
- Do all machines recognise new banknotes in the same way?
- Does the frequency with which the sensors are calibrated affect the sorting process?

The following basic requirements were taken as the starting point for the study:

- The tests would be performed using the usual human resources, machines and operating procedures.
- Obtaining uniform and comparable results was an absolute priority. Therefore, the technical team had to ensure the harmonisation of criteria and systems.
- The sample of banknotes under analysis must comprise both new and used notes. In all the tests, banknotes taken from the selected sample would be used.
- The used banknotes fed into the sorting machines were of average quality. Banknotes with an excessive degree of deterioration were not included in the sample.

The tests took place at the Cash and Issue Department's premises in Madrid between November 2008 and March 2009. Used and new euro notes from a variety of different printing works and produced in different years were used. The sample consisted of 460,000 banknotes in seven denominations and they were processed repeatedly during the various tests (on different machines or on the same machines in different orientations or under different conditions), such that the final total number of banknotes sorted came to 3,200,000. The shredding module on the sorting machines was disabled, as the same banknotes had to be used for subsequent tests. The tests were run and processed independently, so as to obtain a file of data and a sorting report for each case. The details of the banknotes to be sorted were entered via the management information centre of the sorting machines.

In order to determine the influence of sensor calibration on banknote sorting, one of the machines used had its sensor calibrated immediately before the tests were run, whereas the other had had its otherwise identical sensor calibrated two months earlier. Also, the manufacturer assisted with supervision of the sorting machines' operations at all times.

Running the tests

Five types of test were performed. These are summarised below:

The **first series of tests** was aimed at obtaining information about whether banknote condition could affect the performance of the sorting machines. All the banknotes in the sample were processed and the time taken to sort each denomination was recorded. It was observed that all

denominations, regardless of banknote condition, required practically the same time to process. Therefore, we can say that in the case of banknotes which are not excessively worn, such as those in the sample, the condition of the notes does not have a significant impact on the performance of the machines. Poor condition banknotes did not slow down the rate of sorting significantly, nor were differences in performance detected when sorting used banknotes or new banknotes².

The **second series of tests** aimed to determine the causes of banknote deterioration. Consistent with the results obtained in other types of tests³, it was confirmed that soiling was a fundamental factor in banknotes' being deemed unfit for circulation. Other factors such as holes, tears, folds, scribbles, etc. were less important, accounting for less than 10% of the total number of banknotes sorted to unfit. In other words, soiling is the main reason for which central banks destroy banknotes considered unfit for circulation.

The **third series of tests** sought to evaluate the differences arising when the same batch of banknotes is processed by two different machines of the same type, but whose sensors have been calibrated on different dates. Machine 1 had a recently calibrated sensor and machine 2's sensor had been calibrated approximately sixty days before the test was performed. Table 1 shows the different percentages of banknotes rejected by each of the machines as being unfit to put back into circulation. As the table shows, the differences are not insignificant and the machine with the recently adjusted sensor rejected more banknotes than the other. In other words: the sensor adjustment deteriorates over time, making it extremely important to check it regularly.

Table 1

Denomination	Use of two machines to sort banknotes	
	Notes sorted to unfit as a percentage of the total	
	Machine 1	Machine 2
€ 5	62.87	51.45
€ 10	37.48	27.92
€ 20	50.64	42.94
€ 50	47.77	30.96
€ 100	68.13	49.99
€ 200	59.30	32.34
€ 500	6.96	4.52

Note: Machine 1: Sensor calibrated for the test. Machine 2: Sensor calibrated previously.

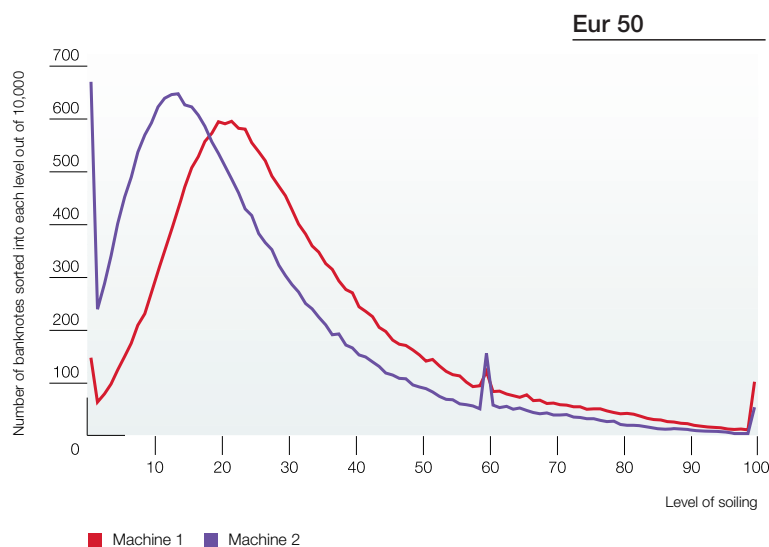
In all the denominations the distribution of the frequency with which banknotes were sorted to unfit as a result of soiling followed a log-normal distribution. Graph 1 shows the distribution of 50 euro notes by levels of soiling. It is worth noting that the frequency curve is similar in the case of both machines, but in the case of machine 1 it appears displaced to the right compared to the curve for machine 2. This suggests that the recently calibrated sensor sorted the banknotes as if they were "more soiled".

