



*An Evolutionary technology
having a Revolutionary impact*

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Abstract:

The second of three white papers reviews the challenges and benefits that checkout solutions provide store retailers and customers.

Computer technology provides retailers with a variety of approaches that can bolster the bottom line and for specific customer groups, maintain a positive customer experience.

This paper focuses on the features, process, capabilities and performance that current checkout technologies provide retailers and consumers. It can help retail executives, operations managers and store managers:

- Define what the “best” checkout solution might be for their operations.
- Compare the capabilities, features, general approach and process of self-assist checkout technology, hand-held scanner checkout and a new type of hybrid checkout system.

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Comparing Retail Checkout Technologies

The retail grocery business has always operated in a ferociously competitive environment. Supermarkets typically have slim margins and profitability. So, grocery retailers seek any advantage that lower labor, capital and operations costs might provide. Computer technology provides retailers with a variety of approaches that can do just that—bolster the bottom line and for specific customer groups, maintain a positive customer experience and customer loyalty.

Current Retail Checkout Technologies

Part I: Stakeholder Pains, Concerns and Priorities

Part II: Comparing Checkout Station Designs and Capabilities

Part III: Comparing Checkout Station Costs and Performance

This second of a series of three white papers focuses on the features, process, capabilities and performance that current checkout technologies provide retailers and consumers.

This paper helps retail executives, operations managers and store managers:

- Define what the “best” checkout solution might be for their operations.
- Compare the capabilities, features, general approach, process of and customer response to self-assist checkout technology, hand-held scanner checkout and a new type of hybrid checkout system.

This paper presents information gathered from academic research papers, trade press articles and surveys of retail customers and store employees.

Choosing the right checkout solution

It’s tempting to describe checkout technologies competing head to head for floor space in groceries and other retail stores. But customer response and retailer survey results indicate a “best fit” approach is a better approach. Rather than making purchase of a specific type of checkout system a referendum on available technologies, it’s more helpful to match capabilities of the systems with retailer business requirements and preferences of local customers.

Self-Assist Checkout Technology

Self-assist checkout stations provide a viable alternative to traditional cashier-staffed checkout. This approach enables customers to pay for purchases from a retailer with minimal interaction with the retailer's staff.

Self-assist checkout counters have been in use for the past 20 years. Currently they are the standard, against which alternatives are measured. They represent one of a series of technologies, which include self-service hand-held scanners, a mobile phone-based "scan and go" self-checkout process and even a tunnel scanner.

In self-assist checkout systems, customers scan the barcodes on their items and manually identify items such as fruits and vegetables (usually with a touchscreen display), which are then weighed where applicable, and place the items into a bagging area. The weight observed in the bagging area is verified against previously stored information to ensure that the correct item is bagged. Customers can proceed only if the observed and expected weights match.

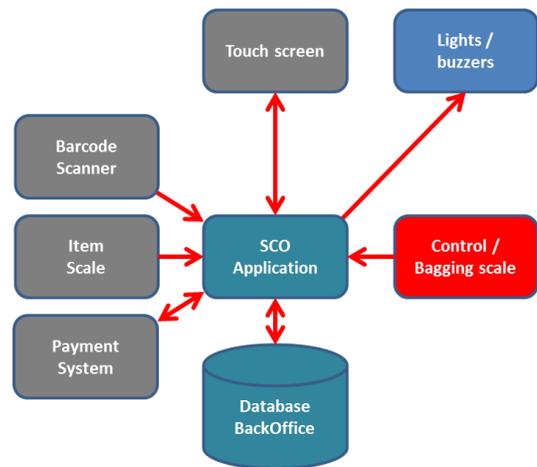
System Structure and Function

Self-assist checkout stations are stand-alone systems that house a computer and peripheral devices in a weighing station. System components include:

- **System software.** A self-service checkout station is controlled by a proprietary program, which controls all system functions. These functions include payment and communications with a database and the retailer's back-office operations.

Self-assist checkout software provides process state, scanning details and customer guidance information. When the customer completes the checkout process, the payment program balances the payment with the sale total. If payment is not received within set time and conditions, attendant intervention may be indicated.

