Computing Technology for the Home: Product Strategies for the Next Generation

Alladi Venkatesh and Nicholas P. Vitalari

Recent developments in the personal and home computer marketplace have raised questions about the effectiveness of current product strategies. In this article, Alladi Venkatesh and Nicholas Vitalari focus on the home computer market which continues to evolve in different ways. Specifically, they identify five technologically oriented product strategies, the electronic game technology strategy, the children's educational focus strategy, the office technology transfer strategy, the consumer electronic interchange strategy, and the home information systems strategy. The authors feel that the home information systems strategy may have the best long-run potential for success because it comes closest to meeting the needs of the changing household.

Introduction

Computing in the home is no longer a novelty; over the last 6 years it has gained a legitimacy [2]. Over 11 million households now have computers in the home. Nevertheless, the home computer marketplace has repeatedly stumbled in its pursuit of success. The prospect of over 80 million American households, plus 160 million households in the economically developed world, computing daily has captivated many small, medium, and large corporations. It has also spelled defeat and setback for some of the most successful "blue chip" electronics and computer firms. The companies in the industry seem to be facing an unusual dilemma. While the market is seductive and compelling, success is capricious and mysteriously elusive [6]. The decision by IBM to discontinue PC Jr and Apple's decision to close down some of its plants heighten the poignancy in the marketplace while raising some inevitable questions.

• Why is the home computing marketplace so uncertain?

• Why have product strategies not been very successful?

• What directions will the home market take and what are likely to be some of the successful strategies?
BIOGRAPHICAL SKETCHES

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- What must be done to capture the elusive market potential?
- What type of firm is in the best position to capitalize on future opportunities?

Making sense of the home computer market is not simple. Our purpose is to provide product strategists, industry observers, and market analysts with (a) an understanding of the current product market, and (b) directions for future strategies. This will be accomplished by an in-depth analysis of some key problems facing the industry and an evaluation of current strategies. For the sake of clarity we have provided a working definition of the home computer in Exhibit 1.

Problems Facing the Home Computer Industry

The current structure of the home computer industry is the result of three major lines of development: personal computer technology, macromarket and infrastructure development, and some strategic marketing concepts [25]. Exhibit 2 expands these developments on a time scale. First, the major impetus for the industry has come from the development of personal computer technology and commercial information services. As seen in Exhibit 2, each line of development has led to the entry of new firms and their further expansion into new products. Second, the developments in the concept of information services have pointed to the need for investment in infrastructure. As a result, macromarket approaches are required to build telecommunications networks, standards, and information sources. At the third level, different concepts of the home market have been in vogue. Early on, the home market was seen as an electronic game market, and more recently, as a children’s education and work at home market.

The point of this history is to illustrate that the market is still evolving and continues to be a challenge even to the dominant firms in the industry. A major challenge facing the home computer industry is to create a clear focus and mission for itself. Interestingly enough, personal computing began in the home. Yet the most stable and lucrative market for personal computing has been the office [9]. Most of the hardware and the software have been developed for requirements at work. This home/office dichotomy is but one of the many problems facing the industry. We have identified six major problems in the market focus of the home computer industry. Each of these problems has in turn resulted in smaller problems within the home computer
industry. Exhibit 3 gives a summary of the problems and their impact on the home computer industry. We believe they must be remedied before long-term market success is possible. Let’s look at the problems in more detail.

The Recipe Syndrome

Until recently, many computer manufacturers marketed home computers as if they were a home electronic device no different from other home products such as television or stereo. While there is some truth to it, such analogies can be misleading. The “recipe syndrome” refers to the tendency on the part of the computer industry to trivialize the complexity of the household and develop hardware and software features that are based on a very superficial understanding of household behavior. For example, a number of home computer hardware and software vendors have suggested that the home computer would be a useful tool for monitoring
## Exhibit 3. Key Problems in the Home Computer Market

