A MARKETING MODEL
FOR A SOFTWARE FIRM

by

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ABSTRACT

This thesis study describes how a software firm operating
in the home entertainment market can benefit from the use of
formal marketing models as decision support tools. This firm
is forced to make strategic, vital decisions in areas such as
product development, distribution, or advertising. However,
the lack of data and the volatility and unpredictability of
the market environment usually discourage any modeling
effort. This thesis demonstrates that, even in this
situation, the use of marketing models can offer great
benefits.

A trial and repeat model is used to describe the retail
sales of the firm, and two submodels are developed to help in
the interpretation of the results. The thesis describes both
the structure of the models and some of their applications.
The trial and repeat model takes into account many of the
peculiar characteristics of this market, such as changes in
the target population, diffusion phenomena, different repeat
rates, and various delays built into the process. The first
of the two submodels describes the amount of the inventory
held by the distribution system and therefore allows to
reconciliate factory shipment data and the estimates of
retail sales provided by the model. The second submodel
provides a simple tool to help to allocate advertising
expenditures across computer magazines.

Thesis Supervisor: John D.C. Little
Title: George M. Bunker Professor of Management Science
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Introduction

The goal of this thesis study has been to build a marketing model for a particular firm that operates in the market of entertainment software for home computers. This market has experienced a tremendous growth during the last few years and is projected to continue to expand at an healthy rate through the end of the decade. Nevertheless, the recent shakeout in the industry has pointed out the strategic importance of marketing decisions in areas such as product development, pricing, advertising, and distribution. However, the rapid growth, lack of history, and extreme volatility of the industry environment have proved real challenges for any serious planning effort. There is a compelling need for tools that can help a software firm to gain a better understanding of this dynamic market and, in conclusion, to make better managerial decisions. We believe that the development of formal marketing models for this industry can be, at least, a step in the right direction.

Marketing models have gained a widespread acceptance as decision support tools in areas in which data availability and past experience allow a non-
controversial specification and calibration of the model. However, in our situation, few, if any, reliable data are available and the future behavior of the market is rather unpredictable. Therefore, both the structure and the calibration of the model rely heavily on the judgement of the managers as well as of the model builders. Under these circumstances, the effectiveness of a formal model in supporting better decisions is not without its detractors, and there are certainly intrinsic dangers in this approach.

In our activity as model builders we have tried to avoid some potential pitfalls. First of all we have strived to gain a thorough understanding of the market conditions as well as of the major strategic alternatives that are available. Secondly, we have built a model whose structure is easy to understand and to manipulate; the programming tool used to develop the model - Lotus 1-2-3 - has proved very valuable in our search for transparency and interactivity. Finally, our model does not directly provide any specific answer or optimal solution to a particular problem, but rather gives an analytical contribution to understand what has happened in the market in the past as well as what can happen, under a particular set of circumstances, in the future.
In other words, we have tried to follow Little's list of desirable characteristics of a marketing model [1], which should be simple, easy to control and to communicate with, robust, adaptive, and complete on important issues; when a tradeoff was inevitable, we have favoured simplicity and ease of use over completeness.

Moreover, we believe that the model building effort has a intrinsic value, independently from the effectiveness of the model as a decision support tool. An analytical, rigorous approach in describing the behavior of the market facilitates the kind of comprehensive, long-term thinking required for strategic planning. The effort of quantifying the marketing phenomena highlights the areas in which information is most scarce, and can trigger and direct future efforts of data collection. Therefore, even if a model is not able to provide all the answers, it is at least likely that it will identify most of the relevant questions.

The content of this thesis is ideally divided in two major sections. The first section provides the kind of background information about the entertainment software industry that we needed for our modeling effort. This section provides the reader with a framework that should be useful in order to understand the model and to assess
its soundness. More precisely, in chapter one we describe the home computer software industry in general; we examine some data and projections about the penetration of personal computers in U.S. households, as well as the related evolution of the software market. Chapter two uses the previous information to illustrate what are the major strategic decisions faced by a software firm. Particular attention has been given to the areas in which the use of a formal marketing model as a decision support tool seems more promising.

The second section illustrates the marketing model which has been developed for our software firm and the underlying assumptions. Particularly, chapter three illustrates the trial and repeat model used to describe the retail sales of the products of our firm, while chapter four illustrates additional submodels which have been developed to help in the interpretation of the results of the main model. In fact, we had to consider the segmentation of the market, the difference between retail sales and factory shipments, and the impact of advertising and distribution decisions.

The company which has provided the material and the commitment and support of its managers for this case study is indicated in the text with the fictitious name
of Softcorp. All the data or information regarding its marketing activities have been disguised or omitted.
Chapter 1

THE ENTERTAINMENT SOFTWARE INDUSTRY
1.1 Penetration of Personal Computers in U.S. Households

The target population for the entertainment software industry is constituted by the households in which there is a personal computer. The penetration of personal computers in U.S. households has grown from 0.6 percent at the end of 1981 to 12.4 percent at the end of 1984 and is expected to be greater than 30 percent at the end of 1989 (figure 1) [2].

The personal computers currently present in U.S. households can be classified in three broad categories:

- "Low capability" personal computers (TI 99/4A and 2A; Commodore VIC-20, Pet, 64, Plus/4; Atari 400, 600XL, 800XL, 1200XL; Timex Sinclair 1000, Radio Shack Colorcomputer, Coleco Adam). These models are generally priced under $500, are cartridge-based, have 64 KRAM or less and are intended by the manufacturer for consumer use.

- "Medium capability" personal computers (Apple II family, IBM PCjr, TRS-80 family). They are priced between $500 and $1500, include a disk drive in their initial configuration, have 128 KRAM, are expandable, and are intended for consumer use by the manufacturer.

- "High capability" personal computers (IBM PC and compatibles, Apple Macintosh) usually cost more than
**Figure 1 — U.S. HOUSEHOLDS WITH PCs**

(Year-end, net of replacements)

<table>
<thead>
<tr>
<th>Year</th>
<th>PC Sales</th>
<th>Replacement</th>
<th>PCs in Use</th>
<th>Households</th>
<th>Multiple PCs</th>
<th>Penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>388</td>
<td>NA</td>
<td>120</td>
<td>80.0</td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td>81</td>
<td>2106</td>
<td>1</td>
<td>504</td>
<td>81.2</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>82</td>
<td>4764</td>
<td>2</td>
<td>2568</td>
<td>82.4</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>83</td>
<td>4501</td>
<td>4</td>
<td>7141</td>
<td>83.7</td>
<td>5</td>
<td>8.1</td>
</tr>
<tr>
<td>84</td>
<td>5033</td>
<td>7</td>
<td>11327</td>
<td>84.9</td>
<td>8</td>
<td>12.4</td>
</tr>
<tr>
<td>85</td>
<td>5705</td>
<td>13</td>
<td>15705</td>
<td>86.2</td>
<td>11</td>
<td>16.4</td>
</tr>
<tr>
<td>86</td>
<td>6555</td>
<td>22</td>
<td>20155</td>
<td>87.5</td>
<td>14</td>
<td>20.2</td>
</tr>
<tr>
<td>87</td>
<td>7502</td>
<td>39</td>
<td>24678</td>
<td>88.3</td>
<td>17</td>
<td>23.9</td>
</tr>
<tr>
<td>88</td>
<td>8425</td>
<td>45</td>
<td>29254</td>
<td>90.1</td>
<td>20</td>
<td>27.1</td>
</tr>
<tr>
<td>89</td>
<td></td>
<td></td>
<td>33988</td>
<td>91.5</td>
<td>23</td>
<td>30.1</td>
</tr>
</tbody>
</table>

Source: Future Computing, January 1985
and are intended by the manufacturer for office use.

Currently the personal computers installed in U.S. households are divided across these categories in the following proportions: 70-75 percent are low capability, 15-20 percent medium, and about 10 percent high [3]. The percentage of computers which are sold for home use varies widely, too, depending on the category to which the computer belongs; figure 2 provides some indicative estimates [4].

A software firm is interested in the installed basis of personal computers in U.S. households which use a certain type of storage medium. Particularly, since Softcorp's products require the use of a floppy disk, we are interested in the installed basis of floppy disk personal computers in U.S. households. In 1984 this installed basis more than doubled and sales of floppy disk personal computers are expected to further gain market share at the expense of the cartridge segment (figure 3) [5].

