ahead!

Cash Center Automation:
The Way to
Your Tailored Solution

Giesecke & Devrient

Creating Confidence.

Today's industrial processes are highly automated. Driven by the rapid evolution of electronic, digital, and computer technology, automation has taken off, especially over the past century. Now entire production lines are controlled automatically and many of the operations are performed by industrial robots.

Automation has also powered banknote processing for decades. The first automated systems – such as G&D's ISS300 – were introduced in the early 1970s. Here, as in countless other areas, automation offers indisputable benefits: transferring simple, repetitive, and/or sensitive tasks to machines improves not just quality and efficiency, but also security – a key benefit for cash handlers.

So far, however, most automation concepts mainly focus on the actual processing part: the counting, sorting, authentication, and fitness verification of banknotes – although these are just some of the numerous work processes to be performed at a cash center (see box). Besides processing there are six
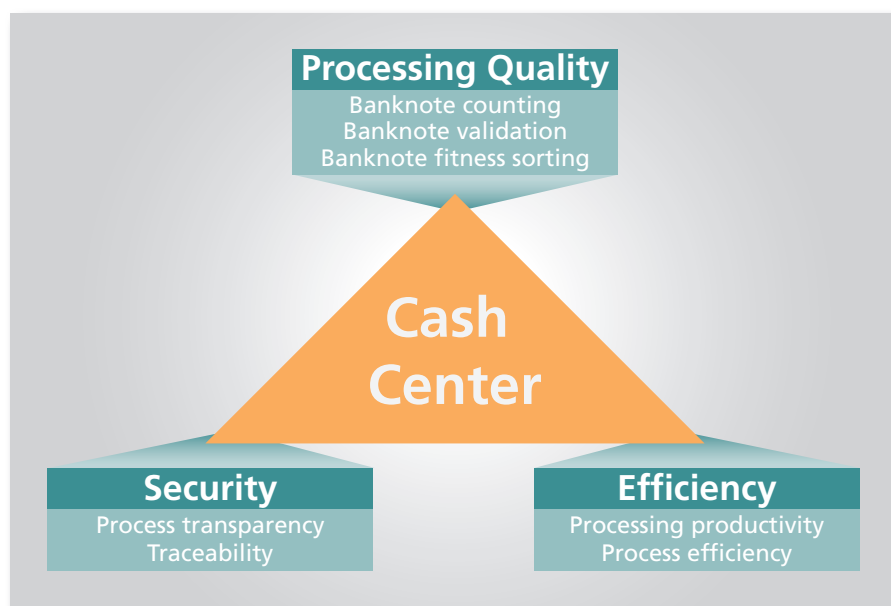

Figure 1: Key requirements for cash centers

other core areas that can benefit substantially from automation:

- Receiving/shipping
- Pre-processing
- Post-processing
- Destruction
- Warehouse
- Material handling

Automation for higher quality, efficiency, and security

Each area comprises several processes, and with latest-stage technology almost every process can be automated and integrated in an end-to-end solution. The possibilities are limitless as the specific design will depend on the needs and requirements

Cash Centers

The cash cycle begins and ends with the central bank: from there, the cash is securely transported to commercial banks and major customers. Consumers receive the cash directly from the bank (ATM/bank teller) or as change at the point of sale. On the "return trip", most of the cash is securely transported from retailers to the central banks, either directly or via the commercial banks. The central bank controls the amount of currency in circulation by issuing and withdrawing coins and banknotes. It also replaces unfit banknotes with new series.

Cash centers are key stations in this cycle: this is where banknotes are counted, authenticated, checked for fitness (quality), and then sorted, bundled, and sent out again. They generally use banknote processing systems which verify the security features integrated in the paper or printing.

Cash centers can basically be operated by any of the providers involved in the cash cycle: central banks, commercial banks, or cash-in-transit companies (CITs). However, the CIT companies' scope of activity depends on the central bank's regulatory style (cf. ahead! no. 1).