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Issue Description</th>
</tr>
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<tbody>
<tr>
<td>Recipe Syndrome</td>
<td>Simplistic uses for computer (e.g., recipes, checkbook management)</td>
</tr>
<tr>
<td></td>
<td>Suggested uses have little value in household</td>
</tr>
<tr>
<td></td>
<td>Products without a market</td>
</tr>
<tr>
<td>Office Bias</td>
<td>Home computer products modeled after office computer products</td>
</tr>
<tr>
<td></td>
<td>Good for work at home uses, less useful for other household activities</td>
</tr>
<tr>
<td>User-Friendly Syndrome</td>
<td>Products sell to work at home market segment—young professionals, self-employed</td>
</tr>
<tr>
<td></td>
<td>Trivializes complexity of technology and the need for consumer training and support</td>
</tr>
<tr>
<td></td>
<td>Focuses adoption and use on the technology but neglects other marketing issues</td>
</tr>
<tr>
<td></td>
<td>Leads to unrealistic consumer expectations and dissatisfaction</td>
</tr>
<tr>
<td>Limited Experience in Consumer</td>
<td>Excludes market segment which has no previous experience with computers</td>
</tr>
<tr>
<td>Electronics</td>
<td>Lack of standards</td>
</tr>
<tr>
<td></td>
<td>Poor aesthetic design</td>
</tr>
<tr>
<td></td>
<td>Lack of common device characteristics</td>
</tr>
<tr>
<td>Failure to Analyze Underlying</td>
<td>Incompatibility with other household technologies</td>
</tr>
<tr>
<td>Logic of Marketplace</td>
<td>Reliance on overly optimistic market information</td>
</tr>
<tr>
<td></td>
<td>Focus upon technical characteristics of the computer rather than characteristics</td>
</tr>
<tr>
<td></td>
<td>and activities of the household</td>
</tr>
<tr>
<td></td>
<td>Reliance on technological advance for market growth</td>
</tr>
<tr>
<td></td>
<td>Miss unmet needs of market segments</td>
</tr>
<tr>
<td></td>
<td>Failure to identify required elements of long-term growth</td>
</tr>
<tr>
<td>Fragmented Corporate Strategies</td>
<td>Market segments undefined</td>
</tr>
<tr>
<td></td>
<td>Technology driven strategies</td>
</tr>
<tr>
<td></td>
<td>Suicidal price wars</td>
</tr>
<tr>
<td></td>
<td>Intrabrands incompatibilities</td>
</tr>
<tr>
<td></td>
<td>Lack of product families</td>
</tr>
<tr>
<td></td>
<td>Little evidence of long-term view of market evolution</td>
</tr>
</tbody>
</table>

The household’s food inventory, preparing menus, and cataloging the family’s storehouse of recipes [3]. Most households, not to mention the homemakers, have found these suggestions to be shallow and somewhat naive.

Simplistic feature lists based upon introspective analyses seldom lead to functional and useful home computer designs. Good designs emerge from a thorough analysis of the household environment and its unique requirements. Initially, households were fascinated merely by the technology. However, in the long term, the computer must add something useful and tangible to the household’s ecology. Current computer designs are based on an office ecology and by and large do not rest on an in-depth understanding of the household environment.

### The Office Bias

The office bias is caused by two related factors: the nature of the technology itself and the dominant use of the technology by its users. It is well known that the guiding design perspective for home computer hardware and software has been the corporate office [11]. It is primarily viewed as a productivity tool because of its capabilities in financial planning, word processing and record keeping, and other similar functions [2]. All the major software and computer features are modeled directly upon those factors that have been successful in the office environment.

Confirming these design and product strategy considerations, various studies of home computer use in the last 4 years have revealed that the dominant use of personal computers at home is work related [31,36,46]. A study by Rogers using 1982 data showed that 48% of the home computer adopters reported use of work related word processing and 38% reported using them for business management. In our recent longitudinal study, we have similarly found that the job related use of computers dominates other uses at home [45]. Because of such predominance in use, we have imparted the term “office bias” to this technology.

### The User-Friendly Syndrome

Even a casual examination of the promotional material put out by many computer manufacturers and software developers reveals how much they want the public to
believe that personal computers require nothing more than a modest training in its basic principles [32]. This is true in the case of game-oriented software or simple word processing tasks. Yet most major uses require a solid investment of time and a good understanding of the system and its software. To truly exploit a computer for electronic communications programming, educational use, and home management, users must be willing to spend long hours with it. While we are not arguing that people cannot be trained, some computer manufacturers are misleading the public into believing that computers are for everybody. At the present level of technology and consumer sophistication, this is not true.

**Limited Experience in Consumer Electronics**

Most home computer vendors are severely hampered by their limited experience in consumer electronics [14]. The consumer electronics marketplace is sophisticated, highly developed, and significantly different from industrial or office electronics. Maturity in the consumer electronics marketplace has been marked by a trend toward component designs, portability, multifunctionality, ease of use with the appearance of sophistication, appealing aesthetic design, high quality, and low cost. Most home computers do not match well with these trends.

Another major trend in consumer electronics is toward integration among electronic products. In recent years, consumers have witnessed a growing number of consumer electronics firms that add multifunctional features to traditional product lines. For example, both American and Japanese television manufacturers have introduced televisions that have monitor capabilities, integrated telephone hookups, radio bandwidths, stereo amplification, and CATV (Cable TV) facilities. On the horizon are products with more multifunction, multimedia capabilities that are carefully evolving toward an integrated multimedia center concept. Unfortunately, few American vendors have the experience or manufacturing diversity to support this level of integration.

**Fragmented Corporate Strategies**

Although everyone agrees that the personal computer market is broadly segmented into office computers and home computers, the distinction between product offerings is often unclear. Several companies have purposely constrained the designs of their home computer offerings to avoid interproduct competition with their office personal computer products. In a few cases this has led to confusion among consumers and low product sales.