Floppy disk computers installed in U.S. households can be divided according to the three categories (low, medium, high capability) in the following proportions: 50-60 percent are low capability, 25-30 percent medium,
Figure 2 — PC CUSTOMERS
(year-end 1984, indicative)

<table>
<thead>
<tr>
<th></th>
<th>Homes</th>
<th>Educ.</th>
<th>Corp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low capability</td>
<td>90-95</td>
<td>5-10</td>
<td>0</td>
</tr>
<tr>
<td>Medium capability</td>
<td>50-70</td>
<td>10-20</td>
<td>20-30</td>
</tr>
<tr>
<td>High capability</td>
<td>5-10</td>
<td>5-10</td>
<td>80-90</td>
</tr>
</tbody>
</table>
Figure 3 — FLOPPY DISK PCs IN HOMES

(year-end, net of replacements)

<table>
<thead>
<tr>
<th>Year</th>
<th>FDPC Sales (NA)</th>
<th>Replacement</th>
<th>FDPCs in Use (NA)</th>
<th>FDPCs in Use (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>NA</td>
<td>0.1</td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td>81</td>
<td>114</td>
<td>0.2</td>
<td>6</td>
<td>0.5</td>
</tr>
<tr>
<td>82</td>
<td>341</td>
<td>0.8</td>
<td>13</td>
<td>1.3</td>
</tr>
<tr>
<td>83</td>
<td>816</td>
<td>1.3</td>
<td>35</td>
<td>3.5</td>
</tr>
<tr>
<td>84</td>
<td>2245</td>
<td>3.5</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>85</td>
<td>2755</td>
<td>6.0</td>
<td>8.9</td>
<td>8.9</td>
</tr>
<tr>
<td>86</td>
<td>3326</td>
<td>8.9</td>
<td>12.1</td>
<td>12.1</td>
</tr>
<tr>
<td>87</td>
<td>3993</td>
<td>12.1</td>
<td>15.3</td>
<td>15.3</td>
</tr>
<tr>
<td>88</td>
<td>4665</td>
<td>15.3</td>
<td>18.5</td>
<td>18.5</td>
</tr>
<tr>
<td>89</td>
<td>5315</td>
<td>18.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Future Computing, January 1995
and 15-20 percent high [6].

Finally, since a software firm usually publishes its products for just a few computer versions, we would be interested in knowing the penetration of floppy disk computers in U.S. households for each different product. Unfortunately, we do not have a source of secondary data on this matter which is either reliable or up to date. To our knowledge, the direct measurement of the penetration of different personal computers has been made only with surveys employing rather small samples (400-500 PC owners). This sample size is too small to provide an estimate with a reasonable confidence interval, and the results of these surveys are often already obsolete when they are published.

Alternatively, one might think of following an indirect approach; starting, for example, from the total sales of the Commodore 64, and considering the percentage of these PCs which are sold with a disk drive to home owners. However, this approach is not completely viable, either, since:

- Data regarding the unit sales of the various personal computers are not usually available (the manufacturers do not publish shipment data and there is not a well organized service of data collection in order to
- Most low capability personal computers are without a disk drive in their initial configuration; the disk drive can be bought as a separate entity either when the personal computer is purchased or afterwards (or not bought at all).

- The percentage of medium and high capability personal computers which are used at homes is highly disputable (and volatile) information; the Apple II family, for example, was initially bought mainly for office use, while, during 1984, particularly as a consequence of the introduction of the Apple IIc, has been repositioned with a consumer focus.

Finally, the task of forecasting future sales of the different personal computers can be even more frustrating, as the difficulties experienced by many computer manufacturers easily demonstrate.

In any case, a brief history of the major events that have characterized the penetration of personal computers in U.S. households may help at least to understand the environment in which software firms are operating. Prior to 1982, the rate of penetration in homes was very low, and all personal computers (including the Commodore Pet and the TI 99/4A) were sold mainly in computer specialty
stores. During 1982, Commodore and TI drastically reduced the retail prices of their home computers, and rapidly expanded their retail basis to reach more than ten thousand retail outlets by Christmas 1982 [7]. In the meantime, computer specialty stores were dropping the low capability personal computers from their product lines because of the declining margins. By the end of 1982 the penetration in U.S. households had grown to about 2.5 million from 0.5 million one year earlier.

During 1983, Commodore and TI entered a massive price war, with the prices of many low capability home computers falling below $100 (figure 4). At the end of 1983, penetration in U.S. households had jumped to about 6.8 million, mainly as a consequence of very low retail prices during the Christmas season. However, the fall in prices determined the exit from the market of some of the major manufacturers of low capability home computers. Texas Instruments abandoned following the loss of more than $600 million in its consumer product division, and so did Mattel and Timex [8,9]. Atari was seriously damaged, and its capability to return to profitability is still in discussion [10].

Other important events happened during 1984; first of all IBM began marketing its PCjr, the first IBM
Figure 4 - RETAIL PRICES OF HCs

Source: Fortune, 7/11/1983
product targeted to the consumer market, and Apple
introduced a new portable version (the IIC) of the Apple
II family [11,12,13]. With the introduction of the IBM
PCjr and the repositioning of the Apple II with a home
target, computer specialty stores have regained
importance for the distribution of these relatively
high-price, high-margin products to the consumer market.
Secondly, Coleco finally gave up its efforts to market
its Adam computer, which, priced at $500, had raised
high expectations to be able to fill the gap between the
very low capability Commodore and Atari products and the
more sophisticated Apple and IBM computers. The Adam
computer, presented in June 1983, was delayed in its
production by design flaws, and also haunted by the
decision of Apple and IBM to lower the prices of their
entry models below $1000 [14]. Finally, during the 1984
Christmas season, sales of home computers have been
disappointing, particularly for Commodore’s low end
products, remaining well below the 1983 level.

The home computer segment which is expected to
experience the highest growth in 1985 is the medium
capability one, where new products from both Commodore
(128, Amiga) and Atari (ST) are going to join the best
selling Apple II and IBM PCjr [15]. In the meantime,
prices of the low capability home computers are again falling of a significant amount, with the suggested retail price of the Atari 800XL slashed from $170 to $99 in the last three months, and the price of the Commodore 64 decreased from $200 to $150.

1.2 Growth and Evolution of the Entertainment Software Industry

Contemporaneously to the increasing penetration of computers in U.S. households, there has been a corresponding growth in the number of programs purchased by consumers. The home computer software market can be segmented both according to the type of medium used (floppy disk or cartridge) and to the type of application. The floppy disk segment is quickly gaining market share with respect to the cartridge segment [16], reflecting the increase in the penetration of floppy disk computers in U.S. households. The different application segments are:
- Entertainment: playing all sorts of games, from arcade style to traditional games such as chess or bridge.
- Child education: using the computer to let children
learn basic skills, problem solving strategies, subject areas, computer literacy or programming, graphics and design.

- Personal enrichment: dealing with hobbies, sports and leisure, self improvement, etc..

- Word processing: computer text editing for handling correspondence, paper, and reports.

- Communications: accessing public data bases and information services such as Compuserve or the Source, communicating with other computers, etc..

- Business and household management: keeping track of business or household finances, investments, spending, etc., as well as managing data bases.

- Programming and computer literacy: creating programs or just learning about how computers work.

The entertainment and child education segments are by far the most important, with entertainment software losing market share with respect to word processing, communications and business and household management [17]. Since we are particularly interested in the market for entertainment software for floppy disk computers in homes, figure 5 indicates the estimated number of programs sold in this segment [18].

The entertainment software market comprises several
Figure 5 — Entertainment program sales
(yearly sales, floppy disk medium)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
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<td>341</td>
<td>816</td>
<td>2245</td>
<td>2755</td>
<td>3326</td>
<td>3993</td>
<td>4665</td>
<td>5315</td>
</tr>
<tr>
<td>DSBS</td>
<td>195</td>
<td>532</td>
<td>1332</td>
<td>3487</td>
<td>6049</td>
<td>8943</td>
<td>12057</td>
<td>15276</td>
<td>18518</td>
</tr>
<tr>
<td>EN/SA</td>
<td>1.55</td>
<td>1.60</td>
<td>1.65</td>
<td>1.65</td>
<td>1.64</td>
<td>1.65</td>
<td>1.62</td>
<td>1.61</td>
<td>1.60</td>
</tr>
<tr>
<td>EN/IN</td>
<td>0.65</td>
<td>0.79</td>
<td>0.79</td>
<td>0.79</td>
<td>0.80</td>
<td>0.79</td>
<td>0.78</td>
<td>0.77</td>
<td>0.76</td>
</tr>
<tr>
<td>INITIAL MKT</td>
<td>177</td>
<td>546</td>
<td>1346</td>
<td>3704</td>
<td>4518</td>
<td>5421</td>
<td>6469</td>
<td>7511</td>
<td>8504</td>
</tr>
<tr>
<td>AFTER MKT</td>
<td>127</td>
<td>372</td>
<td>1012</td>
<td>2755</td>
<td>4839</td>
<td>7065</td>
<td>9404</td>
<td>11763</td>
<td>14074</td>
</tr>
<tr>
<td>TOTAL MKT</td>
<td>303</td>
<td>918</td>
<td>2359</td>
<td>6459</td>
<td>9357</td>
<td>12486</td>
<td>15873</td>
<td>19273</td>
<td>22578</td>
</tr>
<tr>
<td>TOTAL MKT</td>
<td>0.3</td>
<td>0.9</td>
<td>2.4</td>
<td>6.5</td>
<td>9.4</td>
<td>12.5</td>
<td>15.9</td>
<td>19.3</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Source: Future Computing, January 1985
different subsegments, ranging from arcade style games to traditional games translated for the computer.