2. The sample used in the tests comprised notes in acceptable condition. Daily experience in the processing areas suggests that poor condition low denomination notes have a powerful effect on the functioning and efficiency of the sorting machines.

3. For some years now, the Eurosystem has periodically analysed the quality of a significant sample of banknotes in circulation (four denominations) in the various countries of the euro area.

Graph 1

Distribution of frequencies of levels of soiling detected in 50 euro notes according to sensor calibration



Note:
Machine 1: Sensor calibrated for the test. Machine 2: Sensor calibrated previously.

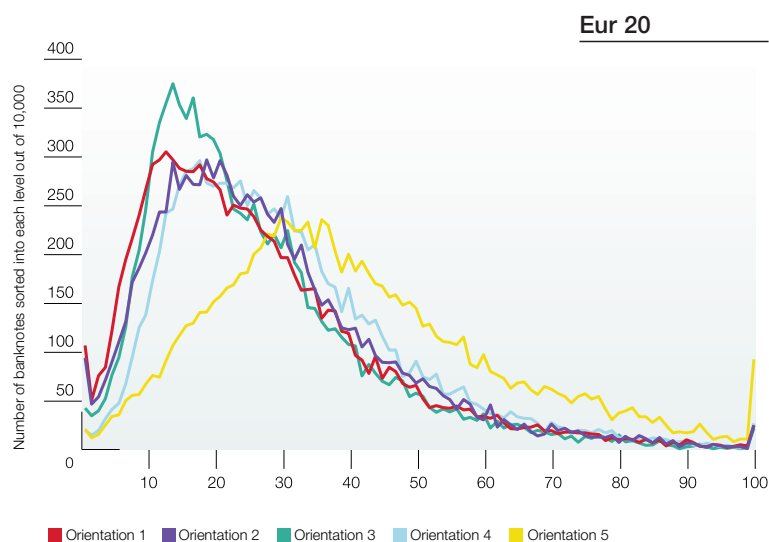
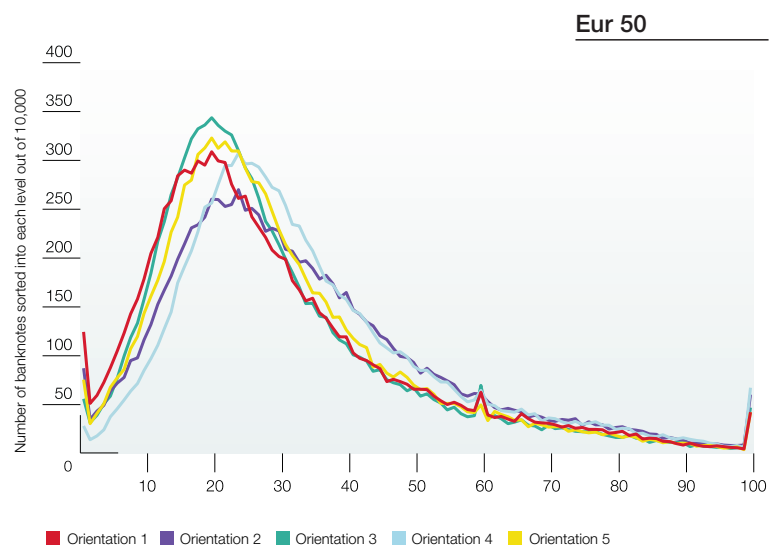
The **fourth series of tests** sought to evaluate the possible differences in the sorting of banknotes according to how they were oriented. The results of sorting banknotes fed into the machine in each of the four possible note orientations and in a mixture of orientations⁴ showed there to be noteworthy differences. The orientation of the banknotes when fed into the sorting machines had an influence on the measurement of soiling, and therefore on the outcome of the sorting by condition. Moreover, it was observed that the worse the quality of the banknotes the bigger the difference in absolute terms between the results in the different orientations.

The machines detected notes in orientations 1 and 3 as being least soiled, giving rise to distributions that were shifted to the left. By contrast, notes in orientations 2 and 4 were found to be slightly more soiled, resulting in the frequency curves that were shifted to the right. Considerable differences were found in the behaviour of the various denominations, and the orientation in which banknotes were fed into the sorter played a decisive role in some denominations but was less important in others. Graph 2 shows the big differences in the results obtained from the test in the case of the 50 and 20 euro notes. These findings suggest more detailed study of this topic is necessary.

The **fifth series of tests** sought to check if the differences between identical banknotes produced by different printing works were detected by the sorting machines⁵. This test was performed using new banknotes. The

Graph 2

Distribution of frequencies of levels of soiling detected in 50 and 20 euro notes according to orientation in which they are fed in to the sorter⁴



work was divided into two parts. Firstly, the parameters of the optical properties of banknotes from different printing works were measured. Secondly, tests were conducted to observe the behaviour of the sorting machines when sorting banknotes from different manufacturers.