Another source of fragmentation in corporate strategies is seen in the large number of conversion products where the game computer is converted to a home computer via add-ons such as keyboards, memory, disk drives, and cartridges. For the most part this add-on strategy has failed and in two cases (Mattel Inc. and Coleco) led to the maker’s departure from the computer electronics business [19].

**An Analysis of the Current Strategies**

The home computer marketplace has been driven by three major strategies: the Electronic Game Technology Strategy (EGT), the Children’s Education Focus Strategy (CEF), and the Office Technology
Transfer Strategy (OTT). While the EGT strategy has slowed down considerably, the CEF strategy is very much alive and the OTT strategy continues to offer a major direction to most computer manufacturers. We will now examine these three strategies in some detail.

**Strategy 1: The Electronic Game Technology Strategy (EGT)**

The EGT strategy, which can be traced back to 1975, is a first generation strategy used very effectively by companies such as Atari during the first years of home computing. Generally speaking, the EGT strategy appeared in two basic forms. The first form of the strategy, and by most accounts a failure, was to add computer capabilities to an existing video game. The second form capitalized on initial success in game technology and offered a line of more powerful home computers.

The EGT strategy failed because it was based on a narrow concept of entertainment [27]. Initial consumer response to the novelty of new animated games soon declined as children lost interest. The EGT strategy was bound to lose because it did not recognize the elementary principles of product acceptance by children. Children's tastes are subject to rapid change and children's toys represent a volatile market. Historically, the toy manufacturers have operated on the principle that the so-called "home games" are seasonal in nature and have relatively shorter product life cycles. For this reason, many manufacturers did not expect to recover their costs beyond a season or two. Although marketed as a great opportunity for bringing the families together around video games, this prediction of a home computer market did not materialize. As Mitchell [27] showed in her study, the electronic games were limited to the male children of the household with some participation by the fathers but very little enthusiasm among females in the household.

Although one can argue that in discussing these strategies, the hobby market should also be included, we have elected not to consider it within the context of the paper whose primary focus is the home computer. The first reason is that there was no specific product strategy for the hobby market as such. The hobbyist was a self-selective "hacker" and as Kaplan [22] noted in 1977, "the so-called hobby computer is essentially viewed as a re-packaged industrial microcomputer without the specialized software and peripherals backing vital for general consumer acceptance. . . . Hobby computers are for people who are willing to spend a great deal of time and money on their toys, who are already knowledgeable in dp (data processing), and who are willing to repair their own systems. Home computers, when they come (1), will be for an entirely different audience."

**Strategy 2: Children's Education Focus Strategy (CEF)**

The CEF strategy is a promising strategy because it is technologically and educationally sound [39]. In one of the most important and insightful books on the computer revolution, Papert [33], a noted authority on computerized learning, presented three basic arguments for the successful use of computers by children. First, it is possible to design computers so that learning to communicate with them can be a natural process; second, learning to communicate with a computer may change the way other learning takes place; and third, children are essentially gifted learners in the Piagetian sense that they can learn without being taught. Consequently, what better customers of new educational technologies can the computer vendors hope to gain than children?

In spite of such a compelling argument for providing education through computers, its realization as a social or economic possibility has not been simple. Several structural problems remain unsolved and, in the near future, appear difficult if not impossible to solve without an infusion of very high levels of investment from school districts, public agencies, and the educational industry. Even at a more simple level of product development and strategy, there are several problems. For example, traditional education is highly dependent upon educational materials and pedagogy developed by highly trained psychologists and educational experts [16]. However, in the home-education market, companies who manufacture the hardware or software often do not have sufficient grasp of this area. Many software programmers are very young, and, although well trained in programming logic, are less qualified to compose educational material. Similarly, the typical expert in the educational field does not write programs. Until these two skills are matched, or are institutionalized through formal mechanisms, the conditions for producing the educational software will be inadequate to meet their goals.

**Strategy 3: The Office Technology Transfer Strategy (OTT)**

From the standpoint of expediency and production setup, the office technology transfer strategy has been the most successful. The most sophisticated form of this strategy is seen in the introduction of the IBM PC and Apple IIc portable computers and more recently in the "clone" market. Both use simple technology pack-
aged somewhat differently from their more expensive office counterparts. Over the last 4 years, they have evolved into newer versions setting the model of success for other companies.

The OTT strategy provides for the quick introduction and production of home computers. Using existing production technologies with minor engineering enhancements, companies can benefit from significant economies of scale and, more importantly, a library of existing software. Off-the-shelf components, novel packaging, and an esthetic design provide the products with enough visual dissimilarity to mark them for the home computer segment. From a marketing standpoint this is ideal since only a few new software products need to be offered to give the home computer the illusion of being new and directed at the home.

On the negative side, however, the drawbacks are:

- The apparent success of the work related use of computers may discourage computer manufacturers from positioning the personal computer in a more home-oriented environment.

