

Information use and company performance

An application to the retail electrical appliances sector

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While there is no doubt that we are living in an information age, the question as to whether information is really beneficial to its users has not often been addressed empirically. This paper aims to address this issue by analysing information use by retail electrical appliance companies in order to explain differences in company performance. The results suggest that some companies spend too many resources on information, so that information use becomes counterproductive.

Keywords: information use, Porter's model, cluster analysis

'The information age has arrived': this is the message that was convincingly proclaimed by Naisbitt (1982), and has been repeated ever since. Indeed, information technology has made the widespread and cheap use of information possible, inducing numerous new applications. The question that has not been addressed, however, is whether economic agents are actually better off because of this overwhelming volume of attainable information.

The present paper aims to discuss this important issue. It does so by concentrating on information use by companies. Standard microeconomic analysis suggests that an optimal level of information demand exists, but in this paper we assume that not all companies succeed in optimizing their information needs. Hence we expect to find differences in performance that can be attributed to deviations from optimal use of information. After a conceptual and formal analysis, this topic is also studied empirically.

The next section of this paper presents a general framework – inspired by the works of Porter (1979, 1980) – to model the competing company in its (economic) environment. It is concluded that an empirical analysis should ideally be directed to a sector that shows distinct characteristics: in particular, sensitivity to information use because of tough competition with many identical companies in a fashionable market. The following section then

describes the sector that was chosen in view of these considerations: the retail electrical appliances sector. A survey was conducted among Dutch companies to analyse the information behaviour of this sector and to relate this to the performance of the companies. The resulting data are described in the subsequent section, and then analysed in detail. The most remarkable result of this analysis is that at least some companies in the sample seem to use too much information: the more information is used, the lower the relative performance of the company.

A conceptual framework: the Porter model

Our starting point – influenced by Porter (1979, 1980) – is the company competing with its competitors (or rivals) within the industry (or sector). All companies in the industry are facing the same competitive forces from their environment. The company that succeeds in taking the best position with respect to these forces, in comparison with the other companies, will yield the best results, which will be revealed by its performing above the industry's average. In this section we first discuss the competitive forces in a general setting.

Basically, four competitive forces can be identified: *new entrants*, *buyers*, *sellers*, and *substitute products*. Porter (1979) provides an elaborate discussion of what determines the strength of the competitors in each of these four areas, which will

be summarized in discussing the electrical appliances sector in the next section.

These four forces may be further aggregated into two categories: forces in the fields of *price* and *volume*. In addition to these free-market forces, regulators (such as the government) play a significant role in defining the rules of the competition. We explicitly assume that the optimal use of information in any of these areas, including regulators, has an effect on the performance of the company.

Where companies produce qualitatively identical products, using qualitatively identical inputs, competition with suppliers of the input and consumers will concentrate on prices. On the other hand, assuming a fixed demand for the products of the company in its sector, new entrants will fight for some share of this demand (a piece of the cake), while substitute products will compete for some part of the demand (the size of the cake). Thus we may assume that new entrants do not change the total demand for the product of the sector, while substitutes try to reduce the size of that demand.

Figures 1 and 2 illustrate this model. Figure 1 shows the field of price competition. The bottom end of the line (P_1) indicates the absolute minimum production cost because of input factors that have to be paid for. The upper end of the line (P_4) indicates the absolute maximum price that the consumer is willing to pay for the product. The middle part of the line is the minimum profit margin (MPM) that the company wants to make on the production of the product. The exact use of this margin is of no interest; the usefulness of this interval is found in the existence of a maximum input price P_2 and a minimum selling price P_3 . Under certain circumstances they can even coincide. P_2 , the lower end of the MPM interval, indicates the maximum amount that the company is willing to pay for the input factors. P_3 , at the upper end of the MPM interval, is the minimum selling price of the company. Competition with suppliers is on the interval P_1 to P_2 , and with consumers on the interval P_3 to P_4 . Note that this latter interval resembles the maximum consumer surplus. The trading prices – P_b for the inputs, and P_s for the output – will by definition be somewhere on these intervals, and the company obviously tries to maximize the selling price P_s , and to minimize its factor inputs buying price P_b . Thus, on the consumer's side, we assume that the company tries to make optimal use of the consumer demand, and tries to sell to each consumer for the maximum price possible. An implicit assumption in the context of price competition is that the volume of traded products to each (group of) consumer(s) is not influenced by P_s , as long as it is below P_4 .