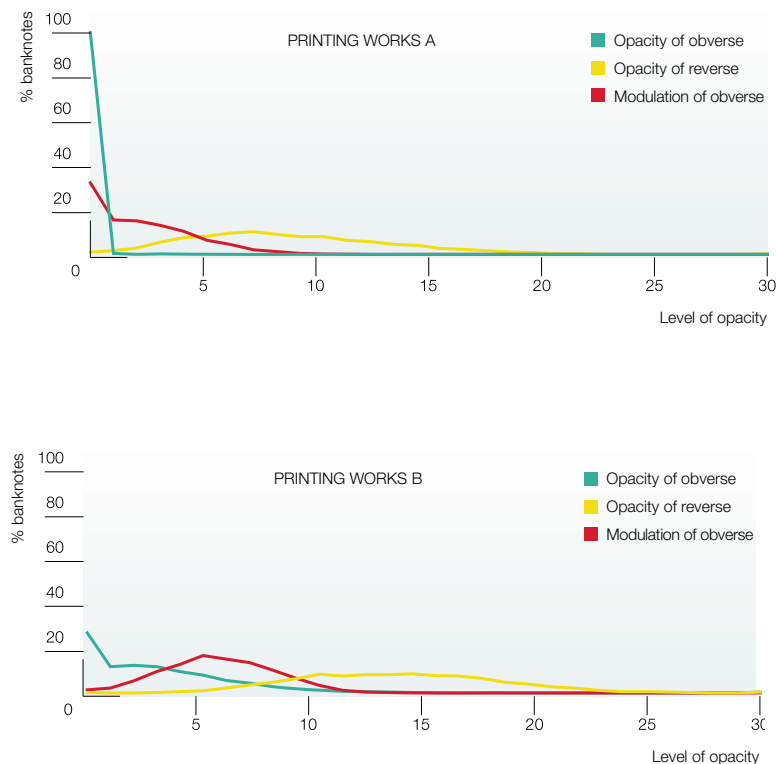
In the first case the test was performed with new banknotes in four denominations (5, 10, 20 and 50 euros) from eight different printing works. For the analysis of banknote condition the opacity of the obverse and reverse, and the modulation or variability of the opacity of the obverse, were measured. As the condition of a new bank note is uniform and it is not soiled, it was expected that the three measurements would be at a level lower than the interval between 1 (very clean notes) and 100 (very soiled notes). However, the results of the tests showed different distribution curves according to the origin of the banknotes. Graph 3 shows the distribution curves of the measurements of the degree of opacity in the tests performed using 100 euro notes from two different printing works.

4. **Orientation 1:** obverse facing up and the watermark to the left. **Orientation 2:** obverse facing up and the watermark to the right. **Orientation 3:** obverse facing down and the watermark to the right. **Orientation 4:** obverse facing down and the watermark to the left. **Orientation 5:** random mixture of the four preceding orientations.

5. Production of banknotes is decentralised in the Eurosystem. Each national central bank is responsible for a share of total Eurosystem production and each bank commissions banknotes from public or private printing works. Moreover, there are various suppliers of raw materials, particularly paper, used in banknote production. Although the technical specifications of the euro notes are the same in all instances, in practice there may be certain differences between the notes produced by different printing works. In the majority of cases these are due to the paper. Nevertheless, the banknotes look identical to the public, given that the differences are minimal and invisible to the naked eye.

Graph 3

Measurement of the level of opacity of the 10 euro note



The obverse measurement reflected the quality of the new banknote more closely, with a large number of notes in the low opacity levels, and therefore very close to what ideally would be expected from new banknotes. The measurement of the reverse presented behaviour somewhat further from the ideal. As regards the modulation of the obverse, it could be said that, in general, the behaviour was a long way from that expected, with distribution curves that differed significantly from one another and were not consistent with the low levels of soiling.

In order to study the machines' reactions to identical notes from different printing works, tests were performed using two machines with sensors calibrated on dates sixty days apart, using notes of all denominations produced by four different printing works.

Highly significant differences were observed in the way the new notes from different printing works were sorted, and in particular, in the case of the machine with the sensor that had been calibrated immediately before the trial. It is worth mentioning that the sorting machines' optical sensors recorded some strange results. It was observed that the sensors, having been designed to process used banknotes, were incorrectly calibrated for use examining new notes. In extreme cases, the optical differences detected by the sensors caused new banknotes from certain print works to be deemed unfit for circulation.

Conclusions

Modern banknote sorting machines represent an important step forward in the automated processing and sorting of banknotes, yielding significant gains in productivity and efficiency. Their use also makes it possible to achieve more uniform results from sorting operations by removing the

subjective perceptions of the operator. However, their automatic operation must be supervised closely by the technicians responsible for monitoring them to avoid the advantages of predictable and uniform functioning being lost. The tests performed, a summary of the results of which are presented here, seem to suggest that sorting machines do not always behave in the same way and may be affected by various operational factors that typically arise in everyday use. Some of the main conclusions that may be drawn from the work discussed here are:

- Studies on banknote sorting offer extremely valuable information to central banks' cash managers. In particular, an optimal policy will tend to reduce the unnecessary destruction of banknotes and contribute to cost savings, thereby enhancing levels of operational efficiency.
- The calibration and adjustment of the machines is a fundamental factor in the evaluation of the quality of banknotes in circulation. The central bank needs to continually monitor the behaviour of the sensors and analyse the sorting they perform, bearing in mind the results obtained in the recent past.
- Central banks should have a common sensor calibration policy for all the operations centres at which they sort banknotes so as to ensure uniform treatment of banknotes that are put back into circulation.
- Soil sensors need to be adjusted before sorting machines are used with banknotes other than those they typically handle, such as notes from other printing works, notes produced using different paper, or notes in different series. Otherwise, the number of banknotes sorted as being unfit for circulation will tend to be higher than would be necessitated by actual level of soiling of the banknotes.
- The orientation in which banknotes are fed into the sorting machine has an effect on the outcome of the sorting operation. Central banks should take this factor into account when defining their policy for accepting notes.

