Reading Between the Lines

BY CHARLES GERENA

How the grocery industry coalesced behind the UPC bar code

Dallas, May 1971 — the city was hosting the largest gathering of the grocery industry, the annual convention of the Super Market Institute (now the Food Marketing Institute). Reporters roamed the convention floor while friends reacquainted themselves.

R. Burt Gookin, president and CEO of the H.J. Heinz Company, was a featured speaker. He was scheduled to provide an update on an industrywide effort to devise a standard product code, something that past workgroups had tried and failed. What the attendees didn't know was that the executive would be laying the groundwork for a multiyear push into new technology, an effort that would put his industry connections to the test.

In his speech, Gookin urged every grocery manufacturer and retailer to adopt a Universal Product Code (UPC) that would help modernize the labor-intensive grocery business. "We hadn't had anything like this," recalls Thomas Wilson Jr., a former consultant at McKinsey & Company who helped Gookin and his group come up with the UPC. "Technology was stumbling along in the grocery industry. A number of good friends who were top executives came up to me afterward and said, 'This is a big deal, isn't it?'"

Indeed, the UPC and the ubiquitous bar code that represents it have transformed the supply chain, not only in the grocery industry but also in other sectors of the economy. Goods are better managed at every step, from the supplier's truck to the store's shelf to the customer's bag.

The grocery industry, which was more fragmented in the 1970s than it is today, agreed upon the system — a numerical code for storing information about a product and a symbol to represent that code — in less than three years. Business history in the United States has plenty of examples of firms that couldn't coordinate their efforts to develop an industry standard without lengthy wars, such as that between the Betamax and VHS videotape standards in the 1970s and 1980s and between the Blu-ray and HD-DVD formats in the 2000s.

What made the difference with the UPC bar code? Technological advances provided the means. Economic pressures provided the motivation to align the competing interests of grocery manufacturers and retailers behind a single standard. The pragmatism and determination of key executives like Gookin helped overcome the industry's inertia.

IBM had a major role to play, specifically its retail store systems division, now owned by Toshiba but still based in Research Triangle Park in Raleigh, N.C. The company proposed the bar code design that was chosen to represent the UPC and developed one of the first supermarket scanners in its Raleigh facilities. (IBM even commandeered a supermarket in the Cameron Village shopping center to take a publicity photo for its new scanner.)

An early bar code scanner at a Marsh supermarket in Troy, Ohio, on June 26, 1974.

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Lines in the Sand

The idea of automating the checkout process dates back to the 1930s. But it wasn't pursued until a pair of graduate students in Philadelphia, Bernard Silver and Joseph Woodland, decided to take up a challenge posed by the CEO of a local retailer in the late 1940s. They came up with a pattern of thick and thin lines to represent information, similar to how groups of dots and dashes sent over a telegraph can carry a message. The inspiration came during Woodland's trip to a beach when he idly drew lines in the sand.

In 1949, the pair filed for a patent for a bull's-eye variation of their idea that encoded information using a pattern of concentric circles. Two years later, Woodland joined IBM but was unsuccessful at selling the patent to the multibillion-dollar corporation. He eventually sold the bar code patent to Philco, which later sold it to RCA.

There were a couple of reasons why no one was interested in Silver and Woodland's idea. First, the technology didn't exist to reliably read bar codes. Second, bar codes didn't have much economic value without a standard for how that information was stored and read by a machine.

Flash forward to the late 1960s and early 1970s. Grocery retailers were being squeezed by inflationary pressures. They made less than a penny on every dollar of sales after taxes, says Bill Selmeier, founder of a virtual museum of the bar code called IDHistory.com. Selmeier helped market the UPC at IBM.

With such razor-thin margins, grocers looked to reduce costs wherever they could. According to Selmeier, labor costs of checkout clerks were a significant percentage of a store's operating expenses. "There were almost as many clerk hours as there were backroom hours," he explains. The cost of mistakes in ringing up purchases was also high, as was the cost of individually pricing goods.

