TECHNOLOGICAL PROFILE OF SHOPPING CENTERS:

Present and Future Use

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Overview

The availability of technology is exploding in the world today. Utilization of new technologies will cause retail stores and shopping centers to be very different places in the future. Today, cost is one of the primary deterrents to using the technology available. In the future decreased costs will make the implementation of technology much more accessible to all retailers and shopping centers, regardless of size.

Before determining which technologies they wish to utilize in any project, shopping center developers and owners must first be aware of what technologies are available. In this study, the researchers identified 66 technologies and grouped them into the following nine categories: 1) customer tracking and data-base marketing, 2) technology as entertainment and visual merchandising, 3) technology to provide information and shopping assistance for customers, 4) direct broadcast satellite technology, 5) information technology for communications and data sharing, 6) technology for energy management, 7) technology for security, 8) on-line shopping services, and 9) technology for resource conservation/recycling.

For this study, completed questionnaires were received from 26 firms representing 356 malls across the country. Owner/developers were asked questions related to the number of their malls currently utilizing each of the 66 technologies. In addition,

where less than half their properties utilized the technologies, firms were asked to respond to how likely they would be to implement the specific technology in at least 50% of their properties within the next five years.

Current usage indicates technologies being used most heavily are in operational areas such as budgeting and report generation, energy management, security, and resource conservation. Lightest usage is in customer-servicing areas such as customer tracking, data-base marketing, entertainment, shopping assistance and on-line shopping services.

Significant growth is likely over the next five years in the use of several technologies in both the operational and customer-servicing areas. The greatest expected growth was reported for on-line home pages, on-line shopping, informational computer-based kiosks, satellite communications and computer connections between mall managers and tenants.

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■ Background: Technologies Available

Shopping centers and retail stores will be very different places in the future; one reason will be the exploding use of new technology. Several retail analysts predict that shopping centers in the future will be major entertainment centers - giant community gathering places that offer much more than just shopping (Lynch, 1992). The use of technology will be highly visible in this environment.

Today, only the "giants" in retailing are able to afford to implement cutting-edge technology. Tomorrow, drastically lower costs will make the technology available to almost everyone. The competitive edge, however, will go to those shopping centers and retailers who can use the technology most effectively. Successfully implemented, technology will allow personalized services to be delivered to almost every customer, and it will also allow retailers and shopping center managers to differentiate themselves in a crowded marketplace.

How has technology already been implemented by shopping centers and retailers? What does the future hold? Some examples of how technology is already being implemented are described in the sections which follow.

Customer Tracking and Data-base Marketing Technology

One of the most widely used applications of computer and multi-media technology is in the area of customer tracking. Existing technology provides shopping centers and their tenants with the ability to understand and anticipate customer behavior better. Valley View Center (managed by LaSalle Partners) in Dallas has implemented computer-based kiosks to institute a Smart Shoppers Club, a high-tech customer-loyalty program. Customers complete an application providing both demographic and psychographic information about themselves. They are then assigned a PIN number (similar to ATM machines) which they enter at a computerized kiosk each time they visit the mall. When customers enter their numbers, they become eligible for prizes, and each visit counts toward frequent shopping points which can also be redeemed for prizes and discounts. In addition, the computer provides customers information about mall events and special sales, and even dispenses coupons. More shopping centers may be using such kiosks in the future. Their cost has come down significantly - by about 50% in the last two years (Rouland, 1994).

Futurists predict that technology will eventually be available to allow shopping centers and retailers to track every customer that enters the shopping center, profiling their purchases, average dollars spent, food court patronage and loyalty to specific stores, products and brands (Kastner, 1994).

In some stores that use shopping carts, infrared transmitters can be attached to the carts, with a grid of receivers in the ceiling picking up the transmissions as customers shop. A thermal map of the sales floor can be produced revealing "hot" and "cold" spots. When these "cold spots" are addressed, traffic has been shown to increase 30% (Robins, September, 1994).

This technology also has the capability of being expanded to interact with the POS register when customers arrive at the checkout. The data can be read by the terminal to determine the actual path of the customer while in the store, amount of time the customer spent in the store by location and the amount of time spent in front of specific displays. All of these data can then be matched against the dollars spent and the types of products purchased.

Technology as Entertainment and Visual Merchandising

Using technology to entertain customers is another way that shopping centers and retailers can differentiate themselves. The use of entertainment and visual merchandising by shopping centers is nothing new. In fact, these merchandising techniques have been a part of most shopping centers since their beginnings. Play areas for children, food courts,

fashion shows, mall exhibits and displays or having Santa Claus make an appearance are techniques almost all shopping centers have used. However, the use of technology to attract and entertain customers has not been as widely utilized.

As consumers' buying behaviors change, entertainment is growing in demand. Both retailers and owners/developers of shopping centers are attempting to focus on entertainment as a means of attracting customers. The success of Mall of America and The Forum Shops in Las Vegas are just two examples of shopping center development marrying retail environments with entertainment. Some retailers are also using technology to achieve this purpose. Many retailers, such as Tandy's Incredible Universe and Disney Stores, encourage consumers not just to shop, but to interact with the technology ("Linking retailing to fun," 1995).

Another entertainment use of technology has been the development of a video network that can be beamed directly into a shopping center's food court. Through unique programming, the network can inform, entertain and, most importantly, place before potential customers a vast selection of merchandise that can be immediately purchased while they are at the shopping center (Kastner, 1994). The use of virtual reality will be another technology available to make shopping more entertaining. For example, customers who purchase golf clubs can be taken into an electronic theater where they can "try out" the clubs at golf courses around the world. Even their swing with the clubs can be analyzed by computer. Retailers and shopping centers are also beginning to experiment with holograms as a means of producing "virtual" displays.