Main findings

- The fact that banknotes' condition differs, while remaining within tolerable quality limits, does not have a significant impact on the performance of the sorting machines.
- Soiling was the main cause of banknotes being sorted to unfit for circulation.
- Sorting machines with recently calibrated sensors detected more banknotes to be unfit for circulation than machines with sensors that had been calibrated less recently.
- The results of banknote sorting are sensitive to the orientation in which the notes are fed in to the machines.
- New banknotes from a number of printing works caused distortion in the functioning of the sensors. The machines sorted new banknotes as having a high level of opacity.

Open Main Cashier System

■ Yoshihiro Akita *Glory Ltd*

Glory was founded in 1918 and produced Japan's first coin counting machine in 1950. Today, its technologies extend to a wide range of related fields including various forms of settlement and biometric authentication.

Glory has now been developing cash processing equipment for over half a century. The firm currently offers advanced solutions and is committed to ongoing innovation in cash and document processing and biometric authentication technologies to provide secure and reliable products for its customers world-wide. The aim of this article is to briefly present the main features of the Open Main Cashier System (OMC), a modern model for cash sorting on a small scale.

Innovation in cash handling for financial institutions

Glory was originally a manufacturer of industrial machines. It developed Japan's first coin counting machine at the request of the Japanese Mint in 1950. From the outset, it has developed cash handling machines representing continuous innovation in the industry. It was also the first company in Japan to develop coin wrapping machines, coin lockers, and coin-based vending machines.

The 1970s saw the beginning of what has proven to be a continuous stream of product innovations for cash handling at bank branches. Since that time, the implementation of technology has achieved important labour savings. Currently, further automation has been achieved for small recyclers in the case of both banknotes and coins.

In 1986 Glory produced the OMC System. It is an integrated system with multiple units for banknote deposit and dispensing; for banknote sorting; coin deposit and dispensing; and for coin sorting. The system enables the cash sorting activities on a small scale to be automated providing further security and control.

Features of the system

Combined technologies

- **Identification:** Banknotes and coins are processed quickly and accurately by high precision sensors which identify the currency denomination, authenticate cash, and then assess the quality of the currency.
- **Sorting:** Identified banknotes and coins are securely transported and stored in individual safes. If the quality of the currency is not sufficient for re-issue, it is segregated and stored separately from re-issuable currency.
- **Wrapping:** As soon as deposited banknotes reach the correct quantity (100 pieces) they are automatically bundled; similarly coins are automatically wrapped when the coin roll size is reached. They are then transported to the storage unit ready for disbursement.
- **Storage:** Within the OMC system cash is accurately transported at high speed either piece by piece or pack by pack to designated storage units. All cash in any form can be recycled. Even when loose banknotes are stored the system aligns them facing upward.
- **Calculation:** The operation of the OMC is managed by the control terminal which ensures that all value calculations are correct and transactional data is recorded.

Sophisticated functions in a compact system

- Its ergonomically designed layout allows for comfortable operation and ease of monitoring.
- The composition is flexible and modular to meet a variety of operational requirements.
- User friendly.
- Simplified transport system minimises downtime.

The latest version of the system requires only minimal human intervention. By automating banknote bundling and coin wrapping, deposit checking, and enabling full currency recycling, human error can be reduced to almost zero.

Summary

Glory has now been developing cash processing equipment and providing high quality products for over half a century. The high security provided by automating currency handling is a very important countermeasure against operational risk. Glory offers advanced solutions today, and is committed to ongoing innovation in cash and document processing and biometric authentication technologies to provide secure and reliable products for its customers world-wide.

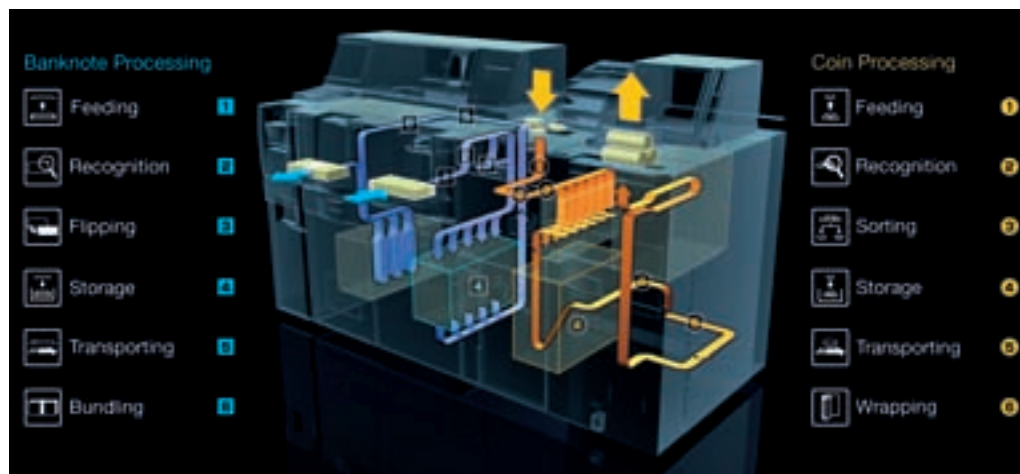


Illustration of the OMC System / Glory Ltd

International events

Seminar on currency-related communications in Canada

On the 10th to 12th June 2009 the Bank of Canada ran an international seminar in Ottawa to debate central banks' communication policies on currency-related issues, and in particular, the communication strategy currency issuing institutions need to follow in the wake of a counterfeiting crisis.

