

# The Information Use in a SME: Its Importance and Some Elements of Influence

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**ABSTRACT.** The aim of this study is to gain some insights into the importance of the information use for the success of a SME. Consequently we examine some characteristics of the owner/manager and his firm which determine the extent of this use. The value of the model is examined for 208 Belgian SME owner/managers. Our data suggest there is a positive relation between the extent of information use and the performance of a SME. Moreover, we find that SME owner/managers with a greater strategic awareness, with less firm experience prior to the present position and with a greater desire for growth use more information. Also, smaller family ownership and intervention in strategic management, as well as greater delegation of decision making, lead to a higher information use.

## 1. Introduction

The explanation for the differences in performance is very complicated in view of the many influences on success. One of the factors that is frequently referred to is the use of adequate information and a sound information system. For big companies, the proposition that information can be considered as an increasingly important production factor is indeed repeatedly supported in literature. For the smaller companies, the proof is not so comprehensive, especially where the Belgian SMEs is concerned (for instance, Bragard et al., 1992). Actually, it is very astounding that in this information age – in which the importance of information for everyone is so accentuated – there are so few profound scientific studies on this process

in the SME. Thus, without denying the existence of other determinants of success, we investigate whether Belgian SMEs which are better at gathering and analyzing information have a competitive advantage over their rivals.

Although the relation between success and the use of information is the central research question, we also integrate the typical determinative factors of the SME process. In other words, we place the problems concerning information in a broader context. We look closely at the manager. The importance of the entrepreneur for the success of his firm seems generally accepted (for instance, Frank, 1988; Jovanovic, 1982; Oi, 1983; Van Hootegeem, 1985). As Braverman (1984) stated: 'Businesses fail because managers fail. The successful company is managed by the individual who makes a minimum of blunders.'

It is well accepted that the SME owner/manager plays an essential role as searcher and assimilator of information. He does not always have subordinates at his disposal to acquire and process information. Research shows that when the SME owner/manager sets a high value upon internal or external tasks, the firm will also be inclined to react in a similar way (Gibb and Dyson, 1984). Thus, the manager's sensitiveness to information, and likewise the firm's sensitiveness, is a function of the person-specific characteristics of the SME owner/manager.

In addition to the above theories that view the behaviour as the result of personal factors, there are also the theories that state that behaviour is determined by situational or environmental factors. The manager finds himself in a firm that must be situated in a much broader societal context (Hansen and Wernerfelt, 1989). This means that besides the individual characteristics

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of the manager, the characteristics of organisation and environment must also be taken into account (Hambrick and Finkelstein, 1987).

In this research, we only concentrate on the person- and firm-specific factors which have an influence on the intensity and/or composition of the used information sources. Although we do not deny that the external environmental factors have a very important – although more indirect – influence on the information sensitiveness of the manager, these factors can be divided into sectorial and national ones. Since we limit ourselves to Belgian SMEs from three sectors, they are postulated to be of limited importance, and therefore we do not examine them.

In this study, a SME is defined as a firm with a maximum of 100 employees to restrict the study to those firms where the determinant role of the owner/manager still exists. At the same time, a minimum of 20 is premised for the personnel staff. This is to exclude those firms that are in the start-up phase or that offer very personalized services. Moreover, research shows that in SMEs with at least 20 employees, technical matters no longer take precedence over managerial matters (Donckels and Mok, 1990), which is to the benefit of this research.

The paper is organized as follows: the next section presents the research questions, the research methodology and a description of the sample. In Section 3, we discuss the selection of the observed variables and the development of the latent constructs. Also, the suitability of our choice is examined, and the final model is presented. In Section 4, the presumed hypotheses are tested, using partial as well as a global model. A summary and conclusions end this study.