It goes without saying that cash centers have to meet very high standards in terms of building and process security. In addition, they have to meet the special statutory requirements and central bank regulations that govern cash verification and sorting. Other requirements may depend on the operator: a commercial cash center (operated by a CIT company or a commercial bank) has to manage different customer accounts and post balances on the same day. Cash centers operated by central banks are allowed to destroy unfit banknotes in accordance with applicable security standards.
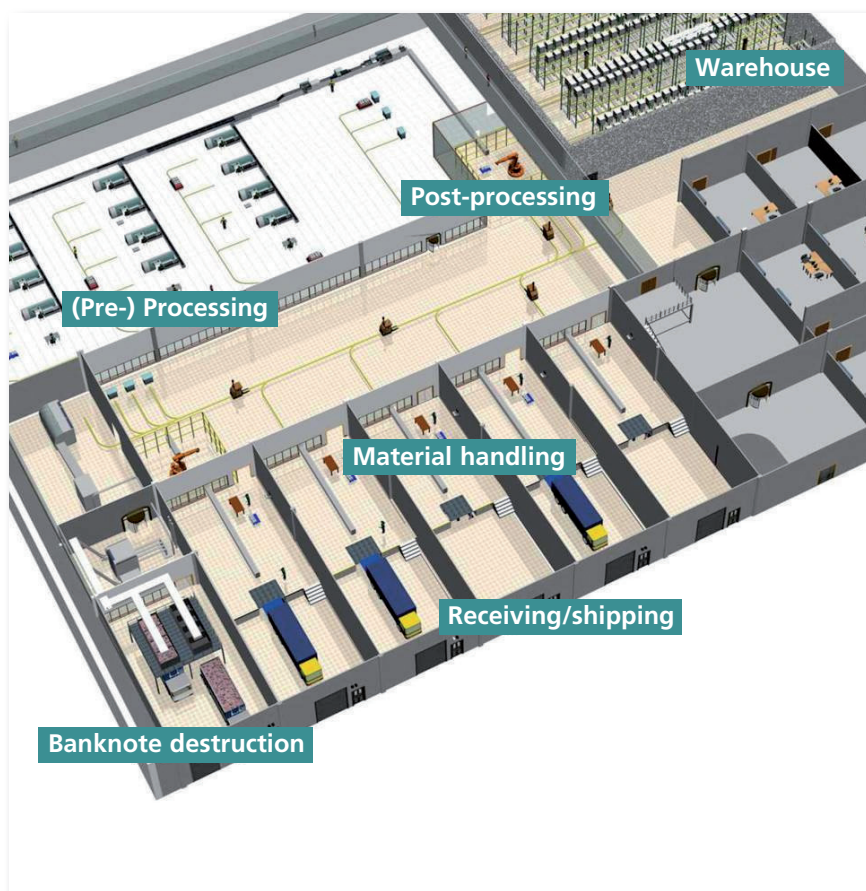
Figure 2: Possible layout of a cash center

Receiving/shipping:
Electronic data transfer,
automatic loading and unloading

This area covers everything from the cash center being notified of incoming CIT shipments (with personal data, truck license plates, etc.) to confirming shipment acceptance – or, for outbound shipments, everything from picking and placing to pick-up.

In the simplest form, everything is done manually or with simple tools: shipments are announced by fax; vehicles, personnel, and shipments are inspected visually; cash shipments are handed over manually. Inbound shipments are acknowledged and captured by entering shipment information on paper forms; the sacks or containers are loaded or unloaded by the CIT company's personnel, with some help from the cash center employees.

Automation speeds up several steps in this process. Here they are, in order of technical sophistication:

of the individual operator and environment. Or, in other words: every single situation may call for its own automation solution.

So, before setting out to modernize a cash center – for instance, as part of an expansion or a relocation – or starting to plan a new cash center "from scratch", operators should be aware of the full range of automation options available in order to find the best solution for their specific needs.
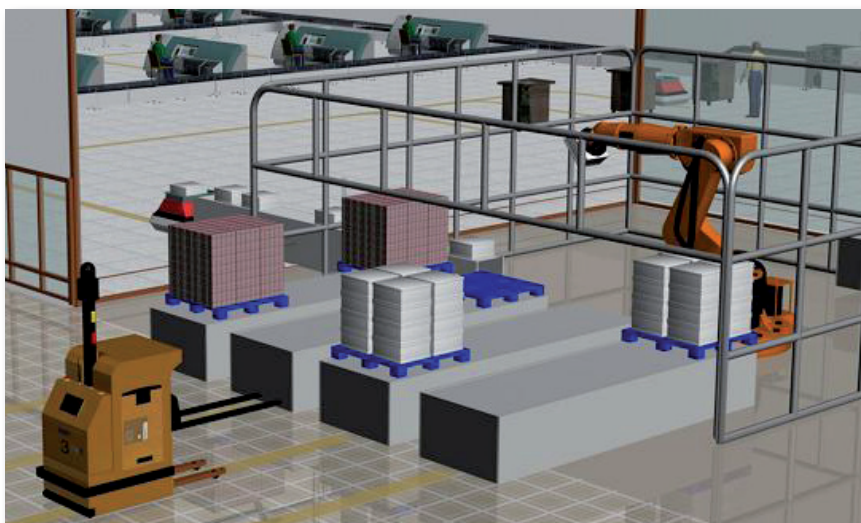