The seminar was attended by well-known professionals in the fields of issue and communications from 15 central banks in Europe, America and Oceania. The Governor and Deputy Governor of the Bank of Canada and high level representatives of the United States Federal Reserve System attended and took part in the seminar. A number of talks were given on the meeting's central topic, examining the variety of

ways the issue of communication is addressed in different countries. Strategies and policies focusing on maintaining and bolstering the public's trust in their currency were analysed and working groups were set up to discuss and present various different cases.

The attendees highlighted the importance of the currency-related communications policy for central banks and in particular for Issue Departments. The seminar's brilliant organisation by the Bank of Canada and the warm welcome extended to all its participants by the members of the Currency and Communications Departments, along with the active participation of all the attendees, were all factors contributing to the successful closure of this high-level meeting.

The excellent impression taken away from the meeting has meant that the possibility is being consid-

ered of a future event's being arranged to continue the Bank of Canada's initiative.



Participants at the Seminar on currency-related communications / Bank of Canada

Banknote 2009

From the 6th to 9th December 2009 Washington will be hosting the seventh edition of the Banknote Conference, which it is predicted will be attended by around 500 delegates from all around the world. The Banknote Conference is a forum at which delegates from the public and private sectors can meet to discuss the leading technologies and emerging trends in the banknote industry and exchange ideas and opinions. The topics due to be discussed at the conference relate to various aspects of the design, production, issue, use and counterfeiting of banknotes. The agenda also includes a visit to the premises of the *Bureau of Engraving and Printing*, the US public printing works, and the Federal Reserve's cash operations centre in Baltimore.



(cont. page 24)



VI Curso Internacional

de Gestión del Efectivo

de Gestão de Numerário

■ **J. Darío Negueruela** *Banco de España*

The sixth edition of the International Course on Cash Management (CIGE), organised by the Banco de España, was held in Madrid from 1 to 5 June 2009. The course was attended by twenty-two students from seventeen countries in Latin America and a team of prestigious lecturers of various nationalities, all with a strong track record in the field, drawn from central banks, banknote printing works, universities, the judiciary, the police, private banks and other institutions.

The course was officially opened by Mr Javier Aríztegui, Deputy Governor of the Banco de España. The first day began with a look at the history and origins of money, followed by lectures on the design and manufacture of banknotes, and call-for-tender-based systems of supply. In the afternoon there was a visit to the premises of the Spanish banknote printing works (Fábrica Nacional de Moneda y Timbre–Real Casa de la Moneda) where students were able to see the processes involved in the printing of euro-denominated banknotes at first hand.

The second day was held at the premises of the Banco de España in Madrid, and involved theoretical sessions and a visit to the vaults, operations and banknote processing areas of the Cash and Issue Department. The third day dealt with topics concerning issuance, security, risk management in treasury and monetary income. The day was dedicated exclusively to theory sessions, which gave rise to numerous questions and contributions from the participants.

The fourth day was a mixture of theoretical and practical sessions. After a presentation on currency-related communication policy, there was a workshop at which a high court judge, the chief inspector of the Banco de España's Investigation Brigade, and an expert from the Banco de España –representing the three pillars of the fight against counterfeiting— discussed anti-counterfeiting measures.

The statutes of the CIGE establish that the Thursday morning session will be kept free for the host country to devote it to a topic of its choice. Thus, after the workshop, a panel was set up to discuss cash management strategies in the wake of a liquidity crisis. The session comprised a presentation and discussion of the work of four teams of students carried out over the preceding days. Each of the teams had previously been assigned a possible response by a central bank to managing certain crisis situations, and had worked with the help and coordination of one of course lecturers to develop their case. The work of the four groups was of a very high standard and prompted a very interesting debate. As a result the Banco de España aims to publish the full content of the four talks by the panel in the near future.

The talks on the last day of the course were devoted to human resources in cash departments, the viewpoint of private entities on cash management, and the new phenomenon of Islamic banking. The closing session was led by J. Darío Negueruela, the course director, who gave a talk on "The lessons drawn from the liquidity crisis in the autumn of 2008".



Mr Javier Aríztegui (right) and J. Darío Negueruela (left) during the opening session of the course / BILLETARIA

There was also time for leisure and cultural tourism. Excursions were organised in the mountains of Madrid, along with a visit to the palace and gardens of the Granja de San Ildefonso, the former summer residence of the Spanish monarchy, and the city of Segovia, which concluded with dinner at a famous restaurant near to the emblematic 3rd century Roman aqueduct.

The closing ceremony and awarding of diplomas was presided over by Javier Alonso, Director General for Operations, Markets and Payment Systems at the Banco de España. During the same act, Mr João Sidney de Figueiredo, Head of the Treasury Department at the Brazilian Central Bank, Banco Central do Brasil, officially announced his institution's offer to host the 7th edition of the CIGE, which is due to be held in June 2010 in Rio de Janeiro.