The high inflation of the 1970s also complicated pricing. "Grocers wanted the flexibility to change prices without having to peel off all the price stickers on items in inventory and applying new stickers, and risking some cashiers not paying attention and charging the old price after all," says Emek Basker, an economist at the University of Missouri who has studied the economic effects of bar codes.

Around the same time, several manufacturers of front-end equipment for grocery stores began talking to their clients about modernizing the checkout process. They were working on something that could automatically read product information into a computer system — an electronic scanner. Stop & Shop and Sylvania teamed up to test a scanner that used incandescent light. RCA approached Kroger about developing a scanner that used the company's

laser and machine-readable symbol, which was shaped like a bull's-eye and based on Silver and Woodland's design.

The problem was the lack of a standard product code. Grocery manufacturers and retailers had different numbering systems, while each chain of stores had its own. "That would have been an impossible problem for the grocery manufacturers to tackle. They would have had to have inventory that was different for each chain," notes Barry Franz, a former associate director at Procter & Gamble, during an oral history interview. Franz was one of the executives who represented grocery manufacturers during the UPC's development.

Setting the Standard

Earlier in the 1960s, workgroups within the Grocery Manufacturers Association (GMA) and the National Association of Food Chains (NAFC) joined together to tackle the issue of standardization. While they agreed that something needed to be done, they couldn't agree on much else.

Manufacturers wanted a standard that would be cheap to implement, so their proposed code consisted of five digits that were equal to the item numbers they already used and five digits that would be unique to the manufacturer. Retailers wanted just a five-digit product code that would be quicker to key into an electronic cash register. "The two sides tended to meet, argue, and go home without any resolution," recalled Tom Wilson in an oral history interview recorded by IDHistory.com.

To break the impasse, NAFC president and CEO Clarence Adamy turned to McKinsey & Company, a management consulting firm that frequently worked with the grocery industry, in 1968. McKinsey came back to Adamy a few months later with recommendations for both a product code and a machine-readable symbol to represent it. The first phase of the standardization effort would require five months and $100,000. Adamy said his group didn't have the money and passed.

Instead, Adamy worked with the heads of five other trade associations in the grocery industry to put together another workgroup to do the job. The Ad Hoc Committee on a Uniform Grocery Product Code consisted of 10 well-respected executives representing the manufacturing, distribution, and retail sides of the business.

What made this standardization workgroup different was the decisionmakers were at the table from the very beginning rather than relying on technical experts who "were not empowered to solve the problem," said Franz in an oral history interview. "This was something that was going to have to be done at a fairly high level." Also, the focus was on resolving

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big-picture questions on the economic viability of a standard product code, not on the details of implementing it.

In August 1970, the ad hoc committee met for the first time at a hotel near the end of a runway at Chicago's O'Hare Airport. In addition to advisers they brought from their respective firms, they agreed to hire McKinsey to facilitate the committee's work.

Seven months later, the committee concluded that a 10-digit, all-numeric code would be economically feasible. The first five digits would identify the product manufacturer and be assigned by a central authority. The second five digits would identify the product and be assigned by the manufacturers.

Before Gookin made his big announcement at the Super Market Institute's convention, McKinsey helped drum up support. Wilson and Larry Russell presented the committee's recommendations to dozens of groups of grocery manufacturers and retailers between April and May 1971. They also met one-on-one with the industry's top executives to secure their commitment to the standardization effort — in writing. The last written confirmations came the night before Gookin's speech in Dallas.

Even before the ink was dry on those confirmations, the committee got to work on the visual representation of the UPC. In March 1971, they formed a Symbol Standardization Subcommittee chaired by Alan Haberman, chief executive of a Massachusetts-based supermarket chain, to research and evaluate the alternatives. Seven manufacturers submitted proposals, including RCA, Singer, and Pitney Bowes.

IBM also threw its hat in the ring. Back in the mid-1960s, the company had developed a 60-pound electromechanical behemoth that enabled checkout clerks to enter a code with product information for each item purchased. The company decided not to market the system. "It became obvious that the key entry system wasn't going to pay off," recalled Marvin Mann, former IBM vice president, during an oral history interview. "It would slow down the checkout operation [by] having to key in more digits than just the price."