Figure 3: Receiving/shipping area

Figure 4: Use of robotics during pre-processing

processing fees; in addition, they will have created a sound basis for modernizing cash center logistics (see page 7).

Pre-processing:
From the container to the machine
without manual intervention

In pre-processing, the banknotes in the transport container are divided into lots small enough to allow easy, direct processing.

This involves the following activities:

- Reloading of processing lots
- Removing the straps and singling the banknotes
- Pre-sorting the banknotes and inserting header cards
- Placing the banknotes in the input module of the processing machine with the help of handling equipment

Manipulation is always a risk when these activities are performed manually. By contrast, security and sorting quality improve with every step that is automated. The result is a fully optimized and secure process.

Post-processing:
Ultra-efficient automatic
bundling and packing

After the actual processing, banknotes are typically strapped into packages of

- Inbound and outbound shipments can be announced via electronic data transfer instead of faxes; vehicles and personnel transporting inbound CIT shipments have to pass an electronic identity check (scanning of personal ID cards, etc.).
- If electronic shipment tracking is implemented, too, operators can simply use the route planning data to acknowledge the shipment and post it to inventory.
- An even broader solution also includes advance data transfers (from shipping retailers, etc.) so quantities and identities can be immediately checked on arrival.
- In a fully automated solution, major parts vehicle loading and unloading are also performed by machines.

Hardware and software data interfaces should generally be selected for compatibility. Also, standardized customer interfaces are necessary for full process automation. Specifically, this means introducing standardized, stackable transport containers – in multiple sizes if necessary.

In this area, a key benefit of automation is tighter security. But there is also substantial potential for streamlining processes and improving efficiency: unlike manual loading and unloading, automated processes do not have to meet ergonomic criteria and so can handle larger, heavier containers – which makes processes leaner and simpler. As a result, operators will not only enjoy lower shipping rates and

Figure 5: Automated post-processing

100 units, which are then combined into bundles of five or ten. The bundles are then vacuum or heat-shrink packaged, or simply strapped together, put in containers, placed in transport boxes or filled into ATM cassettes, and then palletized into unit loads.

Automation can support these activities in the following ways:

- Banknotes can be packaged right after sorting – the processing information is generally printed right on the straps.
- These packages can be automatically combined into bundles of five or ten and then strapped.
- Bundles can be mechanically shrink-wrapped and labeled (with additional processing data printed on the label).
- Bundles can also be automatically shrink-wrapped or packed in cardboard boxes. This step can be fully automated for lots of ten or more bundles, even if no prior steps are automated.
- Finally, automation can be used to fill standardized transport boxes and ATM cassettes.

Again, key benefits of automation are faster throughput, better quality, and tighter security. Users tend to trust automatically processed packages far more – and for good reason as processes can be logged and process data integrated in the packaging. In addition, the standardization of package sizes facilitates inspections in the course of storage and transportation.