## 2. Research outline

### 2.1. Research questions

In a preceding sector study (Lybaert, 1995), the hypothesis was tested whether the spread of growth in a sector is greater based on the presence of certain structural characteristics that are important for information sensitivity (that is, expenses for R&D, marketing, and investment, as well as the degree of concentration and the share of white collars). The reason for this was that

some sectors consistently show a much greater spread in the growth than others. With the help of a regression analysis we concluded that two main factors showed a significant influence on our dependent variable, namely, the degree of concentration and the R&D expenditures.

Given this indication of the strategic importance of information, we look at the firm level in order to trace whether the success of the SME is really explained by its information use. In view of the above results, it is possible to give a limited content to the information variable. More specifically, we limit ourselves to the information use concerning the two most significant strategic variables. Thus, we formulate the first hypothesis as:

*H1: SMEs that are better informed about R&D and their competitors will perform better than average.*

With respect to the competitors, we have no intention to trace to what extent the degree of concentration in the sector affects the success of the firm. The individual actions of the firm – that is, the extent to which information about a competitor is acquired, processed and interpreted – that draws our attention. The same approach is presumed for R&D. It is not the importance of these activities in the sector, nor the extent to which the firm performs R&D, that is considered, but rather the extent of information use concerning this factor. This approach seems to be of importance especially for the SME. They may not seem to invest in R&D themselves, but become informed about it.

In the analytical part we also aim, as mentioned, to search for the characteristics that determine the information use in a SME. Some person-specific elements are the age of the respondent, the sex, the personal and leadership characteristics, the level of education, the professional background, the seniority as owner/manager, the occupation of the parents, the role with the foundation, personal experiences, values and habits, goals, expectations, and the skills. Various elements have been mentioned and/or researched. We limit ourselves to five personal characteristics, because of the greatest relevance that has been shown in the literature.

The literature states that certain personality

traits of the SME owner/manager can be related to his information use. One characteristic that often has been investigated is the locus of control. It was found that entrepreneurs with a strong locus of control look for more information to enhance the chance of success (Boone, 1992). Internality also is correlated with the importance that the entrepreneur attaches to various sources of information (Welsch and Young, 1982), as well as with the use of scanning techniques (Khan and Manopichetwattana, 1989; Miller et al., 1982). Other characteristics that can be considered are, for instance, need for achievement (nAch), urge for insight, broad interests, sense of responsibility, urge for performance, self-confidence, non-reliance on intuition, and the like.

Various research shows that the education of the SME owner/manager determines to a large measure to what extent use of information sources is made. Thus, it appears that the more the entrepreneur is educated, the less one-sided is the external information gathering (Docker and Stokman, 1987), the more seminars are attended (Donckels and Lambrecht, 1994), the more intensive is the networking position (Donckels and Elshout, 1992), the more use is made of consultants (Crabtree and Gomolka, 1991) and the more importance is attached to detailed accounting information (Holmes and Nicholls, 1989; Holmes et al., 1991).

Next, we presume that a lower familiarity with the sector leads to a higher inclination to look for information. In the literature, some proof can already be found for this: it has been shown that managers with less industrial experience (Crabtree and Gomolka, 1991), as well as entrepreneurs with the least experience as managers (Donckels and Lambrecht, 1994), consult external consultants the most. Also Finkelstein and Hambrick (1990) established that the length of leadership goes with a decrease in and narrowing of information seeking.

Another variable that deserved our attention is the desire to grow. In the literature, the proof is unanimous that in SMEs, the goals of the firm are synonymous with those of the owner(s) (Birley and Westhead, 1990). Financial aims are essentially determined by the anxiety and the purposes of the managers (Davidsson, 1990; STRATOS, 1987; Donckels et al., 1987a, Donckels and

Hoebeker, 1989). Thus, it is the SME owner/manager that allows the firm to grow, though the empirical works emphasize ever more a general aversion to growth (for a review of international research see Davidsson, 1989). Since it has been shown repeatedly that the growth of a firm is coupled with the gathering of additional information (Holmes and Nicholls, 1989; Holmes et al., 1991; Donckels and Elshout, 1992; Donckels and Lambrecht, 1994), we presume that if the entrepreneur is willing to grow, this will lead to a higher information use.