Both shopping centers and retailers are using technology to entertain customers, giving them a reason to visit the shopping center. If customers are entertained, they will stay longer and possibly buy more ("Bringing fantasy into the mall," 1993).

Information and Shopping Assistance

Some shopping centers and retail stores have developed computerized kiosks that track items purchased by individual customers. At shopping centers, the potential exists to have inventory and promotional information at the kiosk for all the stores. Based on this stored information, customers are able to obtain a downloaded list of promotions or other products that would be of interest to them based on their past purchases. The computer could also suggest coordinating items that would go with past or present purchases.

The same technology can be used by customers who are buying a gift for someone who has shopped the stores before. A similar list

could be generated for the gift purchaser. Some retail stores, like Target, are computerizing the bridal registry in a similar manner. The future bride and groom are given hand-held scanners to enter into a data bank the number of any item they would like to receive as a wedding gift. The store is then able to provide a list of possible items to customers interested in buying them a gift. Similar technology could be adapted by shopping centers for all stores at the center (Chandler, 1994).

Some retailers are implementing a "low-tech" technology that has been around for years - the pager. Drugstores are assigning pagers to pharmacy customers to enable them to do other shopping in the store while their prescriptions are being filled. Pager systems are also being tested at automotive service centers, gift wrap counters and one-hour eyeglass centers. For many retailers, a more important use of pagers is as unobtrusive tools to contact employees without using public address systems (Robins, 1995).

Direct Broadcast Satellite Technology (DBS)

Many retailers and shopping centers are already utilizing DBS technology. J. C. Penney uses satellites to hook corporate buyers to store merchandisers. Periodic meetings are held "over the air," with store personnel becoming involved in the buying process, thus giving them immediate input into buying decisions. Shopping centers could employ similar technology for vendors to reach the center's smallest tenants.

More than 40% of the largest U.S. corporations already use satellites for video conferences; steadily declining prices have been driving growth in this area of technology. Today, less than $30,000 can buy an electronics package enabling hook-up with video conferencing networks. Transmission costs, which reached into the thousands of dollars per hour a decade ago, now equal only two to five times the rate for regular phone service. Most companies justify their initial investments in this technology with projected savings from their travel budgets. Video conferencing typically allows businesses to reduce travel costs anywhere from 20 to 50% (Boroughs, 1995).

Information Technology: Communications and Data Sharing

One use of information technology by retailers has been in the area of employee training. Major retailers like Dillards, Sears and Broadway Stores have already implemented multimedia to train new employees. Results have shown that training time has been reduced by 50%. Multimedia computer-based training combines the use of text, graphics and audio with support from full motion video, animation and still images.

Although invisible to most customers, other technologies may have a greater impact on the future of retailing. More effective labor

scheduling systems are available, and through technologies like Quick Response, stores are able to manage inventories better and have speedier communications with their suppliers (Booker, 1994).

Most commonly, businesses use information technology software to computerize operations. Software packages are available to use with preparing budgets, developing forecasts, analyzing marketing efforts, and maintaining maintenance/repair schedules on major equipment. Some retailers even use software packages to schedule employees. Extensive use of desktop publishing technologies has been made by all types of businesses to prepare reports and develop promotional materials.

Energy Management

Retailers and shopping centers are also implementing technology as an energy-savings tool. Dehumidification and simplicity of HVAC system designs are the two most cost-effective ways to condition the air inside large stores.

Eckerd's Drug Stores has reduced energy costs by installing automatic setback systems in its stores. Systems automatically adjust heating and cooling. Management estimates that the systems have resulted in a 10%–12% annual reduction in energy costs ("Eckerd drug reduces energy costs," 1995).

Security

In the area of security, technology has been available to retailers and shopping centers for years. Closed-circuit TVs, motion sensors, more effective lighting in parking lots, smoke detection systems and keyless entry systems are just a few of the areas where technology has been adapted to improve security. In most of these areas, however, the expense of installing such new technologies has been a huge deterrent.

On-Line Shopping Services

The use of technology may also have a down side for shopping centers and retailers - electronic shopping may keep more and more customers at home. Many on-line shopping services are emerging where customers can select their purchases, pay by credit card and have a regional distribution center fill the order and send it directly to them within days. Do such services have the potential of becoming the shopping centers of the future?

Electronic shopping via PC is still in the early stages of growth. As the technology advances, questions remain about when, if ever, significant numbers of consumers will turn to these new formats to shop. To alter consumer buying behavior significantly, on-line shopping will have to provide better, faster, cheaper, or more entertaining shopping experiences (Reda, 1995).

Only a small fraction of those consumers with on-line capabilities are currently making purchases on-line. Currently, about a third of U.S. households have a PC. Among these computer owners, approximately 12% have an on-line subscription, and only a small fraction of these consumers are making on-line purchases. For example, in some locations, Pizza Hut delivers pizzas from Internet orders. But at stores utilizing this technology, only 2–10 pizzas are sold through cyberspace each week (Fox, 1995).

Resource Conservation/Recycling

Retailers and shopping center owners/developers have also looked to technology in the area of resource conservation. Firms make use of computer-controlled sprinkler systems, use cardboard compactors, and recycle other waste such as plastic, glass, and newspaper. At two of its stores in New York, J. C. Penney has installed environmentally-friendly natural gas units which dehumidify and cool indoor air without the use of any potentially hazardous coolants. These systems have allowed Penney's to realize energy savings and provide improved store air quality for employees and customers ("Penney's Gas System," 1993).