These automation technologies are not new. They have proven their worth time and again in applications and industries such as pharmaceuticals and food processing. Cash centers, however, are a very different proposition. It takes special expertise to intelligently
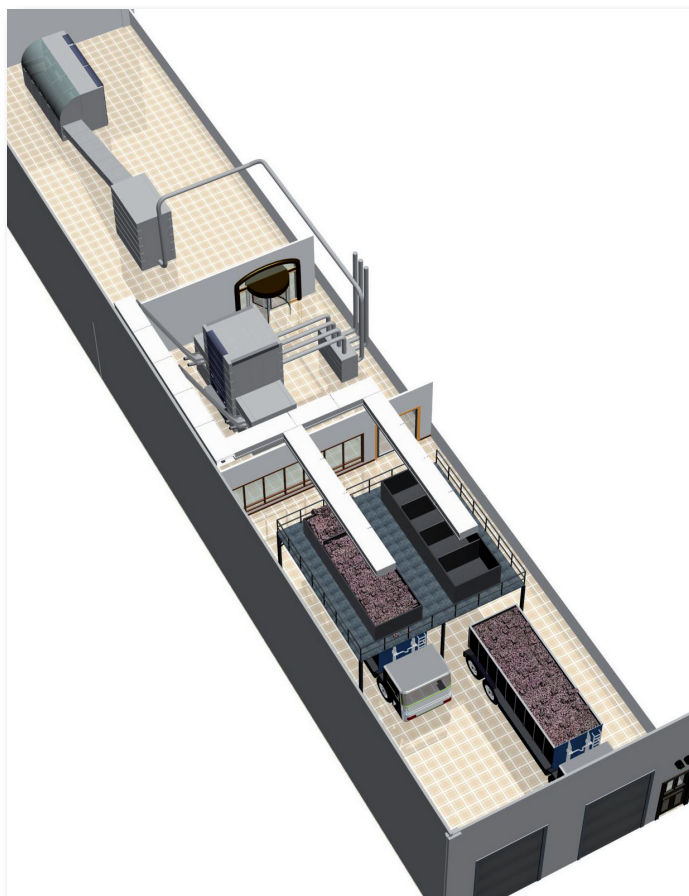

Figure 6: Banknote destruction with volume truck loading

integrate the technologies in an end-to-end solution that supports cash-center-specific processes.

Banknote destruction: Reliably withdrawing cash from circulation

Banknote destruction – i.e. shredding, compacting (previously referred to as "briquetting"), and disposing of unfit banknotes – is still performed manually in some quarters, with some support from automation: banknotes are cancelled with punches, using specific patterns for each punch to ensure that cancelled banknotes can be traced and will thus be harder to misuse. The cancelled banknotes are then shredded or burned.

Three specific steps can benefit from automation:

- Banknote destruction can be performed as a closed cycle in the processing system (using a special module), with online suction and direct discharge into shredder containers.
- The shreds can be automatically compacted by more than 80%.
- After compacting, a fully automated solution can mechanically discharge the shreds into silos and fill vehicles waiting to haul the shreds off.

Automation streamlines this entire process, virtually eliminating downtimes.

The ideal solution would be to have an industrial-scale end-to-end disposal process: from withdrawing unfit banknotes to hauling away the compacted shreds.

As in other areas, preventing manipulation is a crucial part of banknote destruction. When banknotes are withdrawn in this kind of automated process, it is virtually impossible for them to re-enter circulation.

**Warehouse:
More flexibility, better space utilization**

Cash warehouses – designed as high-security vaults – are still warehouses. They require all standard warehousing processes: from putting away processed banknotes to temporarily storing inbound shipments of unprocessed banknotes. Conventional operations handle the banknotes manually with forklifts and other handling equipment. For inventory and warehouse management, relevant entries are logged in inventory lists and index cards.

The following automation options can streamline warehousing:

- The most basic version has two to three rack levels (i.e. as many as a person can reach); the warehouse and inventory management systems are computerized for greater convenience.
- A more advanced solution uses multi-level rack systems and handling equipment. The inventory/ warehouse management software is supported by a warehouse control system to ensure optimal placement of unit loads in the warehouse.
- At the next stage, stereoscopic stackers provide greater flexibility and maximize storage space use in high-ceilinged rooms.
- The most comprehensive solution automates all warehouse equipment. Fully automated storage/retrieval systems pick and/or load the containers onto transport systems. Containers can also be transported by fully automated laser-guided vehicles. No warehouse personnel is needed. The warehouse control system is replaced by an electronic warehouse monitoring system, while "random" storage location management optimizes storage space use.

Fully automated warehouses have been used by carmakers and other companies for decades; in recent years they have also found their way into cash centers. Not only do they enable operators to streamline processes and optimize throughput; in addition, the use of storage space is improved through flexible putaway and computer-aided pulling, which more than compensates for the greater space requirements (in terms of footprint and height). And, as always, full automation provides maximum protection against manipulation.