The last person-specific determinant that is chosen is the familiarity with administration. Here we presume that someone with a high familiarity with administration will make more use of this source of information than someone not possessing this knowledge. Although reference has often been made to the negative attitude of the entrepreneur toward administration (Donckels et al., 1983; I.V.V.M., 1983), as well as to his limited knowledge on this subject (Carsberg et al., 1985; Whitted and Zimmer, 1984; Keasey and Watson, 1987), we do not find any research confirming this link.

In summary, as characteristics peculiar to the SME owner/manager, we investigate his personality, his education, his economic history, his desire for growth and his familiarity with administration as possible influences for his information use. More specifically, the second hypothesis can be stated as:

*H2: The information use of the SME owner/manager will be greater, the higher the information sensitiveness of his personality, the higher and the more management oriented his education, the more unfamiliar he is with business practices and the business sector, the greater his willingness to grow, and the better his knowledge of administration.*

The possible elements concerning the possibilities and the limitations of the firm, that have a certain influence on the decision of the manager about the optimal amount of information to acquire and process are also numerous. We can consider factors such as the age of the firm, the genesis, the legal form, the structure of ownership, the number of partners with creation or take-over, the

expectations and the role of family members and joint owners, the qualities of human potential, the division of labour and the proportion of high qualified personnel, the arrangement for succession in family firms, the system for planning, remuneration, control and information, the formal and informal structure, investments, the evolution of employment, the turnover, the financial condition, exports, and time pressure. Although various elements of this list have been referred to in literature, there are again only five firm-specific characteristics that deserve our attention. Once again the reason is that literature illustrates the greater relevance of these.

As mentioned when discussing the desire for growth, the size of the firm is positively related to the decision to gather additional information. Empirical findings (Holmes and Nicholls, 1989; Holmes et al., 1991) have shown that growing and/or larger firms gather more detailed accounting information than stagnating and/or smaller firms. Such firms also seem to have a broader network than smaller ones and to be more strongly rooted in it (Donckels and Elshout, 1992), while they also play a leading role in seminars (Donckels and Lambrecht, 1994). Basing our argument on the 'Pyramid of Organizational Development' (Flamholtz, 1986), we also specify the stage of organizational growth that the firm finds itself in, and trace which role this plays for the information sensitiveness of the SME owner/manager. Although the two external strategic variables that we premised are important in every phase of the firm, and may never be neglected, it seems possible that a certain explanation for differences in information use is found.

Next we are interested in whether the intervention of the family in the SME has an influence on the information use. In such firms economic arguments do not always seem to prevail over the emotional ones (Donckels et al., 1987b). Thus, it is not surprising that family-run SMEs have, for instance, a less extensive network than their colleagues from the non-family-run firms (Donckels and Elshout, 1992). Although the impact of the family on the managerial decisions appears to be greater in trade and service sectors, and less important in industry, it is important enough to investigate the possible influences.

We also believe that the involvement of co-

workers influences the information sensitiveness of the SME owner/manager in two ways. First of all, there is the indirect effect. Delegation makes it – in addition to the many other advantages (see Cuba and Milbourn, 1982; Jenks and Kelly, 1986) – possible for the manager to spend more time conducting his business (Edmunds, 1982), and therefore, in our view, also at gathering and processing information. Therefore, a greater use of information is not possible for him without changing his allocation of time. The direct effect consists of the presence of personnel which is actively occupied with the collection information. Never before in history has this group been so extensive (Punnet and Sweeney, 1989). In our opinion, the extent of this personnel group and the measure to which they urge on the SME owner/manager to analyzing information, also determines his information sensitiveness.

The next question is whether the presence of information and information systems influences the information sensitiveness. Research has shown that a large number of SME owner/managers contract out their administrative services (Donckels et al., 1983; Carsberg et al., 1985). Yet O'Reilