Future of self checkout

Naveen Nagaraj, Bhaskar Nallapureddy, Paramita Das,
Sunder Parameswaran, Jure Zaninovich, Poola S

This work was created in an open classroom environment as part of a program within the Sutardja Center for Entrepreneurship & Technology and led by Prof. Ikhliaq Sidhu at UC Berkeley. There should be no proprietary information contained in this paper. No information contained in this paper is intended to affect or influence public relations with any firm affiliated with any of the authors. The views represented are those of the authors alone and do not reflect those of the University of California Berkeley.
Current state of checkout
Today… Retailers are losing customers and sales

- 33% left store without buying if lines longer than 7 minutes
- 50% of shoppers avoid stores with long lines
- 66% look at online as an alternate for brick-and-mortar stores

Lower Sales
Poor customer satisfaction
Tarnished brand image

*source: [http://www.retailcustomerexperience.com](http://www.retailcustomerexperience.com)
How are Retailers responding today?

- Vast majority of retailers are considering upgrading their ID capture devices
- Transition from traditional purpose built scanners to Mobile based or personal shopping devices

*source: VDC survey*
Case study 1: NCR - World’s largest supplier of SCO technology

Customers
• 233 retailers
• Most Australian, European, US chains
• 100K+ SCO units deployed

Technology
• Seamless POS integration
• Bi-optic scanner w/ LED Scan
• International EAS Tag deactivation
• wired/wireless scanner
• Security scale for weight verification
• Item integrity via self-learning weight database
• Remote attendant station
• High availability service.

SCO Value proposition

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-checkout ASP (4 units)</td>
<td>$60,000</td>
</tr>
<tr>
<td>Headcount Reduction</td>
<td>4</td>
</tr>
<tr>
<td>SG&amp;A Reduction @ $30K each</td>
<td>$120,000</td>
</tr>
<tr>
<td>Payback Period (months)</td>
<td>6</td>
</tr>
</tbody>
</table>

Payment device
Security agent
Device Manager
Graphical User Interface
Remote Attendant Interface
NCR SelfServ Checkout Consumer Experience Application
Personalization Engine
Transaction Broker
POS Client Application
Remote Attendant Station
Payment device
Store Controllers
Case study 2: Scandit - Mobile apps based SCO technology

Customers
- Home depot, Capital One, Verizon, Genentech, Ahold

Technology
- Scandit Mobile framework
- Scandit cloud services
  - Data caching
  - Barcode scanning (mobile and case)
- User data management
- Shopping list mgmt
- Analytics
- Notifications
- Sharing
- Existing IT infrastructure
- QR code generator
- Kiosk to pay

SCO Value proposition
Self-checkout SDK (500 units) : $4000
Payment KIOSK price 4@ $2K  $8,000
Headcount Reduction 4
SG&A Reduction @ $30K each  $120,000
Payback Period (Months) 1.2

How Scandit works
1. Customer checks in to store. Begins shopping
2. Customer is shown specials
3. Customer scans items in cart
4. Customer can add items via smart search
5. Review or change items
6. Customer uses QR code at checkout; payment is made at the kiosk
Case study 3: Digimarc – Watermark powered ID

Customers
- Kraft Heinz Co, Wegmans, New Seasons grocers

Technology
- Invisible watermark printed on all sides
- Readable by image scanners
- Robust against orientation
- Occupies zero package space
- Reuse existing package printing flow with one extra step – embed watermark
- Compatible with existing workflow on manned and SCO
- Biz model: IP licensing, SDKs

Digimarc value proposition
Barcode cost (per SKU): $300 initial + $50/yr
For a supermarket chain with $2.5B in sales, 40000 SKUs of which 10000 SKUs are of private label brand

<table>
<thead>
<tr>
<th></th>
<th>Private label adoption</th>
<th>Complete adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payback period</td>
<td>9months</td>
<td>3months</td>
</tr>
<tr>
<td>ROI 1st yr</td>
<td>30%</td>
<td>400%</td>
</tr>
<tr>
<td>ROI 10yr</td>
<td>267%</td>
<td>1700%</td>
</tr>
</tbody>
</table>

Watermark Embedder workflow

[Diagram of Watermark Embedder workflow]
Case study 4: Skip - RFID based SCO technology

Customers
- ~30 early adopters
- Macy’s, American Apparel, Walmart

Technology
- Cost effective RFID tagging
- RFID readers detect/track the items
- Seamless integration with billing and security.
- Value added services – inventory management, and analytics
- Extensible platform for promos, ads and product details/recommendations.