For central banks, vaults are their warehouses. These are "staff-free zones". Warehouse systems are essential to efficiently storing reserve funds and circulating banknotes according to the first-in/first-out method, which avoids the negative effects of long-term storage. Plus, only unmanned warehouses can take special precautions such as reducing oxygen levels in the air to prevent spontaneous combustion.

It takes special IT skills to build automated warehouse solutions. For example, the inventory management system has to be compatible with the
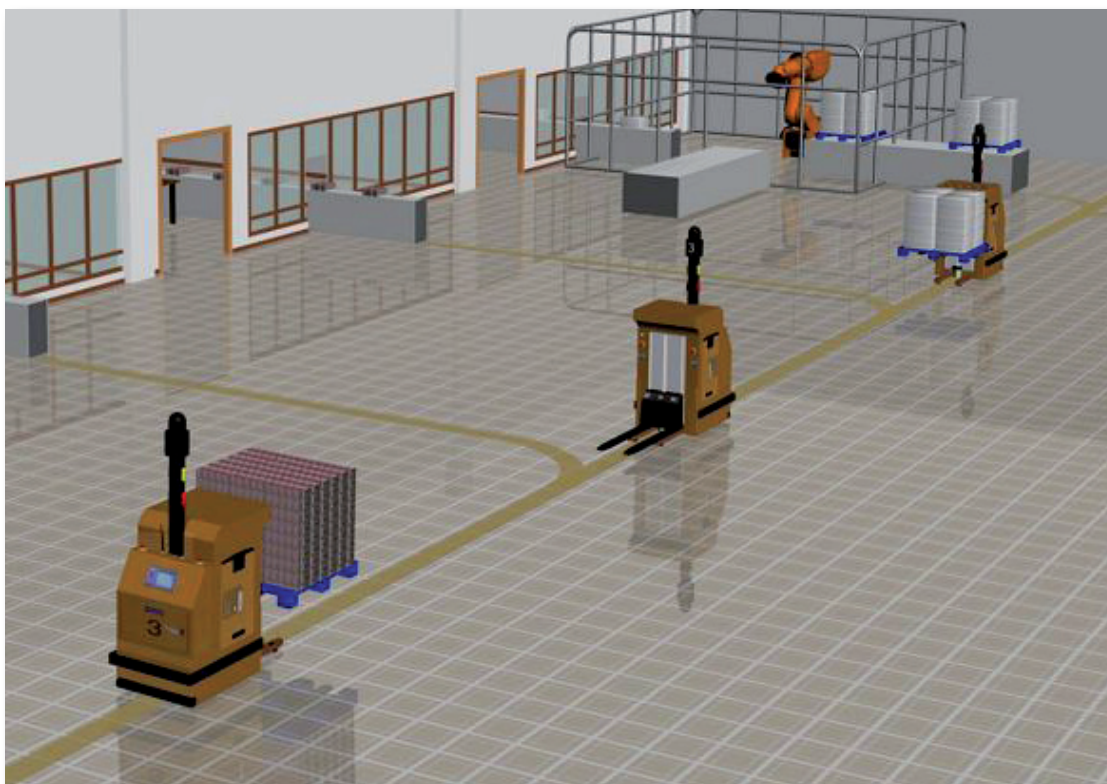

Figure 7: Stereoscopic warehouse

Figure 8: Automated material handling

control software for the storage/retrieval systems – this minimizes waiting times.

Material handling: Automatic operation with no downtime

Material handling is the process of transporting cash between core areas in the cash center. Conventional material handling uses lifting equipment, or forklifts for larger containers. Automation can resolve various challenges here, too:

• Banknote packages can be transported individually or in containers on a roller conveyor and/or conveyor belt; this process is controlled by a computerized ERP system.

• Packages can also be transported on pre-defined routes using overhead rail conveyors or laser-controlled automated guided vehicles (AGVs). AGVs can also be used on a flexible basis.

• The most advanced solution expands the AGV system even more: robots take packages from transport containers, put them into containers, and load them onto pallets. This solution requires standardized containers, although different sizes are possible (also see "Receiving/shipping").