Then the UPC effort came along. Mann began working with the ad hoc committee while IBM's development team in Raleigh started working on a scanner that would read a symbol.

The evaluation of the proposed UPC symbols and scanners took two years, focusing on both the economic viability of the solutions and how well they met the demands of a typical checkout counter. The symbol had to be as small as possible — 1.5 square inches — so that it wouldn't take up valuable real estate on the package. Yet it had to be reproduced easily using current printing techniques and read accurately regardless of how the package was positioned as it moved across the scanner.

Prototype scanners and symbols were tested at Battelle Institute's labs in Columbus, Ohio. At the same time, says Selmeier, grocery manufacturers brought their marked goods to Raleigh to verify on IBM's equipment that they could be scanned properly. "Grocery manufacturers were terrified that they were not going to make good symbols," he notes. "That would reflect poorly on their product."

The subcommittee also insisted on real-world testing at grocery stores. For example, RCA began testing a prototype at a Kroger store in suburban Cincinnati in July 1972.

The evaluation process culminated with three days of presentations to the subcommittee in January 1973. Two months later, the subcommittee agreed upon a version of the bar code developed by a team at IBM that included Joe Woodland, who was still working at the company. A press conference was held in New York to announce the winning symbol in April 1973.

The other leading contender for the UPC symbol was the bull's-eye proposed by RCA. The bar code "could be made smaller than the bull's-eye" yet still was scannable from a variety of angles, recalled Mann during a September 1999 celebration of the UPC's 25th anniversary. "And it was adaptable to widely varying printing requirements, which was the make-or-break issue for any of the proposed symbols."

The bar code could also pack more information into a given space than the bull's-eye. That density did require more computer power to decode, however. IBM's team addressed that issue during its 20-minute presentation to the symbol standardization subcommittee.

"Bob Evans pulled out of his pocket a round silicon disk" the size of a silver dollar, recalls Franz. "He said, 'You're probably wondering just what we are going to do to be able to decode [the UPC symbol]. The power of each integrated circuit on this disk is equal to some of the current moderate sized computers of today. We're going to use this power at each checkout stand.'"

The Chicken-and-Egg Dilemma

With the standards for the UPC's format and visual representation set, the really hard part began: persuading everyone in the grocery industry to use it. According to an analysis by the ad hoc committee's consultant, McKinsey & Company, manufacturers had to mark at least three-quarters of their goods with a bar code in order for the technology to be cost effective. At the same time, at least 8,000 supermarket locations, about one-quarter of

the total in operation, needed to install scanners.

But who would make the costly investment first? In general, when a technology standard is widely adopted, it tends to generate "network externalities" — economic benefits that accrue to users by virtue of the fact that many other parties are also using it. (For instance, the more people who connect to a social media network, the more valuable the service becomes to its users as a means of communicating.) But these benefits accrue over time and require implementation costs upfront.

"Grocery manufacturers did not want to redesign their labels as long as only a few supermarkets had scanners," explains the University of Missouri's Emek Basker. "Supermarkets did not want to invest in this expensive technology as long as only a few manufacturers had bar codes on their labels."

A number of factors helped the bar code reach critical mass. The ad hoc committee spent a lot of time and money winning the support of most grocery manufacturers before the UPC was announced. In the ensuing years, committee members were in positions of power to push the skittish managers back at their corporate offices.

Also, in a convenient twist of fate, the U.S. Food and Drug Administration issued requirements in 1973 for foods with added nutrients or that carried nutritional claims to have additional information on their labels. Since many processed foods were required to have updated packaging, it was easier to justify adding a UPC bar code at the same time.

As for the supermarket chains, store managers weren't convinced the productivity savings of bar codes would outweigh the substantial costs of implementation, especially at smaller chains. So McKinsey devised a compelling business case that focused on two areas where retailers could achieve short-term, quantifiable savings from implementing the UPC bar code — reduced labor costs at the checkout stand and reduced costs associated with pricing and repricing goods. (The grocery industry was expected to reap $1.4 billion in "hard" savings, with most of the savings accruing to retailers.) Then, the committee members toured the country to present their case.