- OTT creates a disincentive to divert company funds into R&D for nonwork related applications, leading to a neglect of the vast home market by the conventional computer manufacturers.

- Vendors may commit their resources primarily to office type products and may later be unprepared to exploit the home market.

The prognosis for long-term success using the OTT strategy is limited to households that do work at home. At present, the exact size of the work-at-home market is unknown but researchers have shown that it is growing [2,15,30,47]. The possibility that people can work at home in a significant way can be considered both an opportunity and a challenge for the product designers. For example, for people in certain professions (e.g. accountants, writers, consultants, programmers), computers are very useful productivity tools. For others, computers allow them to perform "telework," which essentially means the ability to work from home using electronic networks where the personal computer is the primary tool.

Although work-at-home presents a profound opportunity for product exploration, the concept is not without certain drawbacks that the producers of appropriate technology are slow to appreciate. As Baer [2] points out, some of the issues are:

- Part time work at home does not necessarily save office or administrative costs.

- Work at home will cost employers more if they have to provide for the computers, software, communication facilities, and other work material.

- Work at home may not be a universally acceptable practice if the employers (as well as the employees) believe that face-to-face interactions in the office are important.

- Data security problems may arise when sensitive information is made available at locations outside the office.

In sum, OTT strategy does have a potential but it is not unproblematic.

**Emerging Strategies**

We have implied that a long-term strategy for home computer manufacturers must consider the development and integration of appropriate technology and designs with the demands of the home environment as its main focus. None of the three strategies discussed earlier is formulated with an explicit articulation of the home environment. Previous research in computing technology implementation clearly shows that careful consideration must be given to the social organization within which computers are embedded [24]. From the point of view of designing and developing information and automation technologies for the home, three unexplored but critical opportunity areas can be identified: electronically and digitally controlling home appliances, establishing local networks for home communications, and directly providing electronic information and transaction services [2]. The first of the three possibilities can be labeled the Consumer Electronics Interchange (CEI) strategy and is being explored by some companies. The second and third of the possibilities can be grouped into a single strategy which we
shall call the Home Information Systems strategy (HIS) because of their interrelatedness. We will now discuss the CEI and HIS strategies in some detail. The fusion of these two strategies, the Home of the Future strategy (HF), is a distant possibility and any discussion of it now will be speculative.

The Consumer Electronics Interchange Strategy (CEI)

The Consumer Electronics Interchange strategy places home computer product offerings in the context of established trends in consumer electronics. The CEI strategy has yet to appear in the U.S. home computer market. The closest example is the MSX-based (Microsoft® standard) home computers from Japanese electronics firms and consumer electronic initiatives to provide a common interface to link intelligent appliances [20]. The MSX standard includes interfaces to standard video, audio, and graphics technology. CEI offers many advantages and certain consumer electronic firms are in an excellent position to aggressively implement their approach (Exhibit 4).

The key to the CEI strategy is making the electronic computer compatible with traditional or existing electronic appliances. This ability requires familiarity with consumer electronics, user needs as well as some control, and access to the means of production. The recent success of VCRs illustrates the implementation of this strategy in a rudimentary fashion. Once this key conceptual relationship is recognized and implemented in future consumer electronics offerings, the CEI strategy is uniquely poised to take advantage of future technological developments and the growing coalescence and integration of multimedia and multifunction technologies (television, stereo, telephone, microwave oven, other home appliances with microprocessors, stored video, and CATV). In addition, the CEI strategy builds upon existing understanding of consumer electronics functions and provides tangible incentive for households to invest in home computer technology. The advantages of the CEI strategy appear superior to the OTT and EGT strategies presently in operation. There are at least seven major strengths to the CEI strategy:

1. Exploits consumer familiarity. The CEI strategy exploits the understanding and familiarity that consumers have with existing technology.
2. Exploits future options and technological integration. The CEI strategy is uniquely poised for future enhancements and changes in consumer electronic and is open to the possibility of a future household automation architecture.
3. Based on proven consumer electronic trends. The CEI strategy takes advantage of well-understood trends toward portability, component designs, aesthetic appeal, and maximization of household investment in electronics.
4. Builds upon established reputation in consumer electronics. Companies who have a strong reputation and successful track record in consumer electronics can build upon their strength and gain customer acceptance.
5. Takes possible product line and product family strategies. Because the home computer is designed as part of other consumer electronic devices, companies can develop product line and product approaches to the marketing of products and provide differing features and options for different household segments.
6. Reduced price sensitivity. The CEI strategy may actually raise the price ceiling for home computing products since the technology will be integrated with other traditional consumer electronic products.
7. Exploits multidimensional consumer needs. The CEI strategy positions the computer as a mechanism for enhancing a broad variety of consumer interests such as art, music, home video, control of home appliances, and home communications.