- **Barcode scanner.** Laser-based, one-dimensional barcode scanners collect product information.
- **Other hardware.** System software orchestrates operation of the system's touch screen and scale. The software receives item registration data from the customer barcode scanner, scale and the touch screen. For each item registered, a weight is either read from the product data or from the item scale. The total weight is summed and compared with the reading from a control scale. The software can determine if any discrepancy lies within or beyond specific limits. Out-of-bounds results might require the attention of an attendant.
- **Database and back-office functions.** All product data, discount programs, coupon information and so on are read and updated from the central back-office system and database connected to the checkout station. The station returns all sales data to the database when the sale is completed. Particular operations between the software and the back-office system may also occur interactively for some tasks.
- **Payment systems.** Payment on self-assist checkout stations can be accepted by various methods: card via EFTPOS, debit or credit cards, electronic food assistance cards, cash via coin slot and bank note scanners, and in-store gift cards. Most coupons also use barcodes, which can be scanned the same way as purchased items.



The cost profile and resource requirements of self-assist checkout stations provide a compelling argument for their use in some retail situations.

Resource Requirements

In general, total direct costs and resource requirements per station of self-assist checkout stations are less than those of cashier-based or hybrid checkout technology.

Direct Costs

The cost profile at right summarizes costs needed to acquire, maintain and staff self-assist checkout stations. These costs include:

- **Capital costs.** Self-assist checkout stations with cash handling capabilities range from \$20,000 to \$40,000 each. At time of publication, a standard self-assist checkout station averages about \$22,000. The price of the self-assist checkout front end varies a lot, depending whether it includes a cash handling system. (A cash handling system alone can cost between \$8,000 and \$12,000.) These costs do not include integration with the computer back-office system.
- **Annual non-labor costs** are valued at \$11,197 per unit. These costs include the purchase cost depreciated annually, electricity, floor space, maintenance, cleaning and ongoing support for each station.
- **Annual labor costs.** Self-assist technology is often purchased and operated in clusters of four to six stations. Station attendants are usually assigned to support one cluster. The cost analysis used for our report assumes a cluster of four stations. So, the annual total labor cost of \$71,280 per station for a year of 72-hour work weeks is divided by four, to yield the value in the profile.
- **Total cost per 100 items scanned:** This overall performance indicator shows the effects of throughput speed and operator efficiency on the total-cost profile. Relatively slow scanning speeds and unexpected slowdown in self-assist queues drive the cost per 100 items scanned value to the highest level of self-assist, cashier-assist and hybrid checkout approaches.
- **Staffing and training requirements.** A skilled cashier can scan one item every 2 to 4 seconds. Customers scanning merchandise from self-assist stations scan an item in 6 to 15 seconds. So, a store would need approximately four self-assist checkout stations to match the throughput of one station operated by an experienced cashier.

The effort needed to train a skilled self-assist checkout attendant is comparable with the training needed for any cashier. This is because product knowledge, store policies and general system understanding required is roughly the same.

Self-assist checkout stations are typically installed in clusters of four to six units. One staff attendant normally supervises the use of these stations. The capacity of each cluster varies with the average self-assist basket size. Self-assist purchases are assumed to be approximately one-fourth the size of those in cashier-based transactions.

Cost Profile: self-assist checkout

- Capital costs: \$24,000 per station
- Annual non-labor: \$11,197 per station
- Annual labor: \$17,820 per station
- Each 100 items scanned: \$5.68 to \$6.50

Self-Assist Checkout Performance

When self-assist checkout technology and processes entered the marketplace in the early 1990s, vendors promised lower labor costs, higher revenue per square foot of store space and more satisfied customers. Twenty years on, this approach has delivered some promised benefits but not others.

What Self-assist Checkout Fails to Deliver

The self-assist checkout approach provides lower total direct costs and provides tech-savvy customers with a quick way to complete their purchases. However, it also generates concerns for retailers and consumers alike. These concerns include:

- **Difficult-to-use technology.** Self-assist checkout technology itself is the bane of many customers, who feel that it's all too easy to mess up the scanning and payment process. Items might be counted wrong as they are added to the basket or removed without being scanned. In general, customers need to be aware of and keep track of the scanning process themselves. Any small error can lead to unwanted control measures and retailer scrutiny.
- **Delays.** Many consumers remain unconvinced about the convenience of checking themselves out. Self-assist checkout is designed for small baskets and customers comfortable with modern technology. Customers, who lack the training and experience of a cashier take longer to scan their items. And, customer confusion about coupons, payments and other problems also increase transaction times.
- **A less-than-stellar customer experience.** Lack of cashier assistance makes it difficult for self-assist checkout to deliver a positive customer experience. The self-assist approach lacks consistent human attention, which customers cite as the most important part of a satisfactory customer experience. Does one self-assist checkout attendant have enough time to serve four to six self-assist checkout stations well? Information in the trade press is contradictory.
- **Attendants exposed to angry or impatient customers.** The self-assist checkout concept requires attendant intervention and problem solving. Even with effective training, it's difficult for attendants to stay calm and properly acknowledge complaints and listen to unhappy customers. In some locales, local unions have addressed this issue.
- **Customer skepticism.** In stores that require customers to use self-assist checkout, the approach often gives customers a feeling of lost control, that retailers suspect them of theft and the feeling that retailer cost control is more important than their experience in the store.
- **Shoplifting.** Cheating the system is fairly easy as cross-scanning items or switching items in the basket can be done easily. Standard measures such as random control are often required.

Common Customer Gripes

- Units don't scan items properly: 46%
- Customers can't use own bags: 39%
- Customers doing all the work: 13%
- Delayed while getting help: 12%

Customer response to self-assist checkout use follows several patterns:

- Customers most satisfied with self-assist checkout want to get in and out of the store quickly. They want to check themselves out and have a high comfort level using technology.
- Customers least satisfied with self-assist checkout are less comfortable with computer technology and prefer human intervention—someone to do the checkout chores, help with problems when they arise, and maybe have a bit of a chat.

So, self-assist checkout performance is less a referendum on the technology as a process of matching the right customer with the checkout method he or she is more comfortable with.

Hand-Held Scanning Technology

Customer checkout based hand-held scanning devices has been around for about 15 years. This approach uses a portable barcode scanner, which customers use as they walk the aisles and bag items. Another approach, one based on mobile phone applications that scan 1-D or 2-D barcodes, is currently in development and trial usage has started. While it might be a success, performance data from U.S. retailers is not yet available.

System Structure and Function

As the diagram at right shows, hand-held scanner hardware and software are nearly identical to those

used in the self-assist checkout approach.

The difference: the scanner is not embedded in the checkout station hardware. Instead, it is a portable device.

Customers register each item by scanning barcodes into the transaction database.

Articles that require weighing can be processed in different areas of the store. A barcode can be added to the item, and the item is scanned into the hand-held device server software.

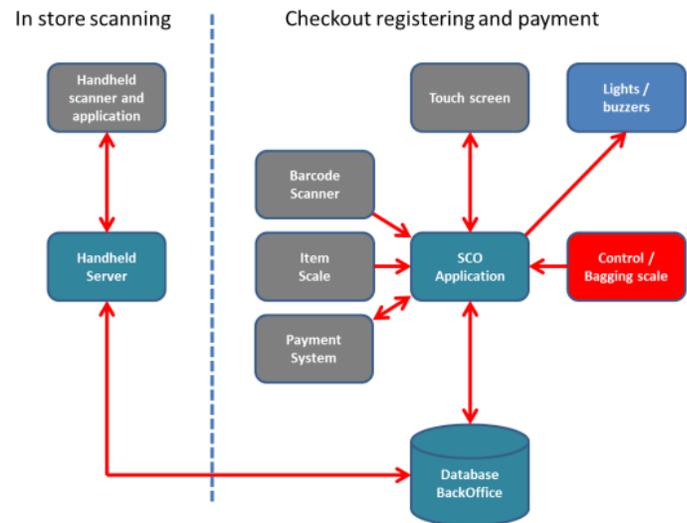
Customers process non-barcode items and make payment in a checkout station that looks and behaves like a self-assist checkout system. System components include:

- **Hand-held barcode scanner:** Customers begin a shopping session by retrieving a hand-held barcode scanner. They consist of a light source, a lens and a light sensor. The sensor translates light impulses into electrical ones. Nearly all barcode readers contain *decoder* circuits, which analyze the barcode image data provided by the sensor and send the barcode information to the scanner output port. Some scanners operate as standalone devices—handheld computers. Data is transferred to the checkout station only at the end of the shopping session.
- **Hand-held scanner software.** Some hand-held scanner solutions are simply web browsers running a web session on the store server against the handheld scanner. Other systems use a small software application that communicates with the handheld scanner via web services or remote procedure call methods.
- **Scanner-database connection.** The store needs a high-performance wireless network to connect front and back ends of the system.