Today's technology presence in shopping centers is exciting, but the future will probably be even brighter. As shopping center owners look for better ways to attract and service customers, and as customers look for faster, easier, more convenient, and more entertaining ways to shop, technology will become a much more important part of the shopping experience.

■ Research Questions

It is clear that the array of technologies available to and being used by some retailers and shopping centers is impressive. However, there is little information as to how widespread the use of specific technologies is and to what degree this use will increase in the future. For this reason, the study reported in this article was undertaken to address the following questions:

1. What technologies are available for implementation by malls?
2. What is the current level of usage of these technologies by malls?
3. Which of these technologies are owners and operators of malls more likely to implement extensively in the next five years?
4. Which of these technologies are owners and operators of malls least likely to implement in the next five years?
5. What benefits and problems are attributed to the use of these technologies?

■ Methodology

Survey Design

The researchers attempted to include all available technologies in their survey. The technologies listed in survey questions were based upon a thorough review of previous studies, examination of industry literature, and input from shopping center managers and executives. The final questionnaire consisted of nine technology categories containing a total of 66 questions about the current and future use of specific technologies. The nine categories included were Customer Tracking and Data-Base Marketing, Entertainment and Visual Merchandising, Information and Shopping Assistance, Direct Broadcast Satellite Technology (DBS), Communications and Data Sharing, Energy Management, Security, On-line Shopping Services, and Resource Conservation/Recycling.

The initial survey instrument was mailed to five shopping center executives across the country. These participants were asked for comments related to whether or not other technologies existed that were being used by shopping centers. They were also asked to comment on the clarity and conciseness of the survey questions. These comments were incorporated into the final questionnaire.

Firms participating in the study were asked to indicate 1) the number of malls they represent, and 2) the number of their malls currently utilizing each of the 66 technologies listed. For each technology utilized by less than half their properties, firms were to respond as to how likely they would be to implement this technology in at least 50% of their properties within the next five years. They indicated their likelihood using a scale of "1 - Not at All Likely" to "5 - Very Likely."

Space was provided at the end of the survey for firms to list any additional technologies being used by their malls which were not included on the survey. In addition to the mailed survey, follow-up calls were made to selected participants to obtain further in-depth information and comments concerning their use or lack of use of specific technologies.

Sample Selection

Firms selected to participate in this study were chosen using a variety of approaches. First, those firms with representation on the ICSC Research Advisory Task Force were sent a personalized letter and questionnaire. Second, a similar approach was used with the remaining 10 largest mall developers. Third, a random sample of mall developers was selected from the *1995 Directory of Major Malls* using an every *nth* page and

every *nth* entry approach. If the *nth* entry represented either a property of a developer already selected or a smaller property which did not appear to be an enclosed center, the entry was not used.

This sampling approach was used until 150 different owners/developers of enclosed shopping centers were identified. The objective in using the sampling and questionnaire design was to gather data only on larger, enclosed shopping centers. Other than these sampling criteria, no attempt was made to stratify the sample according to mall size, age or location.

Data Collection

A package containing a letter of explanation, questionnaire, and prepaid return envelope was sent to each selected firm. The package was stamped with "Important ICSC material." To help increase the response rate, a flyer was included announcing a chance to win a 19-inch color TV if the survey were returned by the established deadline. Follow-up efforts regarding non-respondents were made with the 10 largest firms and with those having representation on the ICSC Research Advisory Task Force.

■ Findings

The following findings are based on a tabulation of all returned surveys. Results are divided according to the nine categories of technology previously identified. A discussion of these findings follows.

Sample

Completed questionnaires were received from 26 firms representing 356 malls. As indicated in Table 1, 11 (42%) of the firms participating represented more than 10 malls and 15 (58%) represented fewer than 10 malls. The average firm represented 13.7 malls, with the smallest firm representing one mall and the largest representing 79 malls. The 26 firms participating represent a response rate of 17.3%, an acceptable

TABLE 1. PROFILE OF SAMPLE

Number of firms:	26	Number of firms with *more than* ten malls:	11	42%
Number of malls:	356			
Average firm size:	13.7 malls	Number of firms with *fewer* than ten malls:	15	58%

rate given the method of collection and the length of the questionnaire, but lower than expected in light of ICSC sponsorship.

Customer Tracking and Data-Base Marketing

In this area of technology, firms were asked about their use of 1) computer-based kiosks, 2) devices to track customer movement in the mall, 3) electronic devices to track numbers of customers, and 4) preferred customer cards issued by the mall.The percentage of malls currently utilizing each of these technologies and the likelihood of future use are presented in Table 2.

As reported, all of these technologies are being used in approximately 15% of the malls represented by the firms responding. The one exception is in the use of electronic devices at entrances and exits to record the number of customers. Here, participating firms reported using this technology at 35.17% of their malls.

In terms of future use, over half of the firms having this technology in fewer than 50% of their malls reported that they are "likely" to "very likely" to implement some form of customer tracking or data-base marketing in at least half of their properties in the next five years. The two exceptions are in the future use of transmitters to track customer movement in the mall (31.10%) and preferred customer cards (43.42%).