The CEI strategy provides a long-term product concept and strategy and exploits consumer familiarity with other consumer electronic products. Furthermore, it is not bound by the artificial distinction between computing products and other consumer electronic products, the latter being carryover from the OTT product.
concept. Many current computer vendors view themselves as computer vendors and thus ignore the larger, more lucrative consumer electronics marketplace.

Nevertheless, CEI strategy has its weaknesses. First, many of the consumer electronics companies that can implement the CEI strategy have exhibited a poor understanding of the home computer market and have a poor track record in this area. Second, the CEI strategy will require a large number of new computer programs and software products. Third, the CEI strategy may suffer from complexity. The trend to further integration is not without its problems, especially in its implementation. All the interconnections may reduce the flexibility of the products and actually encourage a countertrend to the decoupling of electronic products, each with its own computer capabilities. Finally, the CEI strategy runs the outside risk of generating a consumer backlash for automation in the home. Consumers may simply stop adopting the process of increasingly automating their home and find the CEI strategy offensive.

The Home Information Systems Strategy

The Home Information Systems (HIS) strategy takes a long-term perspective in its approach to product innovation. The strategies discussed earlier are basically technology driven and have not responded effectively to the characteristics of the market. We are aware that from the point of view of market pragmatism and opportunism, it is often difficult, if not impossible to avoid technologically driven strategies in emerging markets. Markets do not unfold neatly to facilitate strategic product positioning. In fact, in many cases technology-before-markets is more a rule than an exception and a logical approach to market development. However, this does not mean that technology driven opportunities will be as successful as market driven opportunities in all phases of market evolution. While we concede that the latter is desirable, in a technologically dense environment, it does not present itself in a clear fashion.

The HIS strategy is as much a market driven strategy as it is technology driven. For example, it regards the household as a social organization adapting to emerging technologies. At the same time it views technology as embedded in the social context of the household; that is, it operates on the principle that technology cannot be effective unless the social organization in which it operates can support it.

The core idea behind the HIS is that the household is a system of relationships among individuals who seek and handle information, communicate within and outside the household, and engage in behaviors that optimize their information handling capabilities. From the technology point of view, this translates into the convergence of three different but related technologies: computing, communication, and information. Operationally, the HIS strategy views the household as an electronic information gathering and transaction center with links to external databases and communication networks [28]. Although novel in conceptualization, the idea itself is not far-fetched. According to available statistics, 1% of the U.S. households are already subscribers to home transaction and information services [2].

A cluster of related technologies have already become available to the American households in the last 3 or 4 years. They include: cellular mobile phones, videotex, home banking, electronic shopping, electronic bulletin board, home security networks, and database reference systems. Although individually these technologies are not widespread, it is their collective presence that makes them a considerable force. What is preventing their greater acceptance is, of course, the cost to the average consumer, a lack of perception as to how they would fit into the social life of the household, and the social context of the household itself. However, the concept of the household as an information center should bring home the technological connections among these diffused products. In fact, there is a historical parallel to the transformation of this institution into what we consider to be the modern household. For example, an average American household today is equipped with a variety of home appliances that have, over the years, contributed to the mechanization and automation of work at home. A refrigerator or a vacuum cleaner, taken in isolation, does not have a major impact on the life at home. It is the collectivity of such appliances that constitutes the modern household.

Once we accept the perspective of the household as an information center, we can safely abandon the view of the computer as a productivity tool merely performing tasks such as word processing or record storage. The HIS strategy is, therefore, based on a concept that transcends a single product perspective and replaces it with an integrated perspective.

This allows us to view the household as an information center with computing power to acquire information from sources internal and external to the household and engage in a wide variety of computer-based activities [21]. Consider some typical and logical information processing needs in the home:
1. Voice, data, and graphical communication with members of the same household, other households, institutions, and organizations.

2. Household records management. Increasingly, households are required to manage sizeable volumes of information about financial transactions, investments, taxes, legal requirements, and medical histories.

3. Voice, data, and graphical support for hobbies, entertainment, and work.

4. Household maintenance, monitoring, and control. Access to information about household maintenance and automation of security systems, yard maintenance, and energy management.

5. Future technologies such as smart phones, household robotics, and smart automobiles may be integrated into the HIS concept.

The HIS strategy does have significant costs. Over a period of time, users will have to invest heavily in household information technology. A major investment will be in the internal wiring of the home—a significant cost for existing structures. The use of communications facilities will also add expense to the household budget. Consumer education is also required. Historically, household technologies have been stand-alone devices (TV, telephone, refrigerator, etc.) and there has never been any mechanism to control the different technologies simultaneously. Movement toward integration may introduce a level of complexity beyond the interests of many households that look for simplicity in operating their technologies.