This technology is just one of several important resources required for hand-held scanner checkout operation.

Resource Requirements

In general, total hand-held scanner checkout costs and resource requirements may be similar to those of the self-assist checkout option. Depending on the number of checkout stations and the number of handheld devices required, hand-held scanning checkout costs may vary compared to those of cashier-based or hybrid checkout technology.



Costs

Hand-held scanner and self-assist technologies are similar except for the hand-held scanner.

The hand-held scanners are also computers, which are more complex than simple barcode readers. So, they tend to cost in the range of \$800-\$1,500 per unit.

Scanner charging stations and the devices themselves require frequent maintenance. And a centralized system with checkout stations, barriers and other checkout installations is also required.

Hand-Held Scanner Checkout Performance

Information in the trade press and customer survey results indicate that hand-held scanner checkout is best used in stores such as home improvement and garden centers, which are better suited to larger purchases. In these situations, this approach delivers benefits to retailers and customers by:

- **Providing running totals.** Self-assist checkout systems that use hand-held scanners often provide customers with running totals as they shop. This approach, which gives some customers a sense of control of their purchase, can translate into stronger sales.
- **Delivering customized information.** Hand-held scanners can also use loyalty card information to provide shoppers with information tailored to their interests and shopping habits. For example, in groceries, purchase-related information can include nutrition facts.
- **Offering promotional information.** Hand-held scanner systems can scan loyalty card and purchase information to print coupons, announce upcoming sales and offer combination pricing.

Successful hand-held scanner checkout depends on customer expectations and how well the scanners work. If customers select this option and feel comfortable using technology, all is well. But customers must still engage in weighing and payment steps and show proof of purchase on the way out of the store. And, to customers loyal to conventional checkout methods, the information advantages might not measure up to the lack of human contact.

So as in all types of checkout technology, it's essential to identify and carefully match retailer business requirements, customer expectations and IT capabilities.

Hybrid Checkout

A new generation of Hybrid checkout stations completes the spectrum of commercially available checkout technology. It is the most recent in a series of retail checkout approaches designed to improve retailer cost structures and promote customer satisfaction and loyalty.

The new Hybrid checkout technology shouldn't be confused with switched-mode checkout stations. As the name implies, switch-mode stations can be used either for cashier- or self-assist checkout service. These solutions, that may also have names that include the word "Hybrid" have a small market share, are outside the scope of this paper.

Innovated by PeoplePos, a UK-based company, Hybrid checkout systems are entirely new to the marketplace. So new, that they are in the final stages of development and product introduction. Final development steps include:

- Fully working models have been available for demonstration, design and testing purposes since mid-2013.
- Leading European manufacturers can supply physical Hybrid checkout stations by retailer request.
- At time of publication, front end point of sale software supporting the standard ARTS-RTI interface is being worked on and may be offered on a project basis. This software may be integrated with existing point of sale systems.

The following section describes the capabilities, cost profile, advantages and drawbacks of this new approach.

How Hybrid Checkout Systems Work

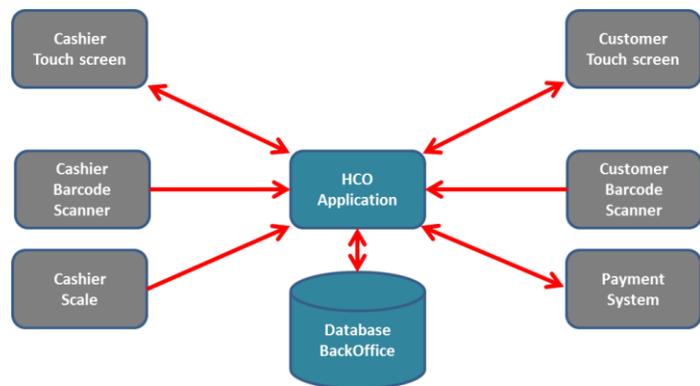
Hybrid checkout is a new approach that combines efficient, technology-based processing and the human touch. It uses a new process and changes how checkout scanning and registration is done.