Entertainment and Visual Merchandising

The use of technology as entertainment and visual merchandising falls into several categories. These include 1) technology to entertain customers, 2) interactive entertainment attractions, 3) video networks for food courts, 4) interactive display window areas, and 5) virtual reality amusement areas. However, research findings presented in Table 3 indicate that few malls are utilizing any of these forms of technology. Currently, the largest usage by malls (28.76%) is to entertain customers with exhibits using technology, such as automated holiday decorations. In addition, 67.83% of the owners/developers having this technology in fewer than 50% of their malls report that they are "likely" to "very likely" to implement this technology in at least half of their malls in the next five years.

Only 3.12% of the firms reported currently using interactive entertainment attractions, such as aquariums, as a drawing card for new customers/tourists. However, 63.72% reported they are "likely" to "very likely" to implement such projects in the next five years.

In the other four categories, fewer than 10% of the firms were currently utilizing the technology, and in all categories more than 50%

TABLE 2. CUSTOMER TRACKING AND DATA-BASE MARKETING TECHNOLOGY

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Computer-based kiosks:							
• to track customer loyalty/shopping frequency	14.74	23	16.85	32.23	36.26	9.16	5.49
• to develop customer profiles	14.74	23	11.36	37.00	35.90	10.26	5.49
• to analyze customer attitudes & opinions	14.74	22	10.66	37.87	37.13	9.19	5.15
Infrared transmitters or other devices to track customer movement in the mall	14.28	21	31.44	37.46	24.41	6.69	0.00
Electronic devices at entrances/exits to record number of customers	35.17	17	2.01	21.29	58.63	17.67	0.40
Preferred customer card issued by the mall	15.16	22	9.56	47.01	33.86	3.19	6.37

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 3. TECHNOLOGY AS ENTERTAINMENT AND VISUAL MERCHANDISING

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Technology to entertain customers (e.g., automated or interactive holiday decorations, mall exhibits)	28.76	18	8.91	23.27	58.91	3.47	5.45
Interactive entertainment attractions as a drawing card for new customers/tourists	3.12	26	21.34	14.94	21.04	37.80	4.88
Video network for food court showing national or local programming	0.89	26	6.12	48.69	28.57	5.54	11.08
Interactive display windows areas	7.51	24	25.16	52.94	8.82	13.07	0.00
Holograms in dislay area	2.34	25	31.33	59.64	9.04	0.00	0.00
Virtual reality amusement areas in the mall	5.12	25	17.75	34.02	12.72	29.88	5.62

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

reported they were not likely to implement that technology during the next five years. Within these four categories, owners/developers would be more likely to implement virtual amusement areas.

Information and Shopping Assistance

The use of technology to provide information and shopping assistance for customers falls into the following categories: 1) computer-based kiosks, 2) mobile telephones, 3) transportation provided for customers outside the mall, and 4) transportation provided for customers inside the mall.

Research findings presented in Table 4 indicate that malls are not currently utilizing any of these technologies to a significant degree. The largest usage (31.67%) was by malls to provide transportation for elderly or disabled customers once they were inside the mall. Yet, 78.02% of the owners/developers having this technology in fewer than 50% of their malls report they are not likely to implement it in at least half of their malls in the next five years.

Only 11.29% of the firms reported currently using computer-based kiosks to provide information and directions to customers. However, 76.58% reported they are "likely" to "very likely" to implement such projects in the next five years.

Currently, only 10.26% of the firms reported using computer-based kiosks to provide customers with information on product availability and instant couponing. Again, a large percentage (69.49%) reported they were "likely" to "very likely" to implement such kiosks in the next five years.

Few malls currently have computer-based kiosks to track customer purchases (7.50%), to provide gift ideas (11.70%), or to be used by customers to make an actual purchase (4.70%). And such kiosks are not likely to have widespread use in the future. For all three of these categories, around 60% reported they were not likely to utilize computer-based kiosks for these purposes in the next five years.

None of the firms responding indicated that they provided mobile telephones for shopping center customers to rent to keep in touch with members of their party. In addition, nearly 70% indicated that they were not likely to install such phones in the next five years.

Only about 10% of the firms responding indicated they currently provide transportation for customers outside the mall. Again, this technology will probably not be a priority with owners/developers. Two-thirds indicated they were not likely to provide such transportation in the next five years.

TABLE 4. INFORMATION AND SHOPPING ASSISTANCE

Technology	Current Use	Future Use				
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]			
			Not At All Likely		*Likely*	*Very Likely*
			1	2	3	4	5
Computer-based kiosks:							
• to track customer purchases to provide list of items to complement those purchases	7.50	24	47.20	18.94	14.29	16.15	3.42
• to provide gift list of ideas based on previous purchases of customers	11.70	23	31.65	27.53	20.89	16.46	3.48
• used by customers to make purchases	4.70	25	22.90	41.16	19.42	6.96	9.57
• to provide information to customers	11.29	24	5.70	17.72	55.38	9.81	11.39
• which provide customers with information on product availability/instant couponing	10.26	22	17.61	12.89	55.03	10.06	4.40
Mobile telephones that customers can rent	0.00	26	28.21	41.60	29.91	0.28	0.00
Transportation provided customers **outside** the mall	9.58	24	13.13	52.84	16.42	11.34	6.27
Transportation provided elderly/disabled customers **inside** the mall	31.67	17	33.70	44.32	6.23	15.38	0.37

[1]Number of firms reporting having this technology in fewer than 50% of their malls.

[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

Direct Broadcast Satellite Technology (DBS)

The use of direct broadcast satellite technology (DBS) falls into two broad categories: 1) the mall providing satellite communication services to tenants, and 2) the use of satellite communication by mall management. As shown in Table 5, firms are not currently using this technology to any significant degree.