Year after year the CIGE continues to surpass its goals in terms of technical and academic quality and the exchange of personal and professional experience, consolidating its position as a top ranking international course on cash management. The success of the 6th edition was made possible by the high standard and level of dedication of the lecturers taking part and the interest shown by the students. From BILLETARIA we would like to express our sincerest gratitude to all concerned.



Mr Javier Alonso (centre), J. Darío Negueruela (left) and Joao Sidney (right) during the closing session of the course / BILLETARIA

Factors which made the 6th CIGE stand out:

- Its strongly international character and respect for national experiences.
- The camaraderie and friendly atmosphere, which created a good working environment.
- The diversity of professional backgrounds among the lecturers and the high academic standard of the theory sessions.
- The stimulus given to student participation through debates and group work. The interest shown by students and their active participation.
- The definition of an institutional image with official logos for use in all CIGE documentation.
- The fact that the course was run in Spanish, Portuguese and English, with simultaneous translation.

Director of the 6th CIGE:

J. Darío Negueruela. Banco de España

Lecturers at the 6th CIGE:

National Bank of Belgium

Guy Ponnet

Banco Central do Brasil

João Sidney

Deutsche Bundesbank

Wolfgang Söffner

Franz-Josef Behringer

Banco de México

Enrique Lobato

Banco de Portugal

Hélder Rosalino

Pedro Paredes

Banco de la República

Bernardo Calvo

Federal Reserve Bank of New York

Jeffrey Pruiksma

The Spanish National High Court

Ismael Moreno

Banco de España Investigation

Brigade

Ángel García Ergueta

Madrid Complutense University

María Ruiz Trapero

Caja Madrid

Juan M. Zarco

Banco de España

Antonio Rosas

Javier Priego

Roberto Andrade

María Luisa Leyva

Manuela Sebastián

María José Fernández

Ángel Camarena

Fernando León

Víctor Andrés



Participants in the 6th CIGE / BILLETARIA

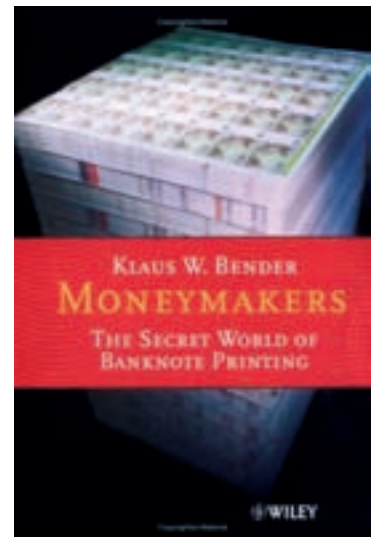
Publications devoted to cash

Moneymakers

The German edition of this book, written by Klaus W. Bender and published by Wiley-VCH Verlag GmbH & Co. KGaA., was published in 2004 and the first English edition, revised and updated, in 2006. It takes a close look at the banknote manufacturing industry,

covering the development of banknote printing machinery, the manufacture of printing inks and the history of some of the private banknote printers. It also describes the complexities of manufacturing euro banknotes, in which various paper suppliers and printing works are

involved. The book is 317 pages long and can be ordered from the following e-mail address: rights@wiley-vch.de.



Watermarking

This 63-page publication describing developments in watermarking as a means of protecting secure documents against counterfeiting was produced in 2006 by the UK company Pira International Ltd. In it a distinction is drawn between two types of watermark: traditional paper watermarks, and digital

ones, which are incorporated in a secure document in encrypted form. Paper watermarks are visible marks and have been used for banknotes for centuries, whereas digital watermarks were developed in the nineties, and are usually invisible, only being recognisable using special devices programmed

with the corresponding detection algorithm. The book can be ordered at the following address: publications@pira-international.com



The art and design of Canadian bank notes / L'oeuvre artistique dans les billets de banque canadiens

In 2006 the Bank of Canada published a particularly interesting book on the country's banknotes entitled *The art and design of Canadian bank notes / L'oeuvre artistique dans les billets de banque canadiens*. It was produced in the form of a bilingual English/French edition with high quality text and images. This beautiful work is an ideal source

from which to study the history and evolution of the artistic design of Canadian banknotes from 1865 to the present day. With it the Bank of Canada continues to demonstrate its outstanding interest in communication policy and presents the banknote as the most tangible symbol in the public's eyes of the central bank's role.

(cont. from previous page 21)



Pacific Rim Banknote Printers Conference

The next meeting of the Pacific Rim Banknote Printers Conference will take place in Tokyo, Japan, from 8 to 13 November 2009. Participants will include representatives of public printing works, central banks and issuing authorities. The Conference currently has 16 members from countries, mainly located around the Pacific, and is a forum for technical cooperation and exchange on aspects of banknote manufacture and issuance.

The Conference has an agreement with the European Banknote Printers Conference for the exchange of observers between the two organisations and for participation in their meetings. The Conference gets together every two years at meetings organised by its member institutions on a rotating basis.