Figure 2 depicts the competition that a company faces. In the inner circle the price line of Figure 1

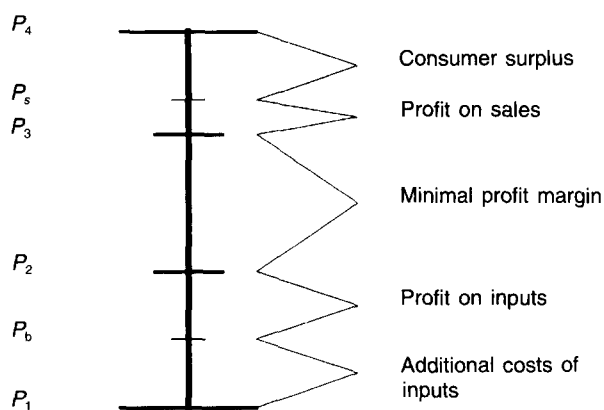


Figure 1 Representation of price competition

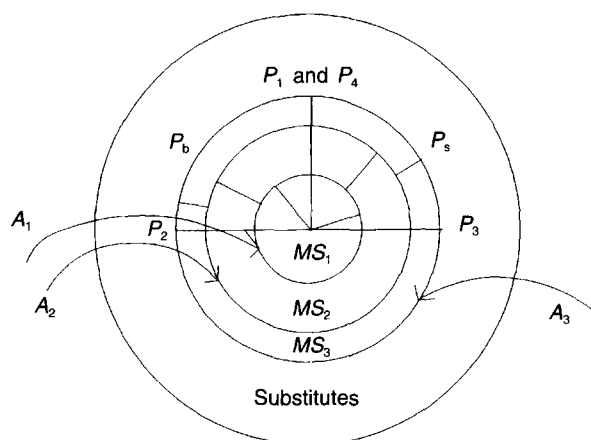


Figure 2 Competitive forces for the industry. MS_i = market share of i

has become a closed circle (P_1 and P_4 are connected here). Within the industry segment, companies are indicated with their share of demand. The outer circle indicates the entire market for the products of the companies, and the substitute products. The threat posed by substitute products is that their share of this total market increases, which means that the inner circle is pushed further inwards. Of course, the industry as such can also increase its market share at the cost of the substitute products: the inner circle expands. Even the complete market can grow: the complete circle inflates, and all parts of the market grow, for example, proportionally.

The threat of new entrants is represented by arrows landing in the industry's market share. As the market does not (necessarily) expand when there are new entrants, the latter's activities lead to

a decrease of the market share of companies already in the market. Notice that, in general, this decrease will take place in the industry itself, as suggested by arrows A_1 and A_2 , but that new entrants can also enter at the border of the industry, contesting also the substitutes market (see arrow A_3).

What is basically illustrated by *Figure 2* is the above-mentioned distinction between price competition and volume competition. An underlying assumption is that volume is independent of price: the company's market share is in the first instance a matter of reaching potential customers. Given that these customers are identified and bound to the company – that is, the company has reached some market share – the company tries to make them pay their maximum price, P_4 . The identification and binding of customers is achieved by using qualitative aspects such as service levels and image building. The costs that are associated with these efforts are assumed to be recovered from the minimal profit margin. Thus these costs may affect the level of P_3 (the minimal selling price), but it is implicitly assumed that this level does not have a real effect on P_s .

The main purpose of the model is to make clear what factors and actors are important for the competing company: consumers of the output, suppliers of the input factors, the government and rivals, this last including competitors, new entrants, and producers of substitutes. The competition is played by taking actions and making decisions, and these decisions are made on the basis of information. So companies need information about customers, suppliers, the government, and rivals.

This leads to the hypothesis that is central in this paper: companies that collect more information about the competitive forces will *ceteris paribus* yield better results with respect to these fields. For example, companies that collect more information about labour markets will be able to hire labour on more profitable terms and specifically will pay lower prices for the same quality of labour than their competitors. In other words, the marginal productivity of information is positive. Assuming that this marginal productivity is decreasing, and making the assumption that the costs of acquiring and using information are linearly increasing, leads to the existence of an optimal level of information use.

In real-world situations not all companies will succeed in optimizing their information demand, which may then be reflected in lower performance. Reasons may for example be found in differences in management, or differences in adjustment time to changing market conditions. This leads to the following research issues addressed in this paper:

- (1) Can differences in company performance be attributed to differences in information use?
- (2) If so, can we determine the optimal information use level? Alternatively, can we determine

and typify companies that use too much or too little information?

These general issues can also be formulated in a more specific way:

- (3) Suppose we have determined which competitive forces are important, and which are relatively unimportant. We then may ask: do those companies more actively collecting information on the important forces perform better than those who do not focus on the important forces?

Note, however, that we shall only be able to attribute differences in performance to suboptimal information use when we compare companies that are otherwise equal; or, alternatively, when we have full information on all other characteristics of the company. Another point that is consequential for empirical research is that information is a production factor, but only in a derived, second-order sense. Information is useful in making decisions about everything concerning the company, but is not directly involved in the production process. We therefore conjecture that the effect of information is visible only when the relative performance (ie compared with that of competitors) is sensitive to differences in information use.

The implications for empirical research are manifest. We assume that the effect of information is most likely to be measurable when two conditions are met:

- (1) competition is tough, with many rivals in the same segment of the market; and
- (2) the market is persistently in a state of rapid change, preferably on both the consumers' and the suppliers' side, and also with regard to governmental regulations.