Hybrid checkout enables the cashier and customer to work side by side in two scanning lines built into a single checkout station. This approach views cashiers as skilled, experienced partners, who can decrease checkout times and provide customers with human contact—two characteristics that most retail shoppers crave.

Side-by-Side Structure and Function

In principle, Hybrid checkout systems work the same way as other computerized POS systems do. The main difference: two sets of nearly identical hardware for user interaction, which are connected to the retailer database, the central systems and each other by a common application. Components include:

- **Two input screens.** A customer screen enables customers to add items and to some extent control the registration of items shared with the cashier. Customers can also register items and partially control the purchase and payment process.
- **Two scanners:** Dual barcode scanners enable the cashier and customer to scan different items at the same time. The system includes split or shared scanning modes, which ensures parallel and simultaneous operation. When the customer works independently while the cashier is busy with other tasks, the process speeds up and reduces stops to the registration process.
- **Cashier-side scale.** Much of the advantage of Hybrid checkout involves using the cashier's skill and experience. This approach provides what many customers want, speedy checkout and help when it's



needed. Weighing and identifying items without barcodes is a major problem that can benefit from cashier assistance. So, weighing duties are delegated to the cashier.

- **Parallel construction.** Putting cashiers and customers side by side isn't just a feel-good touch. It enables cashiers to solve the many little IT and process problems that customers find annoying. The cashier can fix any scanner-related problem quickly because both the cashier and customer use the same computer program. If an item is registered twice (when it shouldn't be), the cashier can click "Customer Area" and correct the error directly. After a few uses, customers will give the cashier items they know might create problems.

Resource requirements of Hybrid checkout technology are different than those of self-assist and hand-held scanner checkout.

Resource Requirements

In general, Hybrid checkout total direct costs are significantly higher than those in self- and hand-held-scanner-based systems. But when compared to the other checkout options, specific costs are lower in hybrid checkout systems.

Direct Costs

The cost profile at right provides typical costs of a newly installed Hybrid checkout station. These costs include:¹

- **Purchase cost.** Purchase and startup costs include hardware, software and installation costs for the base unit and all peripherals.
- **Ongoing non-labor costs.** These costs include the purchase cost depreciated annually, electricity, floor space, cleaning, maintenance, software licensing and other IT services for the basic system and peripherals.
- **Labor costs.** Annual costs of cashiers who operate the hybrid checkout station are the same as those for other checkout technology options. However, annual figures represent several cashiers working at the same station throughout a 72-hour work week.
- **Training costs.** Human skill, experience and good customer relations are essential to the Hybrid checkout approach. Cashiers will need customized training to use the system successfully. To estimate training costs, it helps to start with standard cashier training costs as a baseline and then add costs for extra time needed to gain higher-level skills.
- **Training can be completed in stages.** Training can be customized to support simple shared scanning tasks or either of the two next levels of more demanding and efficient split-scanning tasks.

Retailers can start cashier trainees in a standard, cashier-assisted environment, where they can learn the store's product range, computer menus and product codes. Later, they can be trained to use the Hybrid checkout system. This approach avoids inexperienced cashiers from slowing down higher-speed parallel tasks.

Cost Profile: Hybrid Checkout

- Station purchase: \$25,500 per unit
- Annual non-labor: \$16,397 per station
- Annual labor: \$71,280 per station
- (station operates 72 hours per week)
- Cost of each 100 items scanned: \$1.60

¹ All cost data discussed in this paper are based on analysis information in, "Current Checkout Technology: Part III, Comparing Checkout Station Costs and Performance."

Two or 3 days of training are likely to improve a cashier with conventional skills to one with entry-level hybrid checkout skills. A few months of this experience and another day or two of advanced training would result in a Level-2 or Level-3 cashier, respectively.

- **Indirect benefits.** This approach tells cashiers that they are also customer service representatives with important skills, knowledge and experience. Store managers can also use this training to emphasize and support the importance of customer service generally.