How can the HIS strategy be successfully implemented? First, the market needs to be segmented on the basis of who can afford an integrated information technology system. If we go back to the past several decades, there are any number of examples of technologies that appeared to be unaffordable at the time of introduction but gained acceptance as soon as consumers began to appreciate the benefits. Second, consumer education may be no more difficult than learning to drive an automobile if the integration is achieved at the task level rather than at the level of the technology itself. Normal diffusion patterns suggest that future generations will have greater familiarity with computer technology. Third, the HIS strategy is not dependent upon a single monolithic multiuser computing device. HIS can also function with a variety of separate computing appliances specialized for various needs. Of course, the latter approach requires some industry standards for interconnection and communication protocols. Fourth, the conceptual basis of HIS is compatible with the household ecology, making its long-term viability promising.

Directions for the Future

The five major strategies discussed in this paper are already evident at different stages of development. Each strategy has a similar developmental sequence. (Exhibit 5.) First, a technology initiated product strategy is introduced. This creates a set of market opportunities as well as challenges. Both the opportunities and challenges invite appropriate "response strategies," in that the opportunities result in opening up unanticipated markets, while the challenges, if left unattended, become market barriers that degenerate into unprofitable pursuits. This strategy sequence is assumedly the characteristic of any technologically oriented market. Let us illustrate this sequence for one of the strategies, EGT. Similar sequences can be developed for other strategies by looking at Exhibit 5.

The EGT strategy clearly began as a technology oriented strategy. The economic impact of this strategy over a period of time was the creation of the children's market for educational computing (an opportunity) and the decline of the game oriented market (a challenge), the latter resulting from the wearing off of the initial novelty. In response to the "opportunity" discovered during the impact stage, the CEF strategy (response strategy) was developed. However, no adequate response strategy was forthcoming to overcome the declining game market leading to its virtual collapse.

The basic logic of the framework shown in Exhibit 5 is further elaborated in Exhibit 6. For each strategy, the key concept and some of the key companies are identified. We have also shown what the infrastructure requirements for the different strategies are, but we hold the view that they are more critical for CEF and HIS strategies. For the sake of completeness, we have also included the Home of the Future strategy in both exhibits, but serious consideration of it at the present time would be unrealistic. Consider, for example, the re-

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2According to some researchers who have studied the automobile industry, the year, 1895, marks the beginning of the industry. However, it was not until 1910 that automobiles had reached the popular market in a significant way [13]. The telephone also offers a similar picture of time lag between the introduction and popular acceptance, which is estimated to be about 30 years [34,35].
requirements for infrastructure and technology to support the Home of the Future concept. Significant advances in consumer electronics, robotics, communications, software, and computers will be required. The coalescence of these home technologies, although possible, is difficult to envision in the next 10 years. Moreover, the supportive culture within which to use such advanced technology is unlikely to emerge in the near term. In short, the Home of the Future exists only in advanced research laboratories [5, 12, 17].

Given our prognoses for market strategies in the home computer industry, market strategists must carefully monitor the marketplace. Presently, technology leads the marketplace. The home computer marketplace is underdeveloped and is likely to undergo significant changes in the next 5 years. We will see the rise of the Information Complex—a coalescence of existing industries including computer vendors, communications companies, broadcast and cable television, publishing, and state and local governments that will establish the information infrastructure for computing in the home.

Within this changing industrial context, we believe industry strategists should carefully monitor several key indicators and prepare strategies to exploit these developments as they occur. The success of a particular strategy will depend on the state of the market’s development. Five key indicators will be instrumental in the market’s development:

1. Infrastructure
2. International competition
3. Distribution
4. Technology
5. Market segmentation

Let us review each of these key indicators.
### Exhibit 6. A Profile of Current and Emerging Strategies

<table>
<thead>
<tr>
<th>Nature of the Market—Basic Concept</th>
<th>Key Issues</th>
<th>Key Companies</th>
<th>Time Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Game Strategy</td>
<td>Home as an entertainment center</td>
<td>Implicitly limited to games</td>
<td>ATARI, COLECO, MATTEL, COMMODORE TI, SINCLAIR</td>
</tr>
<tr>
<td>Children’s Education Focus Strategy</td>
<td>Computerized learning is easy and fun</td>
<td>Children as innovators and main catalysts for change</td>
<td>APPLE, ATARI, COMMODORE, Book Publishers</td>
</tr>
<tr>
<td>Office Technology and Transfer Strategy</td>
<td>Home as a work place</td>
<td>Telework</td>
<td>IBM, APPLE, COMMODORE, RADIO SHACK, SANYO</td>
</tr>
<tr>
<td>Consumer Electronic Interchange Strategy</td>
<td>Home as a multiactivity center</td>
<td>Integration of household activities, home automation.</td>
<td>MATSUSHITA, SONY, SANNO, SHARP, ZENITH, NEC</td>
</tr>
<tr>
<td>Home Information Systems Strategy</td>
<td>Home as an information center</td>
<td>Coordinate communication within the household &amp; with outside</td>
<td>IBM, SEARS, AT&amp;T, GTE, JAPAN, INC. NEC, CITICORP, BANK OF AMERICA</td>
</tr>
<tr>
<td>Futuristic Strategy</td>
<td>Very futuristic, unrealizable in the next 10 years</td>
<td>Companies like G.E. are experimenting with this idea</td>
<td>1990?</td>
</tr>
</tbody>
</table>