Consequently, it is most promising to study companies from an industry that is characterized by many small companies in a fashionable international market of consumer products with many suppliers.

The retail electrical appliances sector – sellers of audio sets, TV sets etc – is considered to be an industry that meets most features of the ideal typical industry sketched above, except that there is not much government regulation in this area. In the next section, we take a closer look at this industry, at the same time studying its most important competitive forces as identified above.

The retail electrical appliances sector

In this section we first give a general, introductory description of the retail electrical appliances sector in the Netherlands. Then its competitive forces are analysed, following the model of the previous

Table 1 Expenditures on consumer electrical goods for 1985, 1990 (projection) and 1995 (expected), including VAT (in billions of guilders)

	1985		1990		1995
Vision	1.77		2.25		2.50
Televisions		0.90		1.20	
VCR and camcorders		0.87		1.05	
Sound	0.915		1.45		1.90
Hi-fi		0.64		1.20	
Personal audio		0.275		0.25	
Other	0.45		0.60		0.75
Car radios		0.125		0.25	
General supplies		0.325		0.35	
Total sound and vision	3.135		4.30		5.15
White goods	1.765		2.45		2.85
Total consumer electronics	4.9		6.75		8.00

Source: Pleijster (1991)

Table 2 Some characteristics of the retail electrical appliances sector in 1989

	Total turnover ^a	Number of firms	Turnover per firm ^a	Turnover in apparatuses ^b	Turnover in apparatuses by firm ^a
Chains	1660 (33%)	420 (12%)	3.95	1920 (30%)	3.80
Organized	1350 (28%)	770 (23%)	1.75	1340 (21%)	1.31
Independent	1990 (39%)	2210 (65%)	0.90	1600 (25%)	0.63
Others				1540 (24%)	
Total	5010	3400	1.65	6400	

Notes:

^aMillions of guilders, excluding VAT

^bMillions of guilders, including VAT

Source: Pleijster (1991)

section. This section draws heavily on Pleijster (1991): unless stated otherwise, data are from this report.

Table 1 shows total expenditures for the industry in 1985, 1990 (projection) and 1995 (expectation). It also reports expenditures on so-called *white goods* (refrigerators, ovens etc). Although our intention was to keep the study strictly to the electrical appliances sector, in practice it turned out that this restriction was impossible to maintain because of the mixed structure of many companies. Therefore, the white goods sector is mentioned whenever relevant. The union of the two sectors is referred to as the *consumer electrical goods sector*.

For a detailed discussion of Table 1 we refer to its source. For our purpose the important thing to note is that although many consumer electrical products are in the saturation stage of their product life-cycle, by constant upgrading, introducing 'new' products, miniaturizing etc the sector succeeds in creating a replacement demand that is large enough for it to remain a growth market. This mechanism makes the market a fashionable one.

In 1990 the retail electrical appliances sector consisted of about 2700 enterprises with approximately 3400 stores. For convenience we shall call the stores *firms*. About 420 firms (12%) belong to commercial chains; about 770 firms (23%) cooperate in a less formal way; while the remaining 2210 firms (65%) are independent. (According to the definition in Pleijster (1991) a chain consists minimally of seven firms belonging to the same enterprise.) Table 2 gives some data on the organization and economic performance of the sector.

Noteworthy from this table is the difference between the categories in terms of turnover per firm, which is much larger for organized and chain firms. In general, entrance to a cooperative is excluded for firms with less than Dfl 1 million turnover. A second interesting result is the much larger share of goods in terms of turnover for chains than for independent firms. The remainder of the turnover is generated by service activities such as repair and installation. We now turn to the discussion of the competitive forces in the sector.

Buyers

Electrical appliances retailers sell their products to households. Porter (1979) mentions a number of factors that determine the strength of the competition by buyers (and sellers, which are more or less opposites). Stated briefly, a buyer (or group of buyers) is powerful if it purchases in large volumes, if the products are standardized or undifferentiated, if the products are relatively expensive, or if there are no significant switching costs.

Applying these criteria to the retail electrical appliances industry it appears that consumers may possess quite a powerful position, as the products that they buy are relatively expensive, and the products are highly standardized and undifferentiated. In addition, there are no switching costs, as there are many retailers with low thresholds. The counterpoint is the weak organization of consumers (only approximately 11% of Dutch households are members of a consumers' association), which means that effectively the goods are bought in small numbers only. Thus firms have to deal only with individual purchases, which are not significant for the performance of the firm as a whole. However, the fact that 65% of the firms are independent shows that they themselves are not particularly well organized either.

Suppliers of input

Table 2 shows that by far the largest part of input consists of supplies of tradables, which is typical for the retail sector. Therefore, we concentrate on the suppliers of these goods in the discussion of the input factors.

As there are only a few Dutch manufacturers of appliances – Philips being the most notable among them – the greater part of supply comes from abroad. These imports are predominantly distributed by approximately 120 so-called *sales houses* (which may belong to foreign companies). In 1989, 83% of supply was directly delivered to retailers, and thus only 17% by wholesale, and this latter percentage has been steadily decreasing for years. Thus on the supply side retailers are dealing with a large number of suppliers, almost all from abroad. Although there are many more firms than suppliers, the number of the latter still seems to be too large to speak of concentrated supply.

A second consideration is that the amount of money involved in transactions between a supplier and a firm represents a relatively large part of the firm's expenditure, whereas it is only a relatively small part of the earnings of the supplier. In other words, each individual supplier is important to the retailer, but an individual retailer is less important to the supplier (compare the analogous argument when discussing the buyer's position). Overall, we may conclude that the competitive forces in this area seem to balance.

Recall that the market for electrical appliances is persistently in a state of rapid change as a result of technical progress, and the need to create replacement demand. The success of retailers can be assumed to depend on their ability to respond to these developments. Thus it is important for retailers to be fully informed about the developments on the suppliers' side, and this offers competitive opportunities. However, these opportunities do not determine the strength of retailers as opposed to their suppliers; but they illustrate the importance of keeping well informed about what is happening on the producer's side.

Substitutes

Loosely speaking, two goods are substitutes if they satisfy comparable needs. In this sense we can think of no true substitutes for electrical appliances. Goods that compete for the same part of the consumer's budget are luxury goods in general, like holidays, but clearly they serve different purposes. It is perhaps interesting to observe, however, that the substitutability of luxury goods, in particular by holidays abroad, was occasionally mentioned in the preliminary interviews that we had with some retailers.

New entrants

The threat of new entrants is by and large determined by the ease with which new businesses can be started. A number of factors that may hinder this start can be identified: economies of scale, product differentiation, capital requirements, cost disadvantages independent of size, and access to distribution channels. The common factor in this list is the (in)ability to start business on a sufficient scale for sufficiently low cost. If initial investments are low, in particular insofar as sunk costs are concerned, there are practically no barriers to entry. Indeed, the retail electrical appliances sector typically has low initial investments.

Another point is that total demand is growing only modestly, leaving little room for new entrants. This aspect, in combination with the low attractiveness of the market due to the high level of price competition, appears to have a significant effect, as the number of firms showed a net decrease from about 3650 in 1985 to 3100 in 1989.

Thus, on theoretical grounds, a strong threat from new entrants can be expected, as there are no real barriers to entry. However, the data show a net decrease in the number of firms, probably due to strong competition. It may thus be the case here that though there are many new entrants, they are nevertheless outnumbered by those leaving the market. This, however, leaves the threat of entrants unchanged.

Government

The government's role as a regulator is of significant importance to the functioning of many industries.

For the retail electrical appliances sector, however, governmental actions at the national, regional, or local level are of practically no significance. Yet producers are located all over the world – predominantly in Japan and the USA – and therefore international affairs may be of some concern to Dutch retailers. Examples concern dumping and protectionist policies. Therefore, governmental action on an international level may be of some relevance to the electrical appliances retailers.

Rivals

The above-mentioned fields constitute the domain of competition. This competition is fought with a firm's rivals. Therefore, outperforming competitors requires knowledge not only about these fields, but even more so about the actions of rivals on these fields. Clearly, information about the rivals is of fundamental importance for the firm.

The interesting point about this is who are to be considered a firm's rivals. This largely depends on the consumers that a firm wants to reach, and this again is strongly related to the choice of spatial scale and marketing concepts. These topics deserve some further attention.

Pleijster (1991) indicates that six marketing concepts can be distinguished in the sector. Three of these concepts rely predominantly on the service aspect: a first concept connects this with a broad assortment (*service-choice*), a second one with a medium assortment (*service-normal*), and a third one with a highly specialized assortment (*service-special*). A fourth concept that Pleijster identifies is the *non-concept*: no single aspect of marketing receives special attention. Retailers using this concept typically perform below the sector's average. A fifth concept primarily concerns price competition and only secondarily service competition (*price-service*). This concept is typical for chain stores, who combine this concept with a broad assortment. The final concept is relatively new, and called the *superstore* concept. This makes use of large stores and a very broad assortment, from low-end to high-end products (high-end refers to superior quality products and significantly higher prices, partly due to snob appeal). Moreover, these stores sell derived products in such fields as photography and computers. This last concept is of no practical importance for our current analysis, as there are very few superstores.

Non-concept stores are typically most concerned with survival. They have a defensive strategy in reacting to moves of competitors. Thus, although they may compete with all other types of marketing concept, they are relatively harmless because of a lack of vision.

Tough competition may be expected among firms with the same concept. In addition, the *service-choice* and *price-service* concepts concentrate on similar groups of consumers: only the

instruments they use differ. Further, *service-choice* stores have a local or regional basis, while chains (as an entity) perform on a higher spatial level. As chain stores usually have low prices, stores with the *service-choice* concept also have to be cheap. The resulting low margins necessitate a relatively large (spatial) market. At the other end of the service spectrum, *service-special* shops are quite distinct, as their prime interest is the sale of high-end products and comparative standards for service. However, this makes the market much thinner, also requiring a spatially large market. Thus both *service-choice* and *service-special* stores operate on a relatively large spatial scale, yet address different segments of the market. Therefore, they are considered to be each other's competitors to a minor extent only. Finally, the *service-normal* concept takes an intermediate position. Its strong points are the local attraction, and concentration on brands that are not obliged to be low-priced. Obviously, this is a vulnerable position, as these stores are threatened from two sides. Nevertheless, a considerable number of stores use this concept.