Only in the area of DBS communication to transmit mall/shopping center data was there any significant usage. Of the firms reporting, 78.89% use satellite communication for the transmission of mall data. Almost 70% of the owners/developers having this technology in fewer than 50% of their malls report that they are "likely" to "very likely" to implement DBS for this purpose in at least half of their malls in the next five years. In addition, over two-thirds of the firms indicated that during the next five years, they would be utilizing DBS technology for video conferencing and management updates. Currently, none of the firms indicated that they were using DBS technology for employee training, and over half responded that they were not likely to implement such technology in the future.

Only about one-sixth of the firms currently provide satellite communication services to tenants. Again, widespread usage is not anticipated in the future. More than half the respondents indicated they were not likely to implement such satellite services in the next five years.

Communications and Data Sharing

Of the nine technology categories surveyed, the most extensive use of technology by shopping centers and malls was in the area of information technology. Categories examined in this area included 1) computer connections between developer and mall management, 2) computer connections between mall management and tenants, 3) paging systems, 4) utilization of information technology software, 5) use of desktop publishing technologies, and 6) use of radio equipment to maintain contact with shopping center employees. Findings are reported in Table 6.

Of the firms responding, 68.4% reported utilizing computer connections between developer and mall management for data sharing and communications. Of those firms not currently using this technology in at least half their malls, 83.33% indicated they are "likely" to "very likely" to implement such computer connections in the next five years in at least half their malls. However, less than 10% of the firms currently have computer connections between mall management and tenants.

TABLE 5. DIRECT BROADCAST SATELLITE TECHNOLOGY (DBS)

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Satellite communication services to tenants for:							
• employee training	14.46	23	11.97	40.49	35.21	1.06	11.27
• video conferencing	13.93	23	12.98	40.00	34.74	1.05	11.23
• new product introductions	17.63	22	11.43	40.00	36.07	1.07	11.43
• management updates	17.10	22	10.07	41.73	35.25	1.44	11.51
• transmission of store data	17.63	22	10.37	41.11	31.11	4.81	12.59
Satellite communication by mall management for:							
• employee training	0.00	26	7.98	49.00	24.22	6.84	11.97
• video conferencing	3.70	25	3.47	21.10	52.02	11.27	12.14
• management updates	3.70	25	4.04	27.21	31.25	16.18	21.32
• transmission of mall data	78.89	24	3.76	26.32	39.85	8.27	21.80

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 6. COMMUNICATIONS AND DATA SHARING

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Computer connections via telephone lines between developer and mall management	68.40	7	8.33	8.33	16.67	33.33	33.33
Computer connections via telephone lines between mall management and tenants	9.26	24	16.38	14.37	46.26	16.95	6.03
Paging system in the mall	66.95	8	57.95	14.77	18.18	9.09	0.00
Information technology software							
• to prepare budgets	94.32	1	0.00	0.00	0.00	100.00	0.00
• to develop forecasts	79.51	5	0.00	4.55	81.82	13.64	0.00
• to analyze marketing efforts	57.75	9	0.00	0.75	63.16	17.29	18.80
• to maintain servicing/repair schedules	55.95	11	0.00	39.71	1.47	27.45	31.37
• to maintain maintenance schedules	52.25	12	0.00	39.51	1.46	27.80	31.22
• to perform automated labor scheduling	30.03	17	3.86	34.76	39.48	16.31	5.58

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 6. COMMUNICATIONS AND DATA SHARING *(cont'd)*

Technology	Current Use	Future Use				
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]			
			Not At All Likely		*Likely*	*Very Likely*
			1	2	3	4	5
Use of desktop publishing technologies							
• to prepare reports for communication with tenants	72.27	6	0.96	0.00	15.38	17.31	66.35
• to develop promotional materials	69.17	7	0.93	0.00	16.67	16.67	65.74
Use of radio equipment to maintain contact with maintenance staff, security, etc.	90.79	1	0.00	0.00	0.00	0.00	100.00

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

Again, usage is expected to increase dramatically in the next five years, with nearly 70% of the firms indicating they would install this technology in at least half of their malls in the next five years.

Two-thirds of the firms reported having paging systems already in place. Most of the other firms were not likely to implement them in the future.

Over half the firms reported using information technology software for some purpose. In fact, all but one firm indicated they currently use computer software to prepare budgets, and all but five indicated they use software to develop forecasts. Only in the area of performing labor scheduling is software not being used by at least half of the respondents. In this instance, 30.03% currently use labor scheduling software; however, over 60% indicated they were likely to implement its usage in the next five years.

Firms reported similar usage and plans for desktop publishing technologies. In fact, nearly two-thirds of the firms not currently using this software reported they would very likely be doing so in the next five years.

All but one of the firms responding reported currently using radio equipment to maintain contact with mall/shopping center employees. That firm reported they would very likely begin using such radios in the next five years.

Energy Management

In determining the use of technology for energy management, owners/developers were asked about their use of 1) automatic setback systems controlled at the corporate level, 2) automatic setback systems controlled at the local level, 3) computerized HVAC systems, 4) computerized diagnostic systems, and 5) more efficient lighting. Findings are presented in Table 7.

Overall, firms reported use of these technologies in 40% or more of their malls. The most frequently used technologies reported are automatic setback systems at the local level (83.15%) and more efficient lighting (77.06%).

Of the 10 firms not using more efficient lighting in at least 50% of their malls, approximately 99% report that they are likely to do so in at least half their malls in the next five years.