### Infrastructure

Infrastructure refers to a number of critical support structures necessary to support computing in the home [43]. Developments in infrastructure are key to the development of all mass market high-technology products. Critical factors in the home computer infrastructure are:

**Computer literacy and expertise.** A large number of consumers must have a basic level of computer literacy to make computing in the home viable [23]. We believe that attempts to make computers more user-friendly are only a partial solution. Computer literacy will take time. Simplistic marketing appeals, advertising, and hype will not increase computer literacy. Computer literacy will increase over the next 5 years due to experiences with computers at work and in school. Training efforts by third-party organizations will also contribute to the overall level of computer literacy.

**Standards.** Standards are absolutely necessary for success in the home computer marketplace. Consumers
<table>
<thead>
<tr>
<th>Market Prognosis</th>
<th>Degree of Integration Among Functions</th>
<th>Infrastructure Requirements</th>
<th>Requirements for Market Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited market growth, necessary but insufficient basis for computing in home. Long-term decline</td>
<td>Low</td>
<td>Very nominal. Retail outlets.</td>
<td>Minimal low cost production, creative software, hardware</td>
</tr>
<tr>
<td>Results indicate more potential than current performance</td>
<td>Moderate</td>
<td>Teacher training, standards, quality software, communication systems to libraries, schools, and outside data sources</td>
<td>The nature of the market is not clearly defined as to whether it is the domain of the traditional computer industry or book publishing, etc.</td>
</tr>
<tr>
<td>Limited to market segments that work at home, e.g., technical &amp; professional occupations &amp; part-time workers.</td>
<td>Low</td>
<td>Terminals for teleworking.</td>
<td>Large ad budget, low cost production, appeal to market niche, marketing expertise, larger research development budget</td>
</tr>
<tr>
<td>Initial appeal to electronic enthusiast. As systems become easier to use &amp; as market for home computing will expand to new segment, appeals to consumers at large</td>
<td>Moderate</td>
<td>Standards (e.g., MSX) Service centers Retail outlets</td>
<td>Expertise in consumer electronics Low-cost production facilities</td>
</tr>
<tr>
<td>Too speculative to offer realistic evaluation</td>
<td>Very high</td>
<td>Too premature to consider</td>
<td>Very difficult</td>
</tr>
</tbody>
</table>

depend upon standard interfaces, control features, and device functions to simplify complex technology. Households, in contrast to organizations, do not have trained support staff. The computer industry will have to standardize. Standardization may occur naturally as in the case of the IBM PC or through national associations. Attempts at developing standards are seen in the MSX standard for home computers, standards committees for in-home local area networks, and ANSI and ISO committees to develop standards for Information Services Digital Networks (ISDN). Other standards are needed in software user interfaces, storage media formats, and information network user interfaces.

Communication technology. Communication with the external world is a key feature for long-term success in the home computer market. Many industry leaders have asked the question, "What do you do with a home computer?" If the computer is not connected to outside services and other computer users, the home computer has very little to offer for most consumers [48]. However, if the computer becomes a window to external information services, we see a different story. Digital
communication networks will become the national highway system for the computer user. As the information media, CATV, data communication, voice communications, and graphics begin to coalesce, the home computer will become a central feature of the home.

**Legal and political guidelines.** The tremendous amount of information transferred to households will create the need for new laws. Already a number of proposals have come before Congress regarding problems in national security, taxation of information, and interstate trade of information. The United States still lacks a national information policy. The rise of home computing will precipitate legislative action. The market strategist should monitor these developments. Governments will also become competitors in the information business. Governments at the federal and local levels will have to solve problems of public access, notions of universal services, and social issues regarding the information rich and the information poor.

**Maintenance and support.** Current maintenance and support networks are too expensive for consumers. In the future, a combination of replaceable computer and local maintenance staffs will be required to support computing in the home.

Due to the critical requirements for a supportive infrastructure and its high cost, many companies will enter into joint ventures to create communications networks, information services, and large-scale distribution capabilities. Signs of movement to this type of industry structure are already evident in the failure of several home computing companies and the development of joint ventures. Smaller companies will focus on specialized vertical markets and offer tailored services within the larger information complex. Many lucrative market niches will emerge due to the favorable ratio of marginal revenue versus marginal cost in providing information services and specialized technology. Once the infrastructure is in place, many smaller companies will achieve profitable positions within the industry.