Unfortunately, there is not yet a clear, universally accepted, way of classifying these different games. A possible segmentation is the following:

- Arcade style games: games modeled after popular arcade versions such as Pac Man or Donkey Kong.
- Traditional games translated for the computer: chess, checkers, black jack, etc..
- Strategy and simulation games: games that attempt to replicate real world situations, which require learning, thinking, and planning ahead.
- Adventure and fantasy games: games in which the player explores unknown territories, ventures into lost worlds, and, in general, faces unexpected, challenging situations.

Currently, about 65 percent of computers in U.S. households are used to play games, with arcade style games still being by far the most popular type of games (about 50 percent of computers in homes are used to play such games) [19]. Software piracy, which is an important factor for all the home segments, is particularly acute for entertainment programs. A recent survey found that more than 60 percent of all the games owned are
admittedly copies (and therefore the true percentage of copied programs should be even higher) [20,21].

It has been observed that a curious paradox is at work in the home computer software market [22]; on the one hand, the industry exhibits some of the characteristics of a mass market. In fact, the best selling programs are experiencing high unit sales, well above 100,000 units per year, and a successful software firm can easily ship between 500,000 and 1,000,000 copies of its products per year. On the other hand, the software market continues to be a highly defined specialty business, since the target population for a particular software program designed to run on a specific computer remains only a very small fraction of the total. This situation requires to carefully select both the communication and the distribution channels.

An important trend is an increasing reliance on advertising (both on magazines and now also on radio and television) and on marketing activities in general, such as promotions and couponing [23,24,25]. The marketing budget for a typical home software company has grown to reach 20-30 percent of projected revenues. There seem to be at least three reasons for this increasing importance of marketing in an industry in which the emphasis used to
rather be on product development:

- The explosion in the number of available products. The output of new products has increased so much that software publishers are experiencing increasing difficulties in bringing their titles to the attention of distributors, retailers, and customers. Marketing activities, and advertising in particular, are then used to "buy" that attention as well as to build barriers to the entry of new competitors.

- The peculiar economics of the software business. Fixed costs are very high with respect to variable costs, since the manufacturing cost of a program can be about \$4-5. Therefore, software publishers can spend a large fraction of the revenues generated by an incremental sale in the advertising needed to stimulate that incremental sale.

- The increasing importance of intermediaries [26]. The power of intermediaries (distributors and retailers) has recently increased with respect to the power of publishers. In fact, in order to make retail sales, software publishers need shelf space, and are forced to court both the distributors and the major retail chains. One way to gain the attention of the intermediaries is to ensure a large advertising budget.
In the next section we will examine more closely the most important decisions faced by a software firm in marketing its products. The importance of making the right decision is emphasized by the shakeout conditions that have characterized the home computer software industry in 1984. Plagued mainly by aging inventory which had often come back from the retailers' level, many software publishers have been compelled to scale down or terminate their operations. Among the best known victims of this shakeout are Human Engineered Software and Sirius (respectively second and seventh in revenues during 1983), that have filed for chapter 11 protection, and Synapse (sixth in 1983), which, pressed with financial problems, has sold out a reportedly controlling share to Broderbund (first in 1983) [27,28].
Chapter 2

MAJOR DECISIONS IN MARKETING AN ENTERTAINMENT PROGRAM
2.1 Product, Pricing, and Promotion

The first obvious decision that a software firm faces is which product to bring to the market. There are certain general trends that may be considered, such as the growth rates of the different segments and subsegments of the home software market (for example, education versus entertainment, or arcade style versus strategy games). Moreover, marketing models which use perceptual mapping techniques or a preference-choice approach can be a valuable tool in addressing the product design decision [29]. However, in our particular case, the new product development process was not an issue, since Softcorp's product line has very well defined characteristics which are not going to be changed in a foreseeable future.

The second major decision facing a software publisher is the choice of the personal computers for which the program will be developed and marketed. The choice of the right personal computer can determine either the success or the failure of a product as well as of a company. In order to make a sound decision, a software publisher has to evaluate the importance for the program sales of both the installed bases and the shipment rates of the personal computers for which it is produced. In
general, the future shipment rate of a computer is more important than the installed basis in order to predict the potential demand of a program. In fact, a significant portion of the programs used on a home computer are bought contemporaneously to the purchase of the computer. For example, Future Computing [30] estimates that the average number of entertainment programs purchased initially is about 1.7 per home computer; afterwards a home computer owner buys only about .8 entertainment programs per year.

An additional factor to consider in choosing the computer version is the different market potential of a particular program among owners of different computers. The usage of entertainment programs is in fact particularly high among the owners of low capability home computers (mainly Commodore and Atari). As a matter of fact, in a recent survey, about 49 percent of low capability home computer owners rated games as a very desirable application, while this rating decreased to 32 percent and 12 percent for owners of medium and high capability home computers, respectively [31].

Finally, the development of products for newly announced home computers deserves some attention. While, on the one hand, the potential rewards for being ahead of
the competition are very high, on the other hand the risks of incurring huge development costs for a computer which fails in the marketplace are enormous. Several software developers have been badly hurt by the withdrawals from the market of Texas Instruments and Coleco, whose products had received a large share of software firms' development efforts. The risks assumed by the software publishers are increased by the very favourable return policies which have been negotiated by the intermediaries. Even after shipping the products to distributors and retailers, the software publisher are compelled to accept the return of unsold programs. The example of Sierra-On-Line, which is reportedly holding about $250,000 worth of excess inventory of titles compatible with Atari and Coleco is emblematic [32]. This inventory is mainly constituted of returns from the distribution system, and is being dumped at prices around $2-3 on the Australian market.

The trial and repeat model described in chapter three provides a powerful tool for forecasting sales of Softcorp's products for existing and new home computers. Moreover, one of the submodels described in chapter four allows to estimate the amount of inventory stocked both at the distributor and retailer levels, therefore
providing a tool for the assessment of the risks of returns.

The pricing decision is even more difficult to analyze: little, if any, information is available regarding the price elasticity of demand for software products. It has been empirically observed that most of the hit programs in the education and entertainment segments sell for the same price; currently, this "magic price tag" for entertainment programs is $39.95. The only experiment with price variations of which we are aware has brought the rather bewildering result that there might be a price ($79.95 for the program in the experiment) at which demand is maximum; both an increase and a decrease in price actually determined a decrease in sales [33]. In any case, the price elasticity of demand is probably not very high for at least two different reasons. Retailers are unwilling to stock products with a price tag (and margin) too low, while consumers, being unable to evaluate the quality of the product, use, at least to a certain extent, price as a proxy for quality.

The next problem faced by a software firm is how to communicate the product to the target population. The challenging aspect of advertising and promotion decisions is that the target population is a small, but expanding
fraction of the total. So, for example, while computer magazines are probably too narrow a medium (reaching only 64 percent of home computer owners) [34], television advertising of software products has been criticized as "overkilling" [35]. However, the trend is towards advertising to a broader and broader audience, switching from computer to science and general interest magazines, as well as to television advertising.

The size of the advertising budget of a software publisher is usually set as a percentage of projected sales; there seems to be an "industry standard" in the sizing of the advertising budget at about 10 percent of sales. The reasons for this practice apparently go beyond considerations about the effectiveness of advertising in generating incremental retail sales. A high advertising budget is deemed necessary in order to convince intermediaries (distributors and retailers) to carry the product. For this reason, the contribution of a formal modeling approach to this decision appears to be limited. A more promising field is the allocation of advertising expenditures across different media. In chapter four we will examine a simple model which allows to assess the effectiveness in reaching the target audience of a given allocation across different computer
magazines.

In the increasingly crowded software market, several experiments have been made with sampling and coupons, which are seen as promising means to gain recognition and attention from potential customers. In this case too, the lack of history does not allow to assess the general effectiveness of these programs. For example, the first sampling initiative of which we are aware was conducted by Microsoft only in November 1983, when a diskette containing a sample of its new word processing program (Microsoft Word) was included in PC World at an estimated cost of $350,000 [36]. It is still very difficult to get an estimate of the incremental sales generated over time by this kind of initiatives. An interesting use of the trial and repeat model that we propose in the next chapter is the evaluation of the repeat sales generated by an increment in trial stimulated by a sampling program.

2.2 Distribution

The distribution strategy of software companies is receiving particular attention, since the growth of the
market has determined a corresponding growth in the number and variety of retail outlets in which software programs can be bought. Future Computing [37] currently estimates that there are about 35,000 retail outlets carrying software products. Software publishers have to target the category of retailers that are likely to maximize sales and keep return rates to an acceptable level. Traditionally, software publishers have followed rather liberal return policies, and the rate of returns in the industry has been around 4-5 percent, causing serious problems to many software publishers. A focused distribution strategy, which creates deeper links between the software publisher and the intermediaries, has the additional advantage of providing some feedback about the sell through at the retailer level.