To conclude: strong competition exists at the low end of the market. At this end, the spatial orientation is relatively wide. High-end stores opt for the same spatial market, yet their target population is different. At this high end, competition is significantly less. In between are vulnerable stores, which address both market segments. They concentrate on a smaller spatial scale, leading to a comparative advantage on the local market.

Summary

The sector's position with respect to buyers is quite weak, implying a potentially strong competitive force. Its position towards sellers is more or less in balance. New entrants and especially substitutes seem relatively unimportant. Rivals are especially important at the low end of the market. Finally, national government policy and regulation are unimportant, though international affairs may be of some concern.

Having identified the main competitive forces, we now are ready for an empirical analysis. The data that were collected concentrate on company performance on the one hand, and on information use on the other. As it is not immediately clear which variable(s) should be used as a measure of company performance (this also depends on the objectives of the company), data on a number of indicators (turnover growth, profits etc) are collected. A similar measurement problem is encountered on the information side. Therefore data are collected on a number of input sources, related to the fields identified above. The next section describes the data and collection procedure in some detail, while the subsequent section presents the statistical analysis.

The data

The data used in the empirical analysis are the result of a survey that was held among electrical appliances retailers in November/December 1991. The survey was sent to stores and addressed to the store manager. If questionnaires had been sent to *firms* – many of them with more than one store or department – it was feared that because of the aggregation of departmental data, valuable information on the behaviour of individual actors at the store level would be lost. An implicit assumption in this approach is that store managers can operate independently.

Questions were structured under five headings: general data about the firm, economic data, availability and use of telecommunications media, use of other media, and use of other sources of information. 'Other media' included electronic media such as videotext, but also newspapers and all kinds of periodicals. 'Other sources' dealt with face-to-face contacts with sales representatives, follow-up education etc.

A total of 893 questionnaires were sent by post, including a stamped return envelope, and followed by a telephone reminder. A gross response of 11.6% and a net response of 8.4% (that is, 75 usable forms) was the result. Possible reasons for this somewhat low response are:

- The questionnaires were distributed shortly before the busiest period for retailers: the month of December.
- Retailers are overwhelmed with all kind of questionnaires, which clearly erodes their willingness to participate.
- There was no accompanying letter of recommendation: for example, from the Chamber of Commerce.
- Apparently, respondents were not convinced of the personal benefits of participating.

In spite of the low response rate, a number of 75 observations is, in general, sufficient for data analysis. Similarly, the quality of the data was modest, but good enough for the tentative analysis of the next sections. Moreover, the sample appeared to be representative with respect to the main characteristics (see below).

Electrical appliances retailers who received a questionnaire had been stratified by location. Eight Chamber of Commerce districts were chosen, according to *Table 3*. Four of these districts are in the highly developed Randstad (the region in the western part of the country, where the four major cities are located: Amsterdam, Rotterdam, the Hague and Utrecht) and the other four are from the (slightly) less developed rest of the country. Similarly, both within the Randstad and from the rest of the country, four urbanized districts versus four semi-urbanized regions were selected.

Table 3 Selection of Chambers of Commerce districts

	Randstad	Outside Randstad
Urban	Amsterdam Utrecht	Groningen Nijmegen
Semi-urban	Haarlem Gouda	Roermond Deventer

Table 4 Representativeness of response (in percentages)

	Randstad	Outside Randstad	Totals
Urban			
Sample	47.0	23.2	70.2
Response	37.5	29.2	66.7
Semi-urban			
Sample	18.0	11.8	29.8
Response	23.6	9.7	33.3
Totals			
Sample	65.0	35.0	100.0
Response	61.1	38.9	100.0

Notes: Sample $n = 893$; response $n = 72$

Table 4 shows the distributions of firms in the sample and the response by location. The column and row totals are comparable, but the cells show a significant deviation, most notably for the urbanized region in the Randstad. With respect to the size of the firms – measured by full-time-equivalent jobs they offer – there appeared to be a reasonable similarity between sample (3.6 jobs) and response (3.4 jobs).

Analysis of the data

Preliminaries

In this subsection we first present and discuss the raw data about economic performance and the data concerning the use of information. We study the representativeness of the response and consider whether differences in performance are related to the characteristics of the firms. We also show how the large number of information-use variables are summarized in a few compound variables.

Tables 5 and *6* consider whether differences in performance can be attributed to a firm's characteristics. Three performance indicators are summarized in these tables: profits as a percentage of turnover, market share, and turnover growth. Market share is reported as a subjective perception of this variable, as it is practically impossible to define it exactly (see the discussion above). Similarly, turnover growth refers to expectations for the next two years.