Security

The use of technology to enhance security falls into the following categories: 1) closed circuit TV, 2) motion sensors, 3) personal security

TABLE 7. ENERGY MANAGEMENT

Technology	Current Use	Future Use				
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]			
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Automatic setback systems to control HVAC with controls at the **corporate level**	39.48	15	70.00	1.11	17.22	11.67	0.00
Automatic setback systems to control HVAC with controls at the **local level**	83.15	8	44.74	0.00	37.72	17.54	0.00
Computerized HVAC systems to analyze **energy** load demands & peak usage periods	55.03	11	0.00	22.86	45.71	28.57	2.86
Computerized systems to perform **diagnostics** on HVAC equipment	41.68	13	32.69	10.90	26.92	29.49	0.00
More efficient **lighting**	77.06	10	1.12	0.00	66.29	13.48	19.10

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

devices for shoppers, 4) external lighting, 5) new technologies for exit signs, 6) smoke and sprinkler monitors, 7) computerized tracking of security patrols, 8) ultraviolet beams, and 9) keyless entry systems.

As reported in Table 8, responses of participating firms show significant variance in the use of these technologies. The technologies currently being used in at least half of the malls are more effective lighting in the parking lots (56.86%), equipment to monitor smoke detectors and sprinkler systems (74.56%), and computerized equipment to track inspections by security patrols (60.65%). Little use is reported for motion sensors (7.43%), ultraviolet beams (9.89%) and keyless entry systems (13.46%). None of the responding firms was using personal security devices for children.

The security technologies most likely to be implemented by those firms not currently making widespread use of them are equipment to monitor smoke and sprinkler systems (100.00%), more effective lighting in the parking lots (88.51%), new technologies for exit signs (78.99%), closed circuit TVs in the parking lots (59.00%), and computerized equipment to monitor security patrols (56.50%).

On-line Shopping Services

In assessing the usage of Internet technology, mall owners/developers reported on their current use of 1) on-line home pages to provide information to customers and 2) on-line shopping for customers. As reported in Table 9, the percentage of malls utilizing these technologies is still small - 11.01% with home pages and 4.63% with on-line shopping services. However, of the firms currently not using these technologies in at least half of their properties, over 80% report it is "likely" to "very likely" that they will establish an informational home page and an on-line shopping service for at least 50% of their malls in the next five years.

Resource Conservation/Recycling

The profile of current and future usage of technologies to conserve natural resources is presented in Table 10. The categories of technology surveyed included the use of 1) water control systems, 2) water recycling systems, 3) cardboard compactors, 4) recycling for tenants, and 5) water source heat pumps.

Of these technologies, participating firms reported most frequent use of centrally located trash compactors for tenants (60.88%), time- or usage-controlled sprinkler systems (58.31%), and solid waste recycling (plastic, glass, etc.) for tenants (52.76%). Limited use was reported

TABLE 8. SECURITY

Technology	Current Use	Future Use				
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]			
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Closed circuit TV in mall	26.98	18	19.17	26.32	31.95	15.04	7.52
Closed circuit TV in parking lot	27.15	18	19.54	21.46	37.55	13.79	7.66
Motion sensors	7.43	24	8.44	64.29	16.56	7.14	3.57
Personal security devices for shoppers to attach to children	0.00	25	24.17	52.27	22.96	0.00	0.60
More effective lighting in parking lots	56.86	11	0.68	10.81	11.49	47.30	29.73
New technologies for exit signs (e.g., incandescents and light-emitting diodes)	40.92	15	8.82	12.18	63.87	10.08	5.04
Equipment to monitor smoke detectors/sprinkler systems	74.56	6	0.00	0.00	95.83	4.17	0.00

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 8. SECURITY *(cont'd)*

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Computerized equipment to track inspections by security patrols	60.65	17	3.00	40.50	44.00	4.50	8.00
Ultraviolet beams	9.89	21	31.45	51.26	13.52	0.31	3.46
Keyless entry systems	13.46	22	23.82	56.74	0.94	5.96	12.54
Keyless entry systems that monitor or restrict employee access	7.24	23	25.94	43.44	12.19	5.94	12.50

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 9. ON-LINE SHOPPING SERVICES

Technology	Current Use	Future Use					
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]				
			Not At All Likely		*Likely*		*Very Likely*
			1	2	3	4	5
On-line home page to provide information to customers (e.g., types of store, hours, etc.)	11.01	21	8.28	9.60	0.33	66.56	15.23
On-line shopping for customers	4.63	22	10.93	7.72	14.79	58.52	8.04

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 10. RESOURCE CONSERVATION/RECYCLING

Technology	Current Use	Future Use				
	Percent Utilizing	Number of Firms[1]	Likelihood that technology will be implemented in at least half of malls in next five years[2]			
			Not At All Likely 1	2	*Likely* 3	4	*Very Likely* 5
Water control systems in lavatories (e.g., automatic faucet cutoffs and flushing)	36.11	16	4.82	28.07	39.91	8.33	18.86
Time or usage controlled **irrigation/sprinkler systems**	58.31	11	1.73	27.17	34.68	36.42	0.00
System to **recycle gray water** from mall	9.42	20	23.21	51.43	6.07	18.57	0.71
Cardboard compactors for tenants	60.88	7	0.94	66.04	13.21	0.00	19.81
Providing for other **solid waste recycling** for tenants (e.g., plastic, glass, etc.)	52.76	11	0.54	13.51	76.76	5.95	3.94
Water source heat pumps	20.63	16	22.95	9.84	44.67	22.54	0.00

[1]Number of firms reporting having this technology in fewer than 50% of their malls.
[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

for systems to recycle gray water (9.14%), water source heat pumps (20.63%), and water control systems (36.11%).