For cash center automation to be effective, pick-ups and deliveries from and to various areas should adhere to a strict schedule. Automation solutions keep internal transports prompt and error-free and identify packages electronically – while avoiding human error and manual intervention. This is already the standard solution for many industries, especially e-commerce.
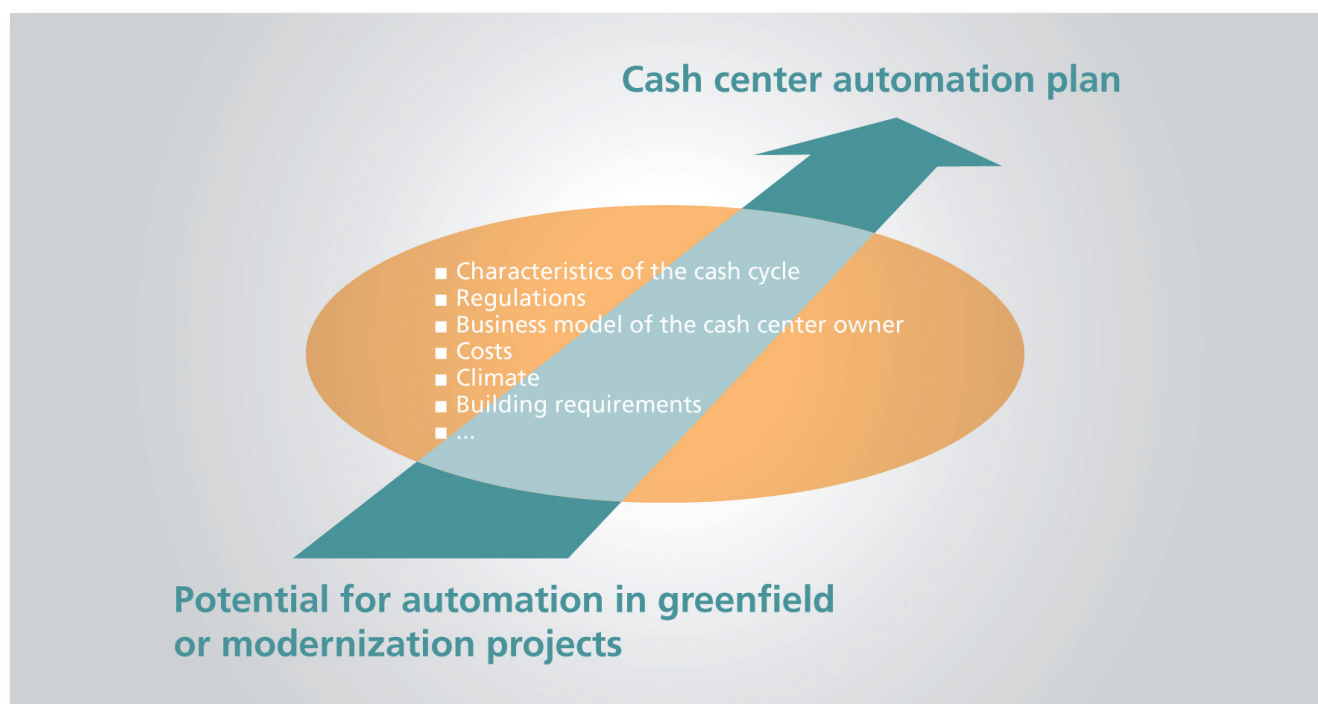
Figure 9: Issues to discuss when defining the ideal automation solution

Complexity necessitates sound overall design

Although every step you automate means an improvement in terms of quality, security, and efficiency, a fully automated cash center – where every area is automated at the highest level possible – will not be feasible and/or advisable for every operator. Rather, the ideal degree of automation varies from situation to situation.

To identify the exact parameters of each situation, a number of questions have to be clarified:

- **Characteristics of the cash cycle:** What denominations does the national currency have? How high is the banknote turnover rate (and thus the degree of banknote wear)? Also: what is the local cash culture like – i.e. how common are cash payments versus credit or debit cards, bank transfers, etc.? How automated is

the cash cycle – how widespread are cash deposit and automated teller machines?

- **Regulations:** What laws have to be followed? What central bank regulations apply to cash cycle monitoring and banknote destruction? What are the insurance terms for high-security transports and warehouses?