Table 5 Competition indicators by location

	Randstad	Outside Randstad	Totals
Urban			
Mean profit	72	129	98
Market share	90	79	85
Turnover growth	71	81	75
Semi-urban			
Mean profit	104	107	105
Market share	118	119	119
Turnover growth	170	100	154
Totals			
Mean profit	85	124	100
Market share	101	88	100
Turnover growth	108	86	100

Table 6 Economic indicators by company characteristics

	Market share	Turnover growth	Profits
Firm size			
Small	27.3	7.9	15.9
Medium	28.3	13.7	16.3
Large	26.2	11.3	8.5
Chain member			
Yes	33.3	6.0	12.3
No	25.0	11.2	14.3
Purchase organization			
Yes	33.2	14.9	11.0
No	22.2	6.7	15.8
White goods			
Yes	29.7	6.2	13.2
No	26.1	12.3	14.5

Table 5 shows that firms in the urbanized part of the Randstad have lower profits compared with those from the urban regions outside the Randstad. Similarly, firms from semi-urban regions have typically larger market shares. Finally, firms in the semi-urban regions in the Randstad have the highest expectations about turnover growth. From this table we conclude that deviations from the average show no consistent patterns, except that firms in the urbanized part of the Randstad perform typically below average.

Table 6 shows that reported market share is independent of market size. Apparently, larger firms serve larger markets, leading to comparable market shares. However, firms that are organized – by joining a chain, or a purchase organization – report larger market shares than unorganized firms. Concerning growth expectations, it appears that small firms have slightly worse prospects than medium-sized and large firms. Also, those organized in a purchase organization are optimistic about their

growth potential, while chain members expect less growth. Quite interesting is the result that firms who also sell white goods have notably lower expectations about turnover growth than ‘appliances only’ firms. Finally, the data on profits reveal that large firms have notably lower profits than other firms. Again, we conclude that observed deviations from the averages show no consistent patterns.

Next we discuss the construction of the variables describing the use of information. A number of questions in the survey addressed this topic, and our goal here is to aggregate these data.

Ouwersloot (1994, Chapter 2) discusses the problems involved in information measurement. For the present discussion, the important points are that it is fairly easy to measure the volume of messages (the units in which information is exchanged), but that the informational content of messages is also related to a number of other characteristics of the message, as well as to the semantic model of the receiver. Moreover, a semantic model is strongly personal and difficult to observe. So we conclude that in the present setting direct measurement of information use is practically impossible.

Consequently, we have to stick to indirect measurement of information use. In the present analysis we use volume as a proxy for information use. Obviously, many important aspects of information are neglected in this way. In particular, the characteristics of quality and timeliness of information have to be mentioned in this respect. However, two arguments may be mentioned as to why volume is a reasonable proxy in empirical analysis. First, the volume of information used can be considered as an indicator of the importance that the firm attaches to information. If a firm attaches much weight to information use it is reasonable to assume that it will also attach weight to the quality of information. In that case, volume and quality will be positively correlated, and volume can be used as a proxy for quality. Second, if a firm uses more information, it will have a higher probability of getting the important facts in time. It will also have more opportunities to verify the information it receives (the positive aspect of redundancy). Thus again we find that volume can be assumed to be strongly correlated with the qualitative aspects of information (in particular its timeliness).

An important category of information sources reported in the data concerns the use of a large number of written sources. This ranges from the use of newspapers to professional journals and information provided by local or national government. A second category of information sources covers data on the number of representatives that the respondent receives, as well as the number of suppliers with whom the firm had a self-initiated contact. A third category tells how many public or private exhibitions the respondent visited.

The Porter-style model described earlier is used to organize the data as follows. The number of written

Table 7 Basic statistics of information variables

Variable	Mean	St dev	Maximum
<i>Pinf</i>	2.79	1.47	6
<i>Cinf</i>	2.52	1.08	4
<i>Yinf</i>	1.73	1.50	5
<i>Exhibits</i>	3.59	3.29	22
<i>Repres</i>	12.85	13.08	70

Correlation matrix

	<i>Pinf</i>	<i>Cinf</i>	<i>Yinf</i>	<i>Exhibits</i>	<i>Repres</i>
<i>Pinf</i>	1.00	0.82	0.53	0.32	0.14
<i>Cinf</i>		1.00	0.47	0.26	0.07
<i>Yinf</i>			1.00	0.18	0.08
<i>Exhibits</i>				1.00	0.43
<i>Repres</i>					1.00

sources that the respondent uses, relating to customers, suppliers and regulatory organizations, was used as a variable representing the use of information on prices, costs and volume respectively. In addition, the arithmetic averages were taken of the number of visiting representatives, and contacts with suppliers, and also of the number of private and public exhibitions visited. Thus, five variables resulted: *Pinf*, *Cinf*, *Yinf*, *Exhibits* and *Repres*, representing the use of information in the field of prices, costs, volume, the numbers of exhibitions and visits and contacts with representatives respectively. *Exhibits* and *Repres* also relate to the use of information on suppliers, but as they are quite different in character from the use of written sources they are treated separately. The Appendix shows how the sources are assigned to the information variables.