Except for the use of cardboard compactors and systems to recycle gray water, firms not currently using the other technologies in half of their properties report a strong likelihood that these technologies will be implemented in at least 50% of their properties in the next five years.

■ Discussion

Current Use

Based on responses of participating firms, a profile of current usage indicates technology being utilized the most heavily in operational areas such as budgeting and report generation, energy management, security, and resources conservation. Lightest usage is in customer-servicing areas such as customer tracking, data-base marketing, entertainment, shopping assistance, and on-line shopping services.

This profile is not surprising for several reasons. First, most of the technologies for operational usage have been available for a much longer time than many of the emerging customer-servicing technologies. Second, many of the customer-servicing activities have historically been viewed as the responsibility of individual retailers, with mall management being more responsible for providing safe and comfortable common areas, managing the tenant mix, and controlling costs. Third, only recently have intensifying competitive pressures and shifting buying habits begun to force malls to focus greater attention on customer-servicing activities.

Those technologies which are currently being used by fewer than 10% of the mall properties responding to the survey are summarized in Table 11. This list generally reflects new, emerging technologies (e.g., on-line shopping services), technologies dealing with activities generally seen as the responsibility of individual tenants (e.g., motion sensors); or technologies addressing a limited, specific problem (e.g., personal security devices or mobile telephones).

With trends emerging toward providing more customer-servicing activities, there are surprises in the usage of some specific technologies. First, only 15.6% of the malls reported offering preferred customer-card programs at a time when these programs are seen as very effective tools in developing relationship marketing. In fact, many bookstores, restaurants, and music stores have already effectively implemented such programs, resulting in the ability to better profile and track frequent

TABLE 11. TECHNOLOGIES WITH LOW CURRENT USAGE

Technology	Less Than 10% Usage
Technology to entertain customers	
Video network for food court showing national or local programming	0.89
Interactive display window areas	7.51
Holograms in display areas	2.34
Virtual reality amusement areas in the mall	5.12
Computer-based kiosks:	
• to track customer purchases in order to provide list of sale/coordinated items to complement	7.50
• used by customers to make purchases	4.70
Mobile telephones that shopping center customers can rent	0.00
Transportation provided customers **outside** the mall (e.g., trams)	9.58
Satellite communication by mall **management** for:	
• employee training	0.00
• video conferencing	3.70
• management updates	3.70
Computer connections via telephone lines between mall management and tenants	9.26
Motion sensors	7.43
Personal security devices for shoppers to attach to children	0.00
Ultraviolet beams	9.89
Keyless entry systems that monitor or restrict **employee access**	7.24
On-line shopping for customers	4.63
System to **recycle gray water** from mall	9.42

customers. And several malls, previously reported in the background section, have successfully implemented such programs.

In follow-up interviews with firms not using preferred customer programs, the major reasons provided dealt with several concerns. Most firms were concerned about the cost of implementing such programs. They viewed these programs as cost centers rather than income-generating activities. Several executives said they had experimented with these programs but found low usage among large portions of their customers; those who did participate represented only a narrow part of their market. Finally, many mall managers expressed concern that their major retail tenants did not want the computer-based kiosks. These retailers wanted customers coming into their stores rather than stopping first at a computer kiosk in the mall. They expressed concern that customer traffic in their stores could be decreased.

Second, given the security concerns customers have expressed about feeling unsafe outside the malls, the provision of some form of transportation by only 9.58% of the malls was lower than expected. The reasons given by firms contacted dealt mostly with the high cost involved and with the lack of real security concerns in many of the secondary and tertiary markets. Some mall managers said they had attempted to reduce these concerns by offering valet parking for those customers who wanted the service.

Third, with the amount of press that entertainment in retailing has received in recent years, it was surprising that so few malls had adopted technology in this area. Although some of these technologies, such as holograms and virtual reality theaters, are in the experimental stage, others, such as video networks, have been available for years. Interviews with mall developers found many of them were using a "wait and see" approach to most of the experimental technologies in this area. In addition to prohibitive costs, they wanted to wait and determine if such activities really caused an increase in customer traffic and sales. Those developers not utilizing video networks in their food courts expressed several reasons for not doing so. Some felt the programming would possibly attract crowds, which could lead to control problems. Others expressed concern that video programming would slow the turnover in tables available to customers. At peak times, customers were already having difficulty finding an empty table at some malls.

Finally, as businesses have moved into the world of electronic communications, it was surprising that so few mall management offices had computer connections with their tenants. Even though they were making use of electronic communications in other areas, they still relied on written or verbal communications with tenants. This is likely to change, however, as the Internet makes e-mail communications much more cost effective.

Those technologies currently in use by at least 60% of the malls responding are summarized in Table 12. A review of this list shows that most technologies currently utilized widely are all in operational areas. The technologies with the greatest usage were 1) information technology software to prepare budgets and 2) radio equipment to maintain contact with staff.