A first consideration for the definition of a distribution strategy is that a software publisher needs to market its products in the same environment in which the computers on which the programs operate are available. The low capability computers such as the Commodore 64 or the Atari 800XL are mainly distributed through the mass merchandiser channel. For publishers with products for the Apple and IBM families, the specialty computer store is a logical retail choice.
Radio Shack computers sell only through Radio Shack stores, so software for Radio Shack machines is best placed in those stores. Software stores are an excellent vehicle for reaching the aftermarket and, additionally, often carry products for computers of several types. However, the emphasis on linking the distribution of software with the distribution of hardware relies on the consideration that, at this point of time, the initial market is still estimated to be 35 percent larger than the aftermarket for floppy disk entertainment programs.

Another possible approach in defining a distribution strategy is to consider the type of retail outlet in which a certain segment of home software products are most often purchased. Figure 6 illustrates the situation for entertainment software; in the last four years the mass merchandiser channel has gained market share (from 23 to 40 percent) at the expense of computer and software specialty stores (which decreased from 31 to 23 percent) [38]. However, Future Computing estimates that in the next few years both mass merchandisers and specialty stores (particularly software stores) will gain market share, mainly at the expense of consumer electronics stores and mail order houses. The percentages of total sales can be compared with the number of outlets carrying
Figure 6 - DISTRIBUTION CHANNELS

(Entertainment software only)

Specialty Stores 7 31.0 25.0 23.0 23.0 24.5 26.0 26.5 27.0 28.0
Cons. Electronics Z 22.0 21.0 20.0 19.0 18.0 17.0 16.0 15.0 14.0
Mass Merchandisers 7 23.0 32.0 38.0 40.0 41.0 42.0 42.5 43.0 43.0
Mail Order 7 20.0 19.0 18.0 15.0 13.0 13.0 11.0 9.0 8.0 7.0
El. Distr. & others Z 4.0 3.0 3.0 3.0 3.5 4.0 6.0 7.0 8.0

Source: Future Computing, January 1985
software in each of the three main categories; at the end of 1984 there were probably about 5,000 specialty, 10,000 consumer electronics, and 20,000 mass merchandiser retail outlets carrying entertainment software products.

The number of distribution alternatives available to software publishers increases because there are different ways of reaching a retail outlet. Computer and software specialty stores usually buy through distributors, or directly if they are part of a large chain. The situation is similar for consumer electronics stores, except for Radio Shack outlets, which generally require a program to be licensed to Radio Shack. Large mass merchandiser chains can be reached either through direct sales or through service merchandisers such as Handleman or Lieberman; while small chains usually buy through software distributors. The use of different intermediaries involves different margins for the software publisher; typical figures are 55 percent of the suggested retail price for direct sales to retailers; 40 percent for sales to distributors, and 8 percent for programs licensed to a computer manufacturer. A computer manufacturer such as Commodore uses direct sales to reach large mass merchandisers and regional distributors to reach the smaller ones. Figure 7 illustrates a
Figure 7 - DISTRIBUTION SYSTEM FOR ENTERTAINMENT SOFTWARE

- 90% direct to customers (mail order)
- 55% direct to retailers
- 40%
- 6%

End Users

% of stores carrying entertainment software:
- Consumer: 3000-4000
- Software: 300-400

% of stores carrying entertainment software:
- Radio Shack: 5000
- Others: 4000-5000

% of stores carrying entertainment software:
- Department: 3000-5000
- Discount: 4000-6000
- Toy: 2000-3000
- Book: 1000-2000
- Appliance: 2000-3000
- Catalog: 1000-2000
- Drug: 2000-3000
- Supermarket: 1000-2000

(source: Future Corp.)
simplified model of this array of different distribution options.

There are still two distribution alternatives left: mail order and electronic distribution. Mail order sales work well in niche markets or for established products that have begun their retail decline. In case of a directly owned mail order service, the software distributor may retain as much as 90 percent of retail price. Electronic distribution might be important in the future; it would allow a customer to pick a program from a catalogue at a retail store and have the program transmitted from a central storage bank to a blank cartridge or disk in the store, therefore avoiding inventory carrying costs.

The purpose of going through this rather detailed explanation of the distribution system is twofold. First of all this background information is necessary for understanding the model of the amount of inventory carried by the distribution system which is described in chapter four. Secondly, the impacts of advertising and distribution decisions (awareness and availability) provide the most plausible explanations for the different rates of penetration of Softcorp's products among owners of different computer types.
Chapter 3

A TRIAL AND REPEAT MODEL FOR SOFTCORP'S SALES
3.1 Trial and repeat models

Trial-repeat models have been successfully employed to describe the reaction of the market to the introduction of a frequently purchased new consumer product [39]. The basic structure of a trial-repeat model is illustrated in figure 8. Individual customers must be made aware of the existence of the new product, the new product has to be available, consumers must be induced to try, and to repeat regularly the purchase of the new product.

In our initial discussions with Softcorp's management regarding the behavior of their market it became readily apparent that it could be described via a trial-repeat model. In fact, Softcorp's customers are very likely to repeat; once a personal computer owner has tried a Softcorp's game, he will probably purchase another one within a certain amount of time. The reason why repeat purchase are so important is that Softcorp's games "contain" only a limited number of hours of entertainment. Therefore they "wear off" after a while and need to be replaced, usually with other Softcorp's games, since there is a pronounced brand loyalty. Modeling the trial process by itself is also important, since there is a steady flow of new entrants in the
Figure 8 - GENERIC STRUCTURE OF A TRIAL-REPEAT MODEL

---

Target population

Advertising

Distribution

Awareness

Availability

Trial

Us

Thee

---
target population that must be induced to try.

The benefits sought by our model building effort were to gain a better understanding of the behavior of the market and, particularly, to verify whether or not the past pattern of sales was consistent with the structure of the market implicitly assumed in managerial decisions. Management was also interested in gaining a better knowledge of the long term effects of an increase in the trial rate, increase that might be obtained through promotion programs such as sampling and couponing which were then being evaluated by Softcorp's management.

While the basic idea underlying trial-repeat models provided a promising starting point for our modeling effort, the simple structure described in figure 8 had to be extensively modified in order to describe the behavior of our market. This chapter illustrates both the structure of the model and the considerations which have guided us in some of the most important choices regarding that structure. More precisely, the next section gives some background information about the use of trial-repeat models for describing the introduction process of a new, frequently purchased consumer good. The following sections describe the peculiar characteristics of our market, the structure of our model and the underlying
assumptions.

3.2 Parfitt-Collins and Assessor

The Parfitt-Collins model was developed in 1968 with the goal of having a simple method for forecasting the ultimate share of a newly introduced frequently purchased consumer good in a test market situation [40]. The model assumes that the ultimate brand share is the product of three factors:

\[ S = P \times R \times B \]

Where \( P \) is the percentage of buyers in the product class who will ever try the brand, \( R \) is the ultimate repeat rate among all consumers who once purchased this brand, and \( B \) is a factor that considers the buying rate index of repeat purchases of this brand (if purchasers of the new brand buy at the average volume of purchasers of all brands in this product class, then \( B = 1.00 \)).

Parfitt and Collins used the pattern of trial and repeat rates in the first few weeks after the introduction of the new brand in a test market in order to estimate the asymptotic values \( P \) and \( R \).
Assessor is a pretest market model designed to give a market share projection for a new brand; it uses a trial-repeat structure and a parallel convergent preference model [41]. For our purposes, we are only interested in the trial-repeat structure. The ultimate market share is assumed to be the product of the long run trial rate $P$ and the ultimate repeat rate $R$ among triers; in this respect, Assessor is equivalent to a Parfitt-Collins model with the usage rate factor $B$ set equal to 1.00:

$$S = P*R$$

However, the Assessor model provides an interesting decomposition of the two quantities $P$ and $R$. The decomposition of $P$ takes into account both awareness and availability; moreover, it models the effect of a sampling program designed to increment trial:

$$P = K*D*F + C*U - (K*D*F)*(C*U)$$

where the term $K*D*F$ takes into account spontaneous trial, $C*U$ the sampling effect, and $(K*D*U)*(C*U)$ adjusts for double counting:

- $K$: long run probability of awareness
- $D$: long run probability of availability
- $F$: long run probability of trial, given
\[ K = D = 1.00 \]

\[ C : \text{ probability of consumers receiving sample} \]
\[ U : \text{ probability of consumers using samples, given } C = 1.00 \]

The parameter F is measured as the percentage of shoppers who buy the brand in a laboratory setting, while the rest of the parameters are estimated on the basis of past experience with similar products and managerial judgements.

The repeat rate R is modeled as the equilibrium condition of a two-state Markov process:

\[ R = \frac{Q}{1 + Q - Z} \]

where Q is the probability that a consumer will switch from an established brand to the new one, and Z is the probability that a consumer who last purchased the new brand will repurchase it on the next buying occasion.