RFID value proposition
RFID tag costs: ~2c per tag
Industry grade RFID readers: $20,000
E2E solution: $100,000
Payback Period (months) ~12

Inventory
- RFID tags on each item
- RFID readers and scanners

Analytics
- Billing and Security
- Receipt via text or email

Personalization and customer engagement
Technology evolution and trends

- **1960**: Manual entry of items and prices
- **1970**: Numerical codes were Keyed at the register
- **1980 - 2000**: Bar code scanners at the cash counters
- **2000 - 2015**: Self-checkout kiosks and Smartphone barcode readers
- **2015 - 2025**: RFID scanners
Trend of Prices for RFID tags

Global Average Factory Selling Prices for RFID Tags Extrapolated to 2015
Graph courtesy of VDC Research Group.
## Technology details and challenges

<table>
<thead>
<tr>
<th>Smartphone based scanning</th>
<th>Digital watermark barcode</th>
<th>RFID enabled scanners</th>
</tr>
</thead>
<tbody>
<tr>
<td>- App is used for scanning the items</td>
<td>- Entire item surface is used to superimpose the barcode</td>
<td>- Each item will have a unique RFID tag</td>
</tr>
<tr>
<td>- The aggregated list is checked out at the cashier or at self-checkout kiosk</td>
<td>- Scanning is same as today except it is fast accurate and easy</td>
<td>- RFID readers will detect the items as items are picked or passed through a scanner</td>
</tr>
<tr>
<td>- <strong>Theft concerns</strong> – No mechanism to ensure that all items are scanned</td>
<td>- <strong>Adoption</strong> – All manufactures need to adopt to the new standard of generating the barcode</td>
<td>- <strong>Security</strong> – no extra detection needed</td>
</tr>
<tr>
<td>- <strong>Customer annoyance</strong> – not eager to do the job of a cashier</td>
<td>- <strong>Cost</strong> - Needs to an overhaul of the existing infra with new software</td>
<td>- <strong>Adoption</strong> – All manufacturers need to align to have RFID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- <strong>Cost</strong> – generating tags and overhaul is quite expensive</td>
</tr>
</tbody>
</table>
Regulatory and Societal Impact

**Regulatory Factors**

- FDA Concerns on impact of **RFID radiations** on food products
- Environmental concerns on RFID tag **recycle and disposal**
- Privacy concerns on tracking customer behavior

**Societal Factors**

- **Human interactions** and personal touch will be lost
- **Reduction** in hourly-pay jobs
- Only well-to-do customers with credit card and smart-phone will be benefited.
- Small and medium retailers will be at a disadvantage
Conclusions

<table>
<thead>
<tr>
<th>Company</th>
<th>Future</th>
<th>When</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCR</td>
<td>Leadership position will be challenged by disruptive technology.</td>
<td>5 Years</td>
<td>Will need to innovate or acquire to maintain leadership and market share</td>
</tr>
<tr>
<td>Toshiba</td>
<td>May eventually abandon market</td>
<td>5-7 years</td>
<td>IBM self checkout acquisition did not pan out. No visible innovation agenda</td>
</tr>
<tr>
<td>Scandit</td>
<td>Acquisition target by NCR</td>
<td>3 years</td>
<td>Complements existing technology</td>
</tr>
<tr>
<td>Digimarc</td>
<td>Best suited to displace barcode technology in near term</td>
<td>2-4 years</td>
<td>Acquisition target by current market leaders</td>
</tr>
<tr>
<td>Skip</td>
<td>Potential major winner</td>
<td>5 years</td>
<td>Success dependent on RFID adoption. Funded by Microsoft</td>
</tr>
</tbody>
</table>