Table 7 contains the descriptive statistics of the resulting variables. Note that the variables are measured on different scales. Also, all constructed variables are positively correlated – which is not very surprising – but these correlations are relatively weak (with the exception of the correlation between *Pinf* and *Cinf*).

Analysis of information use

In this subsection we analyse the information use as revealed in the dataset, and try to combine this with

the firm's characteristics and performance. Our first goal is to identify information use profiles, and classify the respondents according to these profiles. Then we consider whether these categories correspond to other characteristics and – in particular – to performance measures.

For the classification of the firms in the sample we use a clustering technique. We cluster the respondents on the basis of the five aggregated information variables constructed above: *Pinf*, *Cinf*, *Yinf*, *Exhibits* and *Repres*. These variables were first rescaled to have zero mean and unit variance each. Next, a standard clustering algorithm was applied, using the PC software package SPSS (Norusis, 1990). The algorithm makes use of squared Euclidean distances and the 'average linkage between groups' method. Inspection of the resulting dendrogram and agglomeration schedule leads to the detection of four clusters. In fact, three of them were real clusters in the sense that all points were close together, while the fourth cluster consisted of a kind of residual group. This last group contained only five firms.

Table 8 shows the average scores for each group on the five clustering variables. This table shows that the first cluster scores low on all information variables: therefore this cluster is labelled 'low'. The second cluster shows approximately average scores on all variables (with a minor exception for *Repres*), thus giving rise to the label 'average'. The third and fourth cluster score above average for all variables, and so deserve a 'high' label. A distinction between these two clusters results as the third cluster scores significantly higher for the *Pinf*, *Cinf*, and *Yinf* variables, which are based on written sources in particular, whereas the fourth cluster scores higher for the other two variables *Repres* and *Exhibits*, which are face-to-face contacts. Therefore the third cluster is labelled 'high-formal' and the fourth 'high-informal'. The last two clusters consist of 12 and five observations only and share a high level of information use: so for practical purposes they are occasionally combined as a 'high' cluster.

In *Table 9* we study whether the suggestive labels given to the clusters are supported by evidence in the data on the availability of communication media. The table shows the average number of

Table 8 Information use per cluster (mean values of information variables per cluster)

	All (<i>n</i> = 75)	Low (<i>n</i> = 19)	Average (<i>n</i> = 39)	High- formal (<i>n</i> = 12)	High- informal (<i>n</i> = 5)	High (<i>n</i> = 17)
<i>Pinf</i>	2.79	1.00	2.95	4.75	3.60	4.41
<i>Cinf</i>	2.52	1.11	2.74	3.92	2.80	3.59
<i>Yinf</i>	1.73	0.58	1.57	4.00	2.00	3.41
<i>Exhibits</i>	3.59	2.38	3.06	4.69	9.70	6.16
<i>Repres</i>	12.85	9.67	9.35	12.75	52.50	24.44

Table 9 Availability of communication media per cluster

	All (n = 75)	Low (n = 19)	Average (n = 39)	High- formal (n = 12)	High- informal (n = 5)	High (n = 17)
Telephone						
Number of lines/job	0.73	0.69	0.69	0.86	0.72	0.82
Number of apparatuses/job	1.20	1.13	1.15	1.47	1.06	1.37
Fax						
Percentage ownership	68	47	69	83	100	88

Table 10 Company characteristics per cluster

	All	Low	Average	High- formal	High- informal	High
Member of chain (%)	22.7	26.3	12.8	33.3	60.0	41.2
Member of purchase organization (%)	39.1	35.3	34.3	41.7	80.0	52.9
Member of branch organization (%)	40.0	14.3	51.7	28.6	66.7	40.0
Appliances only (%)	37.3	47.4	38.5	33.3	20.0	23.5
Urbanized (%)	66.7	64.7	71.1	66.7	40.0	58.8
Randstad (%)	61.1	70.6	50.0	75.0	80.0	76.5
Firm size						
Small (%)	38.7	52.6	35.9	33.3	20.0	29.4
Medium (%)	32.0	26.3	41.0	16.7	20.0	17.6
Large (%)	29.3	21.1	23.1	50.0	60.0	53.0
Number of jobs	3.41	3.01	3.15	4.58	4.25	4.50
Sales floorspace (m ²)	181	155	133	379	255	337

telephone lines and apparatuses available in each cluster, and the percentage of fax owners. The number of lines and apparatuses are divided by the number of jobs in the companies, to correct for a potential scale effect (the subsequent analysis indeed reveals such a scale effect). Nevertheless, the results show that all three variables more or less confirm the expectation that the availability of telecommunication facilities grows with information use, as reflected in the clusters.