3.3 Peculiar Characteristics of our Market

While we were proceeding in our analysis of Softcorp's market, it was clear that there were many aspects of the behavior of this market which deserved a peculiar treatment, and contributed to make our final model quite
different from the previous ones.

First of all it was necessary to model two inter-twinning trial and repeat processes. In fact, Softcorp's products are perceived as close substitutes of competitors' one in a category of games which has been pioneered by Softcorp and has been gaining market share within the entertainment software market during the last few years. The solution to this problem has been to model the trial of a game in this category with a diffusion process, and to assume that in each period Softcorp had a certain market share among triers. This structure has been suggested by the consideration that the repeat rate among consumers who have already tried a game in this category is high enough to justify a different treatment of triers and non-triers of games in this category.

Secondly we had to adapt our model to take into account the dynamic characteristics of this market. These dynamic effects prevent sales from reaching a steady state solution (constant rate of repeat sales after the initial wave of trials), which is hypothesized by the other models that we have reviewed. In our case, we are not interested in an eventual constant rate of sales that will be reached some time into the future, but
rather in the dynamics of the trial-repeat process itself. Those dynamic elements are not only given by a continuously increasing target audience (home owners of a computer with a disk drive), but also by the quickly evolving market environment (competition, distribution, pricing, etc.), as well as by the time delays built into the process (delay between the purchase of a home computer and trial of a game in this category, and delay between two subsequent purchases of games in this category).

In order to consider those dynamic effects we have modeled the evolution of the market over time, taking one quarter as the unit period. The choice of an even shorter time period unit would have not been possible, since we would not have had data good enough to be able to track the target population or the sales pattern. On the other hand, the choice of one quarter as a unit period allows us to simplify the treatment of both repeat purchases (since we assume that a consumer purchases at most one game in this category within one period, i.e. three months) and seasonality factors.

Finally, we had to consider different probabilities for repeat purchases depending on the number of Softcorp's games owned; we have evidence that both the
probability of buying another game in the category and the probability of specifically buying another Softcorp's game increase with the number of games owned. We will describe in more detail the characteristics of the model in the following sections, but these initial considerations should help to understand the basic structure of the model, which is illustrated in figure 9.

3.4 Target Population

The target population is constituted by the owners of floppy disk computers in homes; the actual numbers that have been used in our model have been obtained by the Future Computing reports on the distribution of purchasers of home and office computers across home users, educational institutions, and corporations. Unfortunately, we do not have any measure of confidence regarding these data, since Future Computing estimates are essentially a subjective blend of the results of proprietary surveys among end-users, retailers, and manufacturers. Nevertheless, this is probably the best source of secondary data regarding this market. In order to obtain quarterly sales we have considered the pattern
Figure 9 - BASIC STRUCTURE OF THE SALES MODEL

New owners of floppy disk computers in homes

Target population: Installed basis of floppy disk PCs in homes

Non-Softcorp triers

Non-Softcorp triers

Owners of at least one game in the category who own 0 Softcorp games

Softcorp triers

Category owners who own 2 or more Softcorp games

Softcorp repeaters

Softcorp repeaters (category repeaters who become Softcorp triers)

Non-Softcorp repeaters

Category owners who own only 1 Softcorp game

Repeaters
of retail sales of home computers during the last three years, and extrapolated the data relative to the remaining years.

Finally, since games in this category are not available for all the different existing computers installed in homes we have considered a correction factor in computing the target population. This correction factor is based on an estimate of the percentage of floppy disk computers in homes for which games in this category have been available. The assumptions used in order to quantify the target population are summarized in figure 10.

### 3.5 Trial

The ultimate trial rate defines the percentage of the target population who will ever try a game in our category if they are aware and the games are available. Among this population of ultimate triers, only a few actually become triers in each period (in order to try, they have to be aware, the games have to be available, and they have to be induced to try). The most important factors which can induce to try are friends or relatives
Figure 10 - ASSUMPTIONS REGARDING THE TARGET POPULATION

================================================================================================
!!! TARGET POPULATION - ASSUMPTIONS !!!
================================================================================================
!!!
!!! INSTALLED BASIS OF FLOPPY DISK PCs IN HOMES (YEAR-END);
!!!
!!! 81 195 532 1332 3487 6049 8943
!!!
!!!
!!! DISTRIBUTION OF YEARLY SALES OF FLOPPY DISK PCs TO
!!! HOME USERS PER QUARTER:
!!!
4 | q1 q2 q3 q4
!!!
!!! 1981 50 10 15 70
!!! 1982 62 12 18 64
!!! 1983 20 14 16 50
!!! 1984 20 14 16 50
!!! 1985 20 14 16 50
!!! 1986 20 14 16 50
!!!
!!!
!!! PERCENTAGE OF THE INSTALLED BASIS FOR WHICH GAMES
!!! IN THIS CATEGORY ARE AVAILABLE:
!!!
!!! 40% 50% 60% 70% 80% 90%
!!!
!!!
================================================================================================
(word of mouth), advertising, and articles or product reviews on computer magazines. Therefore, the number of triers in each period depends certainly on the increase in the target population (number of new home owners of a floppy disk computer with a disk drive), on the number of games already sold (word of mouth and articles on computer magazines), as well as on the period of the year (seasonality) and on advertising and distribution (awareness and availability).

Given the constant flow of new entrants in the target population as well as the increasing attention and market share gained by this category of games during the last few years, we decided to describe the trial process as the diffusion of a new product, and we used a slightly modified version of the Bass model [42]. The Bass model explains the diffusion of a new product as the sum of an innovative (due to external influences) and an imitative (due to word of mouth) processes. In that model, the number of adopters at time $t$, $q[t]$, is given by:

$$q[t] = p*(U-Q[t-1]) + r*(Q[t-1]/U)*(U-Q[t-1])$$

where:

- $p$ : innovation rate
- $r$ : imitation rate
U : ultimate number of triers

Q[t] : cumulative number of triers at the end of period t

The first term says that in each period the innovators are a fixed percentage p of those who have not yet tried. The second term describes the imitation effect, which is maximum when the cumulative number of triers equals 50 percent of the ultimate number of triers.

We have modified the Bass model in order to take into account the fact that the probability of trial p is greater for new owners, who have purchased their computer in the current period, than for old owners. In fact, there is a great deal of evidence in the home software industry that most programs are bought contextually to the purchase of the computer. We also added a seasonality factor to consider that the probability of trial is greatest during the Christmas season.

In conclusion our model of trial is:

\[ TR[t] = S[t] \times (PN \times (U[t]-U[t-1]) +
\]
\[ + PO \times (U[t-1]-Q[t-1]) +
\]
\[ + R \times (Q[t-1]/U[t]) \times (U[t]-Q[t-1])) \]

where:

\[ TR[t] : \text{category triers in period } t \]
PN : innovation rate for new owners
PO : innovation rate for old owners
R : imitation rate
S[t] : seasonality factor in period t
U[t] : number of potential triers in period t
Q[t] : cumulative number of triers in period t

Therefore, if we indicate with MTR[t] Softcorp's market share among triers at time t, the number STR[t] of Softcorp's triers and the number NTR[t] of non-Softcorp's triers are:

\[ STR[t] = MTR[t] \times TR[t] \]
\[ NTR[t] = (1-MTR[t]) \times TR[t] \]

The parameters needed to calibrate this portion of the model are summarized in figure 11. The calibration relies heavily on managerial judgement and uses, when possible, the results of customers' surveys and other Softcorp's internal documents as a validation check. The surveys' results were particularly useful for the estimation of parameters such as the ultimate number of triers or the relationship between the innovation rates for new and old owners.
Figure 11 - ASSUMPTIONS REGARDING THE TRIAL PROCESS

=================================================================
<table>
<thead>
<tr>
<th>TRIAL - ASSUMPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>PERCENTAGE OF THE TARGET POPULATION WHO WILL EVER TRY A GAME IN THIS CATEGORY:</td>
</tr>
<tr>
<td>$ ultimate triers    80%</td>
</tr>
<tr>
<td>$ new owners         10%</td>
</tr>
<tr>
<td>$ old owners         5%</td>
</tr>
<tr>
<td>and DIFFUSION RATE:  20%</td>
</tr>
<tr>
<td>SEASONALITY FACTOR:</td>
</tr>
<tr>
<td>$ q1                 0.8</td>
</tr>
<tr>
<td>$ q2                 1.6</td>
</tr>
<tr>
<td>$ q3                 0.6</td>
</tr>
<tr>
<td>$ q4                 1.5</td>
</tr>
<tr>
<td>SOFTCORP SHARE OF TRIERS:</td>
</tr>
<tr>
<td>$ 1981               30%</td>
</tr>
<tr>
<td>$ 1982               40%</td>
</tr>
<tr>
<td>$ 1983               40%</td>
</tr>
<tr>
<td>$ 1984               40%</td>
</tr>
<tr>
<td>$ 1985               40%</td>
</tr>
<tr>
<td>$ 1986               40%</td>
</tr>
<tr>
<td>=================================================================</td>
</tr>
</tbody>
</table>
3.6 Repeat

The percentage of owners of games in this category who will ever repeat their purchase depends on the number of Softcorp's games that they own. This conclusion is based on the results of Softcorp's internal surveys among category users; these results indicated that the percentages of users very likely to buy another game in this category were about 15, 35, and 60 for owners of 0, 1, and 2 or more Softcorp's games, respectively. This result can be interpreted in the light of other survey findings; Softcorp's games are generally considered to be better designed and to give greater satisfaction than competitors' games. For the same reasons Softcorp's market share among repeaters increases with the number of Softcorp's games that they own; there is, in other words, a strong brand loyalty effect among Softcorp's customers. It is mainly on the basis of these considerations that we have considered three different repeat processes among owners of 0, 1, and 2 or more Softcorp's games, respectively.