This training process description assumes that store operations include both cashier-assisted and hybrid checkout stations. Although this is not a requirement, a gradual conversion from cashier- to hybrid-based services is likely whenever both technologies are used in the same store. Also, a Hybrid checkout may be operated as a cashier-assisted only checkout supporting entry level training if no traditional cashier assisted checkouts are installed.

Hybrid Checkout Benefits and Performance

Because the hybrid checkout approach and technology are very new, few field test results are available.² However, it is useful to compare hybrid checkout capabilities with retailer requirements, customer expectations and performance of other checkout technologies.

Hybrid Checkout Delivers What Customers Want

Hybrid checkout stations offer many benefits for retailers and customers alike:

- **Better financial performance.** Retailers benefit in the best way possible: at the bottom line. Detailed simulations using survey data and trade press information show that hybrid checkout technology could improve annual net profit by an average 0.5% to 1.1% per store. For information about this study and its results, see “Current Checkout Technology: “Part III, Comparing Checkout Station Costs and Performance.”
- **Faster checkout.** By design, the higher throughput of side-by-side scanning in a hybrid checkout station will be greater than is possible in a self-assist checkout station. Depending on the purchase size and customer experience with hybrid checkout, throughput speed in a hybrid checkout station may exceed two times that of a cashier-based station.
- **Hybrid checkout adds to a more pleasant in-store experience.** By adding the human element, hybrid checkout makes shopping more than just a trip to the store.
- **Hybrid checkout cashiers have full control over the checkout process.** This is what many customers want—a staff member to deal with any issues that arise.
- **Cashier-centric approach eliminates or solves many aggravating problems.** The cashier weighs and identifies non-barcode items, confirms legal drinking age and processes coupons on the fly.
- **Hybrid checkout approach is more likely to promote customer satisfaction and loyalty.** Hybrid checkout systems provide customers with a faster, hassle-free checkout experience. And they show customers that their gripes and expectations are important to store managers.

Hybrid checkout can provide speedier checkout and improved customer loyalty. But significant operational constraints exist.

² Field testing is due to begin in early 2014.

Larger Stations and Backup Pose Challenges to Retailers

Hybrid checkout provides many benefits, but limiting factors do exist. They include:

- **Higher cashier training costs.** The hybrid checkout approach requires that cashiers deliver higher-level service than in other methods. Cashiers will need more training to acquire higher levels of checkout, problem solving and customer service skills.
- **Larger station footprint.** Hybrid checkout stations accommodate two people doing registrations at the same time, not one. So, each station requires more floor space and traffic control planning than other checkout station designs.
- **Possible ergonomics problems.** Hybrid checkout enables more throughputs per cashier. This generally means less lifting and healthier moving about. However, larger hybrid checkout station designs can mean more arm motions further from the body and more strain. More frequent cashier job rotations might be required for some hybrid checkout models.
- **Throughput vulnerability to computer system failure.** The throughputs of one hybrid checkout system can typically replace that of two cashier-assisted or 6 to 10 self-assist checkout stations. This makes throughput in stores with hybrid checkout stations more vulnerable to hardware failure if a small number of these checkouts are installed.

For example, a small store with three cashier-assisted stations would lose 33 percent of its checkout capacity if one station fails. The same small store with two hybrid checkout tills would lose 50 percent capacity if a station fails. A store with two cashier-assisted checkout stations may not safely replace them with a single hybrid checkout till, even if the capacity is the same. The risk of lost checkout capacity might be unacceptable to some retailers.

Hybrid checkout performance data from the field is not yet available for analysis. However, this approach offers all of these characteristics of an enjoyable checkout experience:

- Enables faster checkout speeds than self-assist and hand-held scanner transactions
- Reduces waits in checkout lines
- Enables faster problem solving with no need for customer intervention
- Uses cashier skills and experience to solve problems
- Helps customers avoid suspicion of theft and other hanky-panky.
- Provides customers with someone to chat with
- Helps customers avoid having to understand new technology

The question, of course, is whether hybrid checkout technology provides enough additional revenue, cost control and customer loyalty to offset higher capital costs of new equipment and ongoing operating expenses. To decide what's right for your retail operation, see "Current Checkout Technology: Part III, Comparing Checkout Station Costs and Performance." This white paper provides a direct comparison of performance metrics and costs of cashier-assisted, self-assist and hybrid checkout technologies.