- **Business model of the cash center owner:** Is the cash center operated by a central bank, commercial bank, or cash-in-transit company? How much cash does it issue or take in? This answer alone can have a huge impact on processing operations. How many customers does it serve?

- **Costs:** How high are local wage costs – how expensive is cutting-edge technology by comparison?

How automated is the cash cycle in general? This can result in an entirely different cost-benefit analysis for each location.

- **Climate:** How high are the temperatures and humidity? Banknotes have to withstand very different conditions – and storage and transportation have to meet very different standards – in tropical and subtropical countries than in temperate regions such as Central Europe.

- **Building requirements:** How much space is available? Can existing facilities be adapted? What solutions can even be built in this space? And what security requirements does the building have to meet – what inventory restrictions have to be considered?

The answers to these questions will help determine the requirements that the optimal solution has to meet. In view of the complexity involved, successful cash center design will obviously require a sound planning approach to ensure that the targeted improvements in security, quality, and efficiency will actually be achieved.

A truly sound design should also consider intralogistics: transport routes should be configured so as to allow prompt replenishment of every area when and as needed. After all, savings in throughput times will only translate into real efficiency gains for the cash center if they are not partially or completely eaten up by transport delays. The same, of course, applies to other areas as well. Even small errors can have huge impacts – and could jeopardize the profitability of a major investment. To avoid these problems and ensur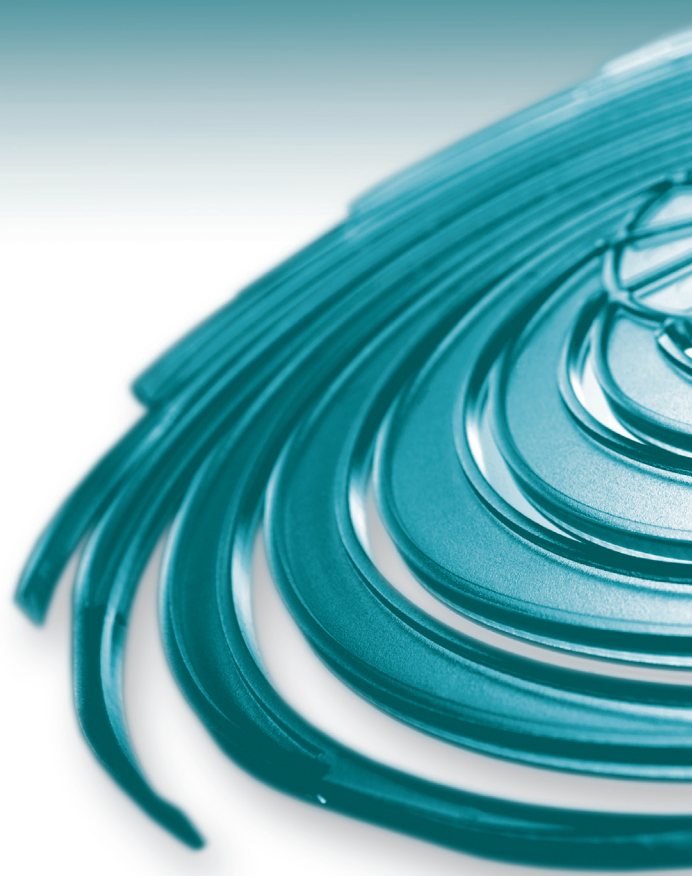e every aspect is well planned, operators should get help from an experienced partner specializing in cash center automation.

Only a sound overall approach results in an optimum automation solution

Obviously, cash center planning has to consider local conditions and comply with national laws and regulations. Sometimes it may also be necessary to consult with other cash cycle stakeholders on issues such as standard container or package sizes. Another key issue is the enforcement and rigorous control of internal policies and procedures; which is why a well engineered design will also include mechanisms to ensure compliance.

Giesecke & Devrient takes a proven approach to cash center automation by systematically reviewing all key criteria for relevance to each case. This includes much more than the actual cash center process: we also have a long, successful track record of designing the buildings and technical equipment with various degrees of automation. For the security equipment installed in cash centers – including testing and formal acceptance by accredited auditors – we work with capable and specialized partners. In sum, we are able to ensure an overall design that is sound, solid, and well thought out.