We had also to make some assumptions about the distribution of repeat purchases over time, since the frequency of repeat purchases is limited by the amount of time needed in order to finish a game. With the help of
survey results, we found that a reasonable assumption is that all the customers who will ever repeat, do it within 15 months from their last purchase. We also found that the number of customers who repeat within less than three months is negligible, and that the majority of them repeats between three and six months from their last purchase.

The number of repeaters among those who own 0 Softcorp's games can be therefore expressed as:

\[
\begin{align*}
R_0[t] &= URO \times ((NTR[t-1]+NRO[t-1]) \times A[1] + \\
& \quad + (NTR[t-2]+NRO[t-2]) \times A[2] + \\
& \quad + (NTR[t-3]+NRO[t-3]) \times A[3] + \\
& \quad + (NTR[t-4]+NRO[t-4]) \times A[4]) \\
S_0[t] &= MRO[t] \times R_0[t] \\
N_0[t] &= (1-MRO[t]) \times R_0[t]
\end{align*}
\]

where:

- \( R_0[t] \): category repeaters among owners of 0 Softcorp' games
- \( MRO[t] \): Softcorp's market share of repeaters among owners of 0 Softcorp' games
- \( S_0[t] \): Softcorp's repeaters among owners of 0 Softcorp's games
- \( N_0[t] \): non-Softcorp's repeaters among owners of 0 Softcorp' games
NTR\([t]\) : non-Softcorp's triers

URO : ultimate repeat rate among owners of 0 Softcorp's games

A\([i]\) : fraction of repeaters which spend \(i\) periods between two purchases (1 period = 3 months; \(A1 + A2 + A3 + A4 = 1\)

The same structure has been used to model repeat sales among owners of 1 and 2 or more Softcorp's games.

Following the same notation, we have:

\[
+ (((STR[t-4]+SR0[t-4]+NR1[t-4])*A[4])

SR1[t] = MR1[t] * R1[t]

NR1[t] = (1-MR1[t]) * R1[t]

and:

\[
+ (((SR1[t-3]+R2[t-3])*A[3] +
+ (((SR1[t-4]+R2[t-4])*A[4])

SR2[t] = MR2[t] * R2[t]

NR2[t] = (1-MR2[t]) * R2[t]

Figure 12 summarizes the parameters needed to calibrate the repeat process.
Figure 12 - ASSUMPTIONS REGARDING THE REPEAT PROCESS

\begin{verbatim}
#-----------------------------------------------------------
# REPEAT - ASSUMPTIONS
#-----------------------------------------------------------
# EFFECT INDEX OF BRAND LOYALTY ON SOFTCORP
# MARKET SHARE AMONG THOSE WHO OWN:
# 0 Softcorp games  1.0
# 1 Softcorp game   1.3
# 2+ Softcorp games 1.6
# PERCENTAGE OF CATEGORY OWNERS WHO WILL
# EVER PURCHASE ANOTHER GAME IN THE CATEGORY,
# AMONG THOSE WHO OWN:
# 0 Softcorp games  30%  
# 1 Softcorp game   60%  
# 2+ Softcorp games 80%  
# DISTRIBUTION OF REPEATERS AS A FUNCTION OF
# THE AMOUNT OF TIME ELAPSED SINCE THEIR
# LAST PURCHASE:
# 3-6 months   0.33
# 6-9 months   0.33
# 9-12 months  0.17
# 12-15 months 0.17
#-----------------------------------------------------------
\end{verbatim}
3.7 Results

The model has given results consistent with all the available data and managerial perceptions. An example of the output of the model is provided in figure 13; that output provides information about the number of games sold by Softcorp and the total number of games sold in the product category, the cumulative number of Softcorp's triers, the average number of games owned by Softcorp's customers, etc..

Not only the output of the model tracks well the available sales data, but also gives results consistent with the findings of the internal surveys or with industry data, regarding, for example, the share of games in this category with respect to total entertainment sales, the relative importance of triers and repeaters, the average number of games owned by Softcorp's customers, etc..

This aggregate version of the model has been used to forecast future sales under a set of variable conditions as well as to assess the impact of incremental trial. It is important to notice, for example, that future sales have two components, one - triers - related to exogenous conditions such as the rate of penetration of floppy disk personal computers in homes or Softcorp's share of
A TRIAL AND REPEAT MODEL FOR SOFTCORP SALES - RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Softcorp</th>
<th>Non-Softcorp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installs of Floppy Disk PCs in Homes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Number of Ultimate Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Number of Category Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Market Share Among Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Softcorp Users</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Market Share Among Repeaters With 0 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Repeaters Among Those Who Had 0 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Softcorp Repeaters Among Those Who Have 0 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Market Share Among Repeaters With 1 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Repeaters Among Those Who Had 1 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Softcorp Repeaters Among Those Who Have 1 S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Market Share Among Repeaters With 2+ S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Repeaters Among Those Who Have 2+ S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Softcorp Repeaters Among Those Who Have 2+ S.G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Softcorp Games Sold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Non-Softcorp Games Sold in Category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarterly Sales As a Percentage of Yearly Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Number of Softcorp Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative Number of Only 1 Softcorp Game</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Number of S.G. Owned by Softcorp Users</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Yearly Sales in Category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softcorp Yearly Sales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Softcorp Market Share in Category</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
triers. The other - repeaters - is more stable and predictable, due to the loyalty of Softcorp's customers. It is quite obvious that, over time, the importance of repeaters increases with respect to triers, given the increase in the installed basis with respect to new additions (both of home computers and of Softcorp's customers). However, without using the model, it is not clear at all how important this phenomenon is, or, in other words, what is the percentage of repeat sales for Softcorp and, even more important, what it is likely to be in the future. In the same way, in evaluating costs and benefits of a couponing or sampling program, it is important to know how many repeat sales are likely to be generated by an incremental trial over time, and this information, too, can be obtained from the model.

3.8 Segmentation

Even more interesting results can be obtained by applying the model to the sales of Softcorp's games for the various computer versions. In fact, segmenting the target population according to the type of personal computer that they own makes a lot of sense for a number
of reasons:

- Awareness can be different because they read different computer magazines (e.g. PC magazine or PC World for IBM owners and Softalk or A+ for Apple owners).

- Availability can be different because they shop for software in different retail outlets (e.g. computer specialty stores for IBM and Apple, mass merchandisers for Atari and Commodore).

- Trial and repeat rates of games in this category can be different; for example, internal survey results indicate that the percentage of category owners very likely to repeat within six months is about 65 percent for Atari and Commodore, 50 percent for Apple, and only 32 percent for IBM. Other results indicate that the percentage of owners rating games as a very desirable application for their computers is about .50 percent for owner of low capability computers, 30 percent for medium, and 10 percent for high.

- Finally, Softcorp's market share can be different across owners of different computers, depending also on the availability of competitors' products for that particular home computer.

As a matter of fact, the application of the model to
the sales of Softcorp's games for the various computers has evidentiated different rates of penetration for different computer segments. While part of these differences could be explained by external, non-controllable market conditions, an important part could be explained by the impact of Softcorp's marketing decisions and deserved a further investigation.

We were particularly interested in assessing the impact of advertising and distribution decisions on Softcorp's sales across different computer versions, and we will propose in the next chapter a simple model of the impact of the allocation of advertising expenditures across different computer magazines on the owners of home computers belonging to different segments.
Chapter 4

OTHER SUBMODELS
4.1 Relating Factory Shipments to Retail Sales

One of the first concerns in our initial discussions with Softcorp's management was that we had no data regarding retail sales; Softcorp simply monitors factory shipments, but these values may greatly overestimate retail sales, particularly in an expanding market, when new titles, new computer versions, new distributors and retailers are added.

In fact, when a new product is introduced, the initial shipments are used to build inventory at various points along the distribution pipeline. This fact is well-known in the software industry, at least because of the estimated 4-5 percent average rate of returns. Returns are software packages sent back to the publishers by distributors and retailers, that had initially decided to stock a product only to realize that its sales were lower than expected. In our case, it is very likely that distributors and retailers are willing to stock a new Softcorp's product as soon as it is announced, since all Softcorp's products have been successful in the past as well as because of the low risk given by Softcorp's very favourable return policy. When a new intermediate distributor or retailer is added to Softcorp's distribution system, there is an obvious increase in
factory shipments. But also when the inventory in the
distribution system adjusts to the new situation, part of
the increase remains, since, with a given amount of
retail sales, inventory increases with the number of
warehouses in which it is stocked.