Future Use

Overall, participating firms report planning an expanded use of technology in both operational and customer-servicing areas. Those technologies that are likely to experience a significant increase in usage during

TABLE 12. TECHNOLOGIES WITH HIGH CURRENT USAGE

Technology	Greater Than 60% Usage
Computer connections via telephone lines between developer and mall management	68.40
Paging system in the mall	66.95
Information technology software	
• to prepare budgets	94.32
• to develop forecasts	79.51
Use of desktop publishing technologies	
• to prepare reports for communication with tenants	72.27
• to develop promotional materials	69.17
Use of radio equipment to maintain contact with maintenance staff, security, or other employees of mall	90.79
Automatic setback systems to control HVAC with controls at the local level	83.15
More efficient lighting	77.06
Equipment to monitor smoke detectors/sprinkler systems	74.56
Providing centrally-located cardboard compactors for tenants	60.88

the next five years are reported in Table 13. This list should be especially interesting to mall developers as they attempt to gauge what competitors are likely to do in the future. When reviewing the list, those technologies with a larger number of reporting firms represent the greatest opportunity for future expansion. A low number of reporting firms indicates that most of the respondents were already utilizing this technology. For example, most reporting firms have already implemented information technology software.

Rapid growth will be experienced in many areas of technology. More utilization is seen for computer connections between mall management and tenants. In addition, most malls are likely to make greater use of satellite communications. More malls are also likely to install computer-based kiosks to provide information and directions to customers. And, the use of home pages and on-line shopping by malls is likely to experience phenomenal growth.

Also of interest are the areas in which firms predict little increased usage in the next five years. Those technologies where two-thirds of the respondents reported little likelihood of implementation in the next five years are reported in Table 14. Some of these are experimental technologies such as interactive display windows and holograms. Many of the others are viewed as solving only limited specific problems; therefore, they are low on many lists. Technologies such as mobile

TABLE 13. TECHNOLOGIES LIKELY TO EXPERIENCE SIGNIFICANT GROWTH IN NEXT FIVE YEARS *(at least two-thirds' consensus)*

Technology	Number of Firms Reporting[1]	Likely implementation in at least 50% of malls in the next five years[2]
Technology to entertain customers (e.g., automated or interactive holiday decorations, mall exhibits)	18	67.82
Computer-based kiosk to provide information and directions to customers	24	76.58
Satellite communication by mall/shopping center management for:		
• video conferencing	25	75.43
• new product introductions	25	68.75
• management updates	24	69.92
Computer connections via telephone lines to allow data sharing and communications between **developer and mall management**	7	83.33
Computer connections via telephone lines to allow data sharing and communications between **mall management and tenants**	24	69.25
Information technology software		
• to prepare budgets	1	100.00
• to develop forecasts	5	95.45
• to analyze marketing efforts	9	99.25

[1]Number of firms reporting having this technology in fewer than 50% of their malls.

[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 13. TECHNOLOGIES LIKELY TO EXPERIENCE SIGNIFICANT GROWTH IN NEXT FIVE YEARS *(at least two-thirds' consensus) (cont'd)*

Technology	Number of Firms Reporting[1]	Likely implementation in at least 50% of malls in the next five years[2]
Use of **desktop publishing technologies** to prepare reports for communication		
• with tenants	6	99.04
• to develop promotional materials	7	99.07
Use of **radio equipment** to maintain contact with employees of mall	1	100.00
Computerized HVAC systems to analyze energy load demands & peak usage periods	11	77.14
More efficient **lighting**	10	98.88
More **effective lighting** in **parking lots**	11	88.51
New technologies for exit signs	15	78.99
Equipment to **monitor smoke detectors/sprinkler systems**	6	100.00
On-line home page to provide information to customers	21	82.12
On-line shopping for customers	22	81.35
Water control systems in lavatories	16	67.11
Time or usage controlled **irrigation/sprinkler systems**	11	71.10
Providing for other **solid waste recycling** for tenants	11	85.95
Water source heat pumps rather than ozone-depleting equipment	16	67.21

[1]Number of firms reporting having this technology in fewer than 50% of their malls.

[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

TABLE 14. TECHNOLOGIES UNLIKELY TO EXPERIENCE SIGNIFICANT GROWTH IN NEXT FIVE YEARS *(at least two-thirds' consensus)*

Technology	Number of Firms Reporting[1]	Unlikely implementation in at least 50% of malls in the next five years[2]
Infrared transmitters or other devices to track customer movement in the malls	21	68.90
Interactive display window areas	24	78.10
Holograms in display areas	25	90.96
Mobile telephones that customers can rent	26	69.80
Transportation provided customers inside the mall	17	78.02
Paging system in the mall	8	72.73
Automatic setback systems to control HVAC with controls at the corporate level	15	71.11
Motion sensors	24	72.73
Personal security devices for shoppers	25	76.44
Ultraviolet beams	21	82.70
Keyless entry systems	22	80.56
Keyless entry systems that monitor or restrict employee access	23	69.38
System to **recycle gray water** from mall	20	74.64
Providing centrally-located **cardboard compactors for tenants**	7	66.98

[1]Number of firms reporting having this technology in fewer than 50% of their malls.

[2]Responses from firms having this technology in fewer than 50% of their malls. Percents weighted by firm size.

telephones, personal security devices, keyless entry systems, and recycling gray water fall into this area.

Study Limitations

While every effort was made to minimize the level of potential error and bias in the study, some limitations should be noted when interpreting the results presented. First, although there was no indication that firms participating in the study represented either a disproportionately high or disproportionately low use of technology, some self-selection bias is possible whenever the response rate is fairly low. Similarly, it was outside the scope of the study to gather data on a mall-by-mall basis where the impact of mall size, age and location could be assessed and controlled.

Additionally, since there was no control on the position of the individual completing the survey, e.g., operations, marketing, research, etc., it is impossible to say how the perceptions of future use of technology might have been affected had such control been possible.

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