Central banking news

Reform of the European legislation to protect the Euro against counterfeiting

By establishing the necessary measures to ensure the euro was protected against the activities of counterfeiters, Council Regulation (EC) no. 1338/2001 of 28 June 2001, represented an important step forward in the early stages of the new European currency's life. The setting-up of National Analysis Centres, the commitments by the various countries, the ECB and the European Commission to exchange information and provide mutual assistance, and the definition of credit institutions' minimum obligations for cooperation in the fight against counterfeiting, were all important milestones in the creation of the current European system to protect the euro. Specifically, the regulation established the obligation on credit institutions, and other entities involved in the handling and delivery of notes and coins to the public on a professional basis, such as bureaux de change, to withdraw from circulation all notes and coins received by them which they know or have good reason to believe are counterfeit. Notes and coins withdrawn for this reason are to be handed over without delay to the competent national authorities.

Regulation (EC) 44/2009 of the Council of the European Union on 18 December 2008, which came into force in January 2009, amended and updated its predecessor. This new Regulation reiterates the existing obligations upon credit institutions and professional cash handlers and furthermore requires that professionals guarantee the authenticity of the euro notes and coins they have received from the public before they put them back into circulation. It is therefore no longer a matter of their simply withdrawing counterfeit notes and coins, but it is also necessary for them to verify, using equipment specially approved for the purpose by the central banks, that used notes which they intend to put back into circulation are legitimate and meet the minimum standards of quality and conditions of



use defined by the authorities. The legislation is particularly strict in the case of the distribution of euro banknotes by ATMs (cash dispensers) and other devices or machines used directly by customers. In these cases manual checks are no longer permitted: instead, automated controls using previously approved systems are now required. Additionally, the obligation now extends to other providers of payment services and economic agents, such as traders and casinos, when they take part on a secondary basis in the handling and public distribution of notes and coins by means of ATMs.

The new provisions represent further progress on bolstering of the measures to protect the euro against counterfeiting and towards the creation of a framework in which both central banks and commercial banks, along with other cash-handling professionals, are more deeply involved in the protection of the European community's currency.

Denmark issues a new 50-krone banknote

Danmarks Nationalbank, the Central Bank of Denmark, has issued a new 50 Danish krone banknote. This is the first in a new series of five banknotes that will gradually be brought into circulation between now and 2011.

The design uses motifs based on Danish bridges and prehistoric finds. The size and colours of the new banknotes will be the same as the current series and will incorporate the latest security technology, such as a Motion window thread so as to make them harder to counterfeit.

Danmarks Nationalbank has run an advertising campaign to explain the reasons behind the launch of the new series of banknotes and inform the public about their security features. The campaign included adverts on TV, in the press and on the Internet. The bank has also distributed stickers for



New 50-krone banknotes / Danmarks Nationalbank

retailers and leaflets about the new banknote door-to-door to every Danish household.

There is a section dedicated to the new series of banknotes on the Danish central bank's website at www.nationalbanken.dk.

Banknote security features

■ Banco de España *Cash and Issue Department*

This section presents a catalogue of the main banknote security features recognisable by the public and currently in use worldwide. The features have been grouped according to their common functional properties for detection by the general public and retailers. The picture of each feature is accompanied by a brief explanatory text. The list will be subject to constant review, adding new security features resulting from technological advances and discarding those that are no longer relevant for the industry.

WATERMARKS



1. Multitone watermark

Image incorporated into the paper which is visible when the banknote is held against the light. It is created during the paper making process by varying the thickness of the paper. The resulting variations in opacity give rise to an image with bright and dark areas.



2. Electrotype watermark

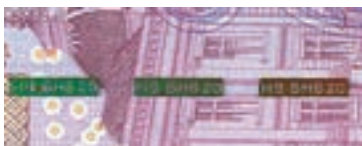
It is a filigree visible when held against the light. It is created during the paper making process using a filament which takes the form of numbers or different types of characters.

SECURITY THREADS



3. Embedded security thread

A thin band of plastic inserted into the paper. It is usually 1-2mm wide and 30-40 microns thick. It often bears microtext and fluorescence. It can also contain electric and magnetic properties readable by banknote processing machines.



4. Window thread

This band is made of a thread wider than the abovementioned, 3-4 mm, that weaves in and out of the paper. The uncovered sections are visible and could contain an optically variable element like an ink that changes colour when the banknote is tilted.



5. Thread with floating images

A window thread inserted into the paper using a standard window embedding technique. The floating image effect is produced by embedding microlenses into the thread. When the thread is tilted, the microlenses move producing floating images.

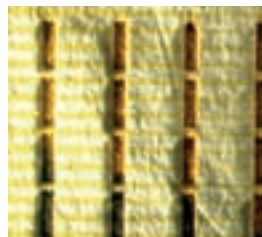
INTAGLIO FEATURES

Tactile



6. Intaglio printing

The printing with relief is detectable by the sense of touch. It is a printing technique in which the ink is transferred directly from the plate to the substrate under high pressure and temperature conditions. The printing produces a relief effect due to the thick layer of ink deposited and the embossing of the substrate. The main motif of a banknote is usually printed in intaglio.



7. Tactile marks for the visually impaired

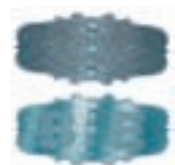
These tactile marks are detectable by touch. They are printed in intaglio and are usually located near the borders of a banknote to facilitate its recognition by the visually impaired.

Visual



8. Colour gradation in intaglio

Gradual superimposition of colours printed in intaglio, which are very difficult to reproduce by copiers.