Next we investigate whether relations exist between cluster membership and a number of other variables. *Table 10* considers this point with respect to company characteristics. For example, 26.3% of the firms in the ‘low’ cluster are members of a chain, 38.5% of the firms in the ‘average’ cluster sell appliances only, and so on. Some interesting observations emerge:

- Respondents from the ‘high’ clusters are more often organized in a chain, sector organization, or purchase organization. This higher organization rate is especially found in the ‘high-informal’ cluster.
- Mixed firms – selling both appliances and white goods – are relatively more represented in the ‘high’ clusters. This may be due to the fact that

mixed firms have to keep informed about two markets: appliances and white goods.

- Information use typically increases with the size of the firm. This is revealed by all three variables that relate to company size: turnover, employees, and sales floorspace.

The first observation suggests that joining some organization is inspired by considerations of streamlining information flows rather than reducing the information needs. The third observation can be due to two mechanisms. Either these firms are larger because they have more interest in information, leading to better performance and subsequently growth – which is factually the premise of this paper – or large firms have more possibilities to pay attention to information (a simple scale effect). Our static and, moreover, small dataset can give no clues about which mechanism is the relevant one.

Finally, *Table 11* presents the mean scores for the indicated economic performance variables for the clusters. As far as the turnover variables are concerned, no clear patterns emerge. The profit variables, however, show that firms with a ‘high’ profile perform relatively badly, and also expect to perform below average in the future. The outcome for the market share variable shows a similar

Table 11 Economic indicators per cluster

	All	Low	Average	High-formal	High-informal	High
Turnover growth (%)						
1991	4.10	2.07	5.70	0.86	7.00	2.78
1992	6.00	7.00	6.06	4.44	5.75	4.85
Turnover speed	5.75	5.50	6.08	5.65	4.13	5.21
Profits (%)						
1990	14.0	20.3	14.4	12.1	4.0	10.1
1991	14.0	24.4	14.0	11.7	4.2	9.8
1992	13.1	19.0	13.3	12.2	3.8	10.7
Market share (%)	27.5	42.4	25.6	19.0	18.0	18.7

pattern. The opposite holds for firms with a 'low' profile. Thus an inverse dependence emerges between information profile and these economic indicators. According to our theory, this suggests that 'high' profile firms attach too much weight to using information, which consequently becomes counterproductive. In other words, the marginal benefits of information for 'high' profile firms are lower than the marginal costs of the information. We immediately add that this is just a suggestion, as our dataset prohibits firmer analysis and conclusions.

In terms of the research issues as formulated earlier, we have found that:

- (1) There indeed exists a relation between information use and company performance.
- (2) Unorganized firms (as they are typically using less information) are the ones that are most likely to show an optimal information demand. Other characteristics are less clear cut.

This latter result allows an interesting explanation. Entry to some organization streamlines information supply, but the only result seems to be that the firm becomes uncritical, and just consumes (or only receives) all information that is handed over to it. Unorganized firms, by contrast, simply have to be critical on the information streams as each piece of information has to be decided upon. This may explain why unorganized firms are much more critical on their information use, leading to the use of less information and better performance.

Finally, it should be clear that our dataset does not permit the investigation of the third issue.

Concluding remarks

For analysing the effect of information on company performance in a competitive environment a model was developed based on Porter's seminal works that suggested the consideration of information use in the areas of costs, prices and volume. The model

was applied to retail electrical appliances firms in the Netherlands, and tested empirically using a self-administered survey. The results from the analysis suggest that firms in this sector might very well be using too much information or (more modestly) might be on the decreasing part of the curve describing the net benefit of information.

Obviously this remarkable result needs confirmation, both on the basis of better datasets, and by exploiting more powerful statistical techniques, and preferably across other sectors as well. Moreover, according to the structure of the theoretical model the distinction between various information areas (suppliers, customers, government regulatory measures etc) should be maintained more strictly. Measurement issues also deserve attention. Both the measurement of information use, and the general issue of measuring company performance, need to be investigated more thoroughly. This latter analysis should also take into account the firm's objectives.

Meanwhile, it may be advisable for management to consider the use of information sources carefully. Apparently, the danger of overconsumption of information is real, in particular when a company is part of a larger organization facilitating information use. Finally, information should be related to those fields where competition is toughest. Although we could not investigate this issue empirically, the theoretical model leading to this point is quite convincing.

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Appendix 1

The construction of the compound information variables

The variables *Pinf*, *Cinf*, *Yinf* summarize the number of written publications to which the respondents have access in the field of prices, cost and volume, respectively. The possible sources for each category are listed here.

- *Pinf*: journal on consumer affairs; publications from the sector organization; publications from the employers' organization; publications from the Central Bureau of Statistics (CBS); Publications by GFK Nederland; local newspaper.

- *Cinf*: journal on consumer electronics; publications from the sector organization; publications from the employers' organization; publications from the CBS.
- *Yinf*: regional newspaper; national newspaper; publications from local government; publications from national government; publications from CBS.

GFK Nederland is a commercial organization that collects and distributes data on sales of consumer electronics products.