McKinsey also identified long-term, harder-to-quantify savings from improvements to processes, such as inventory management. "The grocery manufacturer had much better information," says Selmeier. "Because of the cost of data collection, all the retailers knew was how many cartons of what product they had shipped to a store." Still, McKinsey downplayed these "soft" savings since the ad hoc committee knew that retailers would be far more interested in boosting their bottom line immediately.

Beyond the grocery industry, unions opposed the adoption of the UPC bar code because they feared it would lead to a lot of people losing their jobs. Consumer advocates feared that goods would be mispriced and the technology could be used to track people's purchases.

Eventually, both groups worked together to urge the passage of item pricing legislation. By 1976, California, Michigan, New York, Connecticut, Massachusetts, and Rhode Island required supermarkets with scanners to continue labeling individual items with price stickers.

"The net effect of the legislation was the reduction of potential benefits of the UPC, thereby lengthening the payback period for the investment in scanner technology," noted a 1999 report by PricewaterhouseCoopers published on the 25th anniversary of the UPC. "With the extremely high cost of capital and unstable economic environment of the late 1970s and early 1980s, a number of grocery chains decided to hold off on investing in the new technology."

According to the PricewaterhouseCoopers report, it would take a normalization of economic conditions in the latter part of the 1980s as well as a "drop in computing costs, improvements in scanner technology [and the] elimination of price-marking legislation" for scanners to become widely used. When Kmart and Wal-Mart started requiring apparel makers to mark their goods with bar codes during the 1980s, UPC registrations spread like wildfire throughout the broader retail industry.

In a November 2004 paper, economist James Mulligan at the University of Delaware and Nilotpal Das, a former visiting professor at Hood College, examined the adoption of scanners by supermarkets. They concluded that, in certain situations, the diffusion of new technology is slower when it improves the quality of service rather than the cost of production. Typically, a firm is motivated to do something new when it sees competitors reaping cost savings. But when a new technology is actually more expensive but adds value to an existing product, firms may stay on the sidelines if they believe their customers wouldn't respond to that added value.

This phenomenon was observed in the adoption of expensive high-speed ski lifts during the 1980s and 1990s. Resort owners didn't install them to reduce their costs but to cater to avid skiers and those who highly valued their time.

Das and Mulligan also found this tendency in the diffusion of scanner technology. During the mid-to-late 1970s when NCR and IBM released their first scanners, stores in higher-income areas were more likely to adopt them, perhaps because some of those stores saw a boost in sales from consumers who placed a high value on their time and liked the faster checkout process. But stores didn't see lower costs

initially. Especially in communities with lower-income families that value price over speed of service, store managers didn't think scanners were worth the expense. It wasn't until IBM and others released scanners in the 1980s that could read bar codes more accurately — even those that were partially damaged, crinkled, or wet — before supermarkets could reap savings that could be passed along to price-sensitive consumers.

In the subsequent decades, consumers have benefited from the labor savings yielded by the adoption of the UPC bar code. Economist Emek Basker found through her research, detailed in a June 2013 paper, that "grocery prices fell considerably in the first decade of checkout automation. The largest price effects are for produce and meat, perishable items over whose prices store managers tend to have the most discretion."

Meanwhile, the grocery industry has realized the hoped-for hard savings from reduced labor costs. It has also reaped some of the soft savings related to process improvement. The UPC bar code has empowered grocery retailers, enabling them to design displays to optimize item movement or stock up on a popular item before the manufacturer realizes that it is in high demand.

Grocery manufacturers have been empowered as well. Every time a bottle of Head & Shoulders is scanned by a Wal-Mart associate, information flows from the checkout stand directly to Procter & Gamble. The company uses that information from Wal-Mart to determine if additional shampoo needs to be shipped to a particular location and if the production line needs to be ramped up.

Basker notes, "Bar codes started an entire revolution at the back end of supermarkets."   **EF**

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