9. Latent image

A hidden image that becomes visible when the banknote is viewed at a certain angle. It is made by intaglio printing using a particular structure of lines.



10. Blind embossing

An embossed colourless image that becomes visible when the banknote is viewed from an oblique angle. It is created by deforming the substrate by the high pressure of the intaglio printing without ink.

OPTICALLY VARIABLE FEATURES

**11. Iridescent ink**

A brilliant ink that changes colour when the banknote is tilted. The ink can be applied in a stripe and displaying an image.

**12. OVI ink**

Printing with optically variable ink (OVI), implies it will change colour when the banknote is tilted. Its effect is increased when the whole surface is covered by a layer of this ink applied in silkscreen printing.

**13. SPARK ink**

A particular type of OVI ink which changes colour, containing magnetic particles which can be oriented in such way as to produce a dynamic colour effect when the banknote is tilted. The effect is increased when the whole surface is covered by a layer of this ink applied in silkscreen printing.

**14. Optically variable devices (OVDs)**

Images produced onto holographic elements which change form and colour when the banknote is tilted. These are anti-copying devices based on the light diffraction principle, such as kinograms. OVDs can be stamped onto the substrate in the form of a patch or stripe.

**15. Moiré variable colour**

Feature that uses the latent image principle. It produces a rainbow effect which appears when the banknote is tilted. It is performed by means of an offset printing combined with an intaglio printing.

VISIBLE BY MEANS OF A MAGNIFYING GLASS

**16. Microprinting**

Printing of small characters that are not visible to the naked eye but can be seen through a magnifying glass. When printed onto a banknote, it usually combines characters in positive and negative.

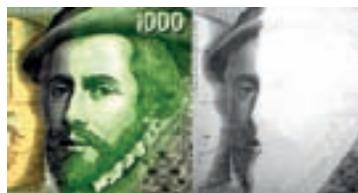
ULTRAVIOLET AND INFRARED PROPERTIES

**17. Ultraviolet properties (UV)**

These properties are incorporated into the fluorescent pigments of the printing inks which are not visible in daylight but are visible under UV light. Ultraviolet properties in banknote printing are more striking when the substrate used is non-fluorescent under UV light.

**18. Fluorescent fibres**

Fibres made of synthetic material and differently coloured embedded into the paper that are not visible in daylight but are visible under UV light. Their length is usually 3-6mm. There are certain fluorescent fibres in which each fibre has several colours. The fibres are incorporated onto the banknote in a random way while elaborating the paper mass.

**19. IR properties (IR)**

These are incorporated into the pigments of the inks. These are inks with different infrared performance due to different absorptions in that spectrum. The IR characteristics are usually applied combining transparent inks with inks opaque to IR.

OTHER FEATURES

**20. See-through register**

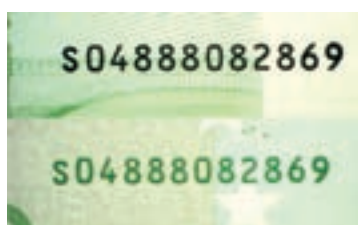
Some elements of an image are printed in offset on the front side of the banknote and the remaining elements of the image are printed on the back. The whole image with perfect coincidence is visible when the banknote is held against the light. This feature is also known as 'perfect register' as it is printed simultaneously on front and back sides in register.

**21. Structure of fine lines (moiré effect)**

Set of fine and narrowly printed lines which produce an optical confusion, named moiré effect, when reproduced by copiers.

**22. Rainbow printing**

Offset printing that creates in the banknote an area with different colours that are gradually mixed together to create a rainbow effect.

**23. Numbering**

The serial number on each banknote, which enables it to be identified. It is usually printed in letterpress, naked eye readable and may also be machine readable if mechanically readable characters are used. The ink usually incorporates magnetic properties.

**24. Transparent window**

Transparent area on a banknote on which optical effects are incorporated by applying various elements, such as a blind-embossed image or an optical device. It is used in polymer banknotes and is beginning to be used in paper banknotes too. In these, the window is placed on a holographic band.

**25. Microperforations**

An image made up of a large number of microholes in the paper, which becomes visible when viewed against the light. The microholes are drilled by means of laser.



Mappe-Monde. G. de l'Isle. Paris, 1707.

BILLETARIA

YEAR III

ISSUE 6

OCTOBER 2009

BANCODE ESPAÑA

Eurosistema

BILLETARIA

October 2009

Publisher

Banco de España / Cash and Issue Department
www.bde.es

Editorial Committee

J. Darío Negueruela
Manuel Galán
Wolfgang Söffner
Luis Fiore

Editorial Staff

María Luisa Leyva
Víctor Andrés
Fernando León
José Moreno
Gabriela Escudero

Special Advisors

Bernardo Calvo
Hélder Rosalino

Secretariat

Cash and Issue Department
Alcalá, 522
28027 Madrid
Tel.: +34 91 338 6310
Fax: +34 91 338 6887

The opinions expressed in the articles are those of the authors and do not necessarily coincide with those of their employers or of the Banco de España, unless otherwise stated.

Total or partial reproduction of the contents of **BILLETARIA** is permitted provided that the source is quoted.

For subscriptions and contacts:
billetaria@bde.es

© Banco de España
Depósito legal: M-16477-2007
Printed in Spain by Artes Gráficas Palermo, S. L.

BILLETARIA