On the basis of these considerations, building a
model of the inventory along the pipeline was useful for
at least two important reasons. First of all, management
was interested in getting a better grasp of the number of
programs shipped but not yet sold to the final customers;
in other words, management needed to know what Softcorp's
actual sales were. Secondly, the inventory submodel
would have allowed us to better validate the output of
the trial and repeat model described in the previous
chapter, since that model obviously describes retail
sales.

4.2 The Inventory Model

Inventory management theory tells us that the amount
of inventory held by the distribution system is made by
cycle stock and safety stock. Cycle stock refers to the
inventory generated by ordering in quantity; increasing
this order quantity increases the cost of holding cycle stock. Safety stock is an identifiable quantity kept to protect against unexpected high demand or long lead times.

The economic order quantity or Wilson lot size formula tells us what is the amount of inventory \( Q \) ordered each time the level of stock reaches a reorder point given by the safety stock plus the expected demand over lead time [43]:

\[
Q = \sqrt{\frac{2A}{S/C}}
\]

where:

- \( Q \): order quantity
- \( A \): order cost
- \( S \): annual usage or sales
- \( C \): cost of carrying one unit in inventory for one year

Therefore the cycle stock (assuming uniform demand) is:

\[
CS = \frac{Q}{2} = \sqrt{\frac{A*S}{2*C}} = \sqrt{\frac{A}{2C}} = \text{constant} \cdot \sqrt{S}
\]

The cycle stock therefore increases with the square root of demand. We are also particularly interested in determining what happens to our inventory when the number of products or of warehouses increases. Assuming that total sales \( S \) are equally distributed among \( N \) products or
warehouses, the cycle stock becomes equal to:

\[ CS = \text{constant} \times N \times \sqrt{S/N} = \]
\[ = \text{constant} \times \sqrt{N \times S} \]

Of course this formula is a very simplified treatment, which does not consider, for example, quantity discounts or the economies of scale in ordering jointly various products. The safety stock is proportional to the standard deviation of demand over lead time. The constant of proportionality is a function of the level of safety which is required in the system, expressed either as the probability of not incurring stockouts, or as the probability of demand not being satisfied from the existing stock. As a first approximation, it is possible to consider safety stock proportional to the square root of both total demand and number of stock-keeping units (analogously to cycle stock) [44].

In our model of the pipeline inventory, we had to consider a two-echelon model of inventory management: the products are stocked both at the retailer and at the distributors level. At the retailer level, inventory is stocked in really small quantities in many different retail outlets. Given the very short lead time promised by many distributors (24-48 hours), and the low unit sales of each product in each retail outlet, many
retailers may find optimal to stock simply one unit of most software products. At these low levels of inventory, the previous formula does not apply very well; in fact, other considerations, such as joint ordering or quantity discounts, become prominent. The amount of inventory stocked at the retailer level has been therefore computed considering the average number of turns of inventory considered "normal" by industry standards. On the basis of available information, this number of turns should be between 3 and 5, but the subject would definitely deserve further investigation. Considering an inventory policy which leads to a constant number of turns of inventory means that $S/Q$ is a constant, not in accordance with the conclusions of the Wilson lot size formula. A number of four turns of inventory per year would also mean that the about 35,000 outlets carrying entertainment products stock an average of 50 floppy disk entertainment packages each, which appears to be reasonable.

In order to model the amount of inventory stocked at the distributor's level, we had to estimate the constant in the previous formula. In this case, we have been able to collect data about either the average amount of inventory stocked, or the specific inventory policy
followed by the major distributors of Softcorp's products. We were therefore able to verify that the above formula was a reasonable approximation of the real world situation as well as that inventory policies were rather uniform across different distributors.

Finally we had to consider the excess inventory held by computer manufacturers who purchase Softcorp's products. Softcorp has an exclusive agreement for the sale of some computer versions of its games through the respective computer manufacturers. Since these customers often purchase very large amounts of games (for example, contemporaneously to the introduction of a new hardware product), and these games remain often for a long time stocked with the manufacturer, we had to consider this particular situation. However, this was a relatively easy task, since the relative data were communicated to Softcorp by the manufacturers.

The model has provided valuable insight into the effect on inventory of the introduction of a new product, and has given to management the first tentative figure about the pattern of their retail sales, rather than their factory shipments. The results of the model have been compared with the pattern of factory shipments of a new product or computer version, and the two outputs are
consistent. Figures 14 and 15 indicate the results and the underlying assumptions of the model.

4.3 Assessing the impact of advertising decisions

We have mentioned in the previous chapter how the use of our model for the sales of the different computer versions of Softcorp's products evidentiated the existence of different rates of penetration. These differences had to be explained, at least in part, by the impact of Softcorp's decisions in the distribution and advertising areas. For what concerns distribution decisions, relative little help could be seen in a formal model, since, working essentially with distributors or computer manufacturers, Softcorp's decisions had only an indirect impact on the availability of the products in the different types of retail outlets.

The situation is different for what concerns advertising; the allocation of the advertising budget across different media determines the reach and frequency for the owners of different computers. In fact, computer magazines in particular, have a well defined audience in terms of the type of computer owned. We were
Figure 14 - ASSUMPTIONS REGARDING THE INVENTORY SUBMODEL

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF YEARLY INV. TURNS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN RETAIL OUTLETS:</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>NUMBER MAJOR DISTRIBUTORS:</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>NUMBER OF SOFTCORP GAMES:</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>12</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>NUMBER MAJOR COMPUTER VERSIONS (AVERAGE STOCKED BY DISTRIBUTORS):</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>SKU CONSTANT FOR MAJOR DISTRIBUTORS (sqrt(sku inv.)/(sqrt(sku sales))):</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>EXCESS INVENTORY HELD BY COMPUTER MANUFACTURERS:</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>20</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
Figure 15 - RESULTS OF THE INVENTORY SUBMODEL

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SOFTCORP YEARLY SALES</td>
<td>#K  4</td>
<td>22</td>
<td>81</td>
<td>256</td>
<td>608</td>
<td>1151</td>
</tr>
<tr>
<td>INV. HELD BY RETAILERS</td>
<td>#K  1</td>
<td>7</td>
<td>27</td>
<td>85</td>
<td>203</td>
<td>384</td>
</tr>
<tr>
<td>INCREASE IN RET. INV.</td>
<td>#K  1</td>
<td>6</td>
<td>20</td>
<td>58</td>
<td>117</td>
<td>181</td>
</tr>
<tr>
<td>SHIPMENTS TO RETAILERS</td>
<td>#K  5</td>
<td>28</td>
<td>101</td>
<td>314</td>
<td>725</td>
<td>1332</td>
</tr>
<tr>
<td>INV. HELD BY DISTRIBUT.</td>
<td>#K  1</td>
<td>5</td>
<td>14</td>
<td>39</td>
<td>79</td>
<td>145</td>
</tr>
<tr>
<td>INCREASE IN DISTR. INV.</td>
<td>#K  1</td>
<td>4</td>
<td>9</td>
<td>24</td>
<td>40</td>
<td>65</td>
</tr>
<tr>
<td>SHIPMENTS TO DISTRIB.</td>
<td>#K  6</td>
<td>32</td>
<td>110</td>
<td>339</td>
<td>766</td>
<td>1397</td>
</tr>
<tr>
<td>EXCESS INV. HELD BY C.M.</td>
<td>#K  0</td>
<td>0</td>
<td>20</td>
<td>40</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>INCREASE IN EXCESS INV.</td>
<td>#K  0</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>-20</td>
<td>-10</td>
</tr>
<tr>
<td>FACTORY SHIPMENTS</td>
<td>#K  6</td>
<td>32</td>
<td>150</td>
<td>359</td>
<td>746</td>
<td>1387</td>
</tr>
<tr>
<td>ACTUAL FACTORY SHIPMENTS</td>
<td>#K  6</td>
<td>30</td>
<td>128</td>
<td>360</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>difference with model</td>
<td>%  1%</td>
<td>5%</td>
<td>22%</td>
<td>0%</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
particularly interested in evaluating the impact of the present allocation of the advertising budget for low, medium, and high capability computer owners, since our model indicated an unexpectedly high rate of penetration in the high capability segment and a rather low rate of penetration in the low capability one. The model had also the purpose of supporting a more effective allocation of the advertising budget in the future. We limited our analysis to computer magazines, mainly because we had reasonably good data about home computer owners readership only for this type of magazines; this is not, however, a major limitation, since computer magazines absorbed about 80 percent of 1984 Softcorp advertising budget. The results of the model confirmed both that the different rate of penetration of Softcorp's products could be explained, at least in part, by the impact of their advertising decisions, and that a more effective allocation in the future will be possible.