**Japanese companies have already aggressively entered European markets with MSX computers. While the MSX strategy has had mixed results, the level of investment points to the seriousness of international competition.**

**Distribution**

Current distribution networks have been successful only for the highly motivated user. However, a significant gap exists in the expertise of a national sales force, the retail computer store, and the retail department store. New distribution networks will be required to support computing in the home. The degree of pre-purchase and postpurchase support required for future home computer users is still unclear. At present, significant doubt exists about the ability of marketers to successfully distribute computer technology effectively without support.

**Technology**

As indicated, the market has been primarily technology driven [38]. Nevertheless, the market strategist must distinguish and monitor three different levels of technology: research technology, available technology, and proven technology, in order to monitor market directions.

**Research technology.** Technology in the research laboratories defines the long-term technological horizon. Today's laboratory technology will be available in the next 3 to 7 years depending upon the complexity of the required production technology. For example, 32 bit computer processor chips were first tested in research labs in the late 1970s. Such chips are available today.

**Available technology.** While a great deal of advanced technology is available, only some of the available technology is useful in consumer products. Technology for consumer products must be highly reliable and low cost. The more recent and advanced technology is seldom reliable and cost effective.

**Proven technology.** Proven technology is technology that has been available for at least 2 years. Proven technology is sometimes referred to as off-the-shelf technology. The first 2 years of a technology's use results in improvements, refinements, and industry experience. As a result, the firm benefits from an existing learning curve that has implications for labor availability, production technology, and software availability.
Market Segmentation

Although current market segments are quite broad, the development of the information infrastructure will reveal a multitude of unmet needs. Needs for new peripherals, software, information services, architectural design, and specialized marketing approaches will emerge. Given the complex nature of the technology and the infinite variety of ways that humans can use information, we will see many specialized segments within the home market. Some segments likely to appear are: home security, telemedicine, home health, home banking and financial services, electronic mail, home shopping, and home entertainment.

Conclusions and Recommendations

It is quite obvious that we are witnessing a new wave of technologies that have the potential to transform the home and work environments in the next 15 to 20 years. In this article we have been more concerned with the former, but recognize that the power of the new technologies is such that they can easily link up both environments in response to the changing patterns of work and personal lives. It was a little over a half century ago that a similar change was heralded, resulting in the transformation of the household into what it is today. It is so much a part of our lives that we rarely notice it. The modern household may be described as the product of the electromechanical revolution. The overwhelming presence of a wide range of household appliances in an average American household is a testimony to the successful implementation of technology within a neatly articulated concept. The concept is simply one of efficiently managing household tasks by substituting mechanical energy for human energy. Strangely enough, the technology surrounding the small electric motor has made this possible.

Using the analogy of electromechanical revolution, we might say that the technologies that will shape the future household in the next 15 to 20 years are the computing, communication, and information technologies. The home computer is one example of the emerging technologies but a profound one. Where do we go from here? The question needs a careful examination of the different product strategies.

Our first consideration is that the product strategies for new technologies should center around a viable concept. The five strategies discussed earlier represent different concepts but are related somewhat. We picked the home information strategy as the best candidate for exploration because it offers the most plausible vision of the household in this information society. To say that we are in an information age is a cliche. But not to recognize that the social institutions that constitute the information society are in fact information centers would be a fallacy. Given the critical role that the household plays, both as a component of the larger social system and as an instrument of change within the social system, a natural perspective of the household for our purpose revolves around the concept of the information center. The question, then, is simply how to exploit this concept in some practical terms.

We know that the technology is in place. There are already some information-oriented technologies in many homes. The telephone is the most widely recognized communication technology that permits a two-way link to the outside world. Another technological link to the household is the cable television, which is not merely an entertainment medium. The rapid growth in the versatility of cable T. V. in offering a variety of information-oriented programs and possible access to outside information sources makes it an important component of the home information system. Then we have VCRs which are part and parcel of the visual information milieu. Finally, we have the computing technology that is the focus of this article. As a first step, the integration of all these technologies is a necessary condition for the concept of "home as information center" to materialize.

We suggest a step-by-step approach to the development of product strategies appropriate to this concept. First, investigate the information needs of the households. They are both internally and externally oriented. These households' needs can be classified in terms of different services. Some examples are:

1. Commercial in-home services: database services; financial services; market (shopping) services; home security and management; home entertainment; work-at-home.
2. Public in-home services: computer network infrastructure; electronic mail; news; local schedules and emergency information; home security network/"computer watchdog."
3. Government in-home services: government information access communication and retrieval (ordinances, zoning, permits, etc.); emergency services; opinion polling and political process facilitation; automated billing of government service units; local government bulletin boards.
Second, identify those services that can be served by the firm’s existing technology and provide a comparative advantage to the firm. From among those services, select the ones that can use the available infrastructure. Finally, study the feasibility of developing products/services in terms of company’s profit objectives and goals.

In conclusion, the actual evolution of the home computer market will be characterized by opportunities and challenges. Given the necessary conditions for market growth, we believe the product strategist can achieve long-term success from the seemingly disconnected, uncertain home computer market.

References