4.4 The Advertising Model

The problem of media selection is to find a way to
deliver the desired number of exposures to the target audience and to schedule the delivery of those exposures over the planning period [45]. The effect of exposures is determined by the reach, frequency, and impact obtained through a certain media schedule:

- Reach is the number of different persons or households exposed to a particular media schedule at least once during a specified time period; it depends both on the audience of each media vehicle used and on the level of audience duplication across those vehicles.

- Frequency is the number of times within the specified time period that an average person or household is exposed to the message.

- Impact is the qualitative value of an exposure through a given medium.

The total number of exposures (E), also called the gross rating points (GRP), is the reach (R) times the average frequency (F):

\[ E = GRP = R \times F \]

While the weighted number of exposures (WE) is the reach (R) times the average frequency (F) times the average impact (I):

\[ WE = R \times F \times I \]
The media decision problem is therefore, given an advertising budget and a certain number of media available, to choose a media plan which delivers the most effective combination of reach, frequency, and impact. The effectiveness of the media plan should be therefore evaluated on the basis of a profit-maximization objective (which is the same as maximizing sales, since we assumed that the advertising budget is fixed).

In our case we were able to identify computer magazine readership for each of the three segments of low, medium, and high capability computer owners. We were also able to identify a measure of the market potential of Softcorp's games for each of these three segments, simply given by the number of owners of floppy disk computers in each segment times the probability that they will purchases entertainment software for their computers.

If the response functions of sales to advertising in each of the three segments are concave and not too dissimilar, an optimal allocation of the advertising budget should provide a higher reach and frequency for the segment with a higher sales potential. We have therefore computed the reach and frequency provided by a given advertising budget for each segment and compared it
with the sales potential. As a guideline to the choice of a media plan, we have also computed an effectiveness index that indicates, for each computer magazine a normalized measure of the sales potential of the magazine readers divided by the cost of advertising on that magazine (figures 16, 17, 18, and 19).

The database used provided us with a measure of the readership of each computer magazine as well as of the total duplication across all computer magazine readers for each segment of computer owners. Since we needed an estimate of the duplication given by a given schedule, we had to construct a reasonable function describing duplication across the audience of the different magazines. We knew that duplication is 0 if we advertise on a single computer magazine, and that it is a given number DMAX if we advertise on all the magazines. We assumed, for simplicity, that duplication increases with the number of computer magazines following a quadratic law:

\[
D = 1 + (D_{\text{MAX}} - 1) \times \left( \frac{(N-1)}{(N_{\text{MAX}}-1)} \right)^2
\]

where:

- \(D\) : duplication with \(N\) magazines
- \(D_{\text{MAX}}\) : maximum duplication (with \(N_{\text{MAX}}\) magazines)
- \(N\) : number of computer magazines
- \(N_{\text{MAX}}\) : total number of computer magazines
Figure 16 - ASSUMPTIONS REGARDING THE ADVERTISING SUBMODEL (A)

<table>
<thead>
<tr>
<th>Magazine</th>
<th>Cost</th>
<th>L.C.</th>
<th>M.C.</th>
<th>H.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computing</td>
<td>10000</td>
<td>16%</td>
<td>21%</td>
<td>24%</td>
</tr>
<tr>
<td>Compute!</td>
<td>5500</td>
<td>24%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Byte</td>
<td>8000</td>
<td>13%</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>Creative Computing</td>
<td>6000</td>
<td>11%</td>
<td>18%</td>
<td>15%</td>
</tr>
<tr>
<td>Computerworld</td>
<td>6000</td>
<td>10%</td>
<td>11%</td>
<td>17%</td>
</tr>
<tr>
<td>Compute!'s Gazette</td>
<td>4000</td>
<td>16%</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>PC Magazine</td>
<td>5000</td>
<td>4%</td>
<td>6%</td>
<td>36%</td>
</tr>
<tr>
<td>Softalk</td>
<td>3000</td>
<td>3%</td>
<td>17%</td>
<td>25%</td>
</tr>
<tr>
<td>PC World</td>
<td>4000</td>
<td>4%</td>
<td>8%</td>
<td>28%</td>
</tr>
<tr>
<td>Popular Computing</td>
<td>6000</td>
<td>6%</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td>Family Computing</td>
<td>5000</td>
<td>9%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>99'er Home Computing</td>
<td>3000</td>
<td>9%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Info World</td>
<td>5000</td>
<td>5%</td>
<td>6%</td>
<td>15%</td>
</tr>
<tr>
<td>Personal Software</td>
<td>3500</td>
<td>4%</td>
<td>5%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Figure 17 - ASSUMPTIONS REGARDING THE ADVERTISING SUBMODEL (B)

================================================================================

IMPACT OF ADVERTISING DECISIONS - DATA (B)
================================================================================

AVERAGE NUMBER OF C.M. READ (by C.M. readers):

<table>
<thead>
<tr>
<th>Category</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>l.c.</td>
<td>1.34</td>
</tr>
<tr>
<td>m.c.</td>
<td>1.28</td>
</tr>
<tr>
<td>h.c.</td>
<td>2.17</td>
</tr>
</tbody>
</table>

TOTAL PERCENTAGES OF PC OWNERS IN HOMES WHO READ COMPUTER MAGAZINES (considering duplication):

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>l.c.</td>
<td>60%</td>
</tr>
<tr>
<td>m.c.</td>
<td>70%</td>
</tr>
<tr>
<td>h.c.</td>
<td>71%</td>
</tr>
</tbody>
</table>

PERCENTAGES OF PC OWNERS IN HOMES INTERESTED IN PLAYING GAMES IN THIS CATEGORY:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>l.c.</td>
<td>65%</td>
</tr>
<tr>
<td>m.c.</td>
<td>50%</td>
</tr>
<tr>
<td>h.c.</td>
<td>30%</td>
</tr>
</tbody>
</table>

PERCENTAGES OF THE TOTAL NUMBER OF FLOPPY DISK PCs IN HOMES WHICH BELONG TO EACH CATEGORY:

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>l.c.</td>
<td>50%</td>
</tr>
<tr>
<td>m.c.</td>
<td>30%</td>
</tr>
<tr>
<td>h.c.</td>
<td>20%</td>
</tr>
</tbody>
</table>
Figure 18 - RESULTS OF THE ADVERTISING SUBMODEL (A)

<table>
<thead>
<tr>
<th>Magazine</th>
<th>eff.</th>
<th>FP(2)</th>
<th>DP(3)</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computing</td>
<td>1.0</td>
<td>4</td>
<td>0</td>
<td>40000</td>
</tr>
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<td>Compute!</td>
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<td>2</td>
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<td></td>
<td></td>
<td></td>
<td>36500</td>
</tr>
</tbody>
</table>

(1): Effectivness is measured in results/cost, where results is the fraction of the target population reached with the magazine.

(2): Full Page

(3): Double Page


Figure 19 - RESULTS OF THE ADVERTISING SUBMODEL (B)

<table>
<thead>
<tr>
<th></th>
<th>45%</th>
<th>52%</th>
<th>54%</th>
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<tr>
<td>m.c.</td>
<td></td>
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<td></td>
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<tr>
<td>h.c.</td>
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<td></td>
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</table>

AVERAGE NUMBER OF DIFFERENT MAGAZINES CARRYING ADVERTISEMENTS READ BY THOSE REACHED:

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<th></th>
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<th>1.14</th>
<th>1.48</th>
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<td></td>
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<tr>
<td>h.c.</td>
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</table>

AVERAGE FREQUENCY OF ADVERTISEMENTS FOR THOSE WHO ARE REACHED (double weight to DP):

<table>
<thead>
<tr>
<th></th>
<th>8</th>
<th>8</th>
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<td>m.c.</td>
<td></td>
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<tr>
<td>h.c.</td>
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</table>

RELATIVE MEASURE OF POTENTIAL DEMAND IN THE THREE SEGMENTS:

<table>
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<td></td>
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<td></td>
</tr>
<tr>
<td>h.c.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
magazines)

N : number of magazines used by our schedule

NMAX : total number of magazines with non-negligible readership

The reach was then computed as the sum of the audiences of the computer magazines used in the media plan, divided by the duplication factor D.
Closing Remarks

The experience gained by working closely with Softcorp's managers on this project has clearly pointed out that decision making can be improved by the use of formal marketing models.

In addition to their use as a decision support tool, marketing models offer probably less visible, long term benefits which are even more valuable. We have already explained how the process of formal analysis of the market behavior can highlight the areas in which data are more scarce and valuable, and therefore direct future data collection efforts. Moreover, the model building process by itself can be very beneficial, triggering ways to think about a problem that otherwise would not have occurred to the decision maker.

These results have been obtained in a market particularly characterized by lack of data and environmental instability. While these conditions have generally discouraged the use of formal models, our experience is that the potential benefits more than compensate for the challenge of the model building effort.
Footnotes


[13] Business Week - "How Apple is Bullying IBM's
PCjr" - April 16, 1984, p. 84.


is Already Here" - August 20, 1984, pp. 102-104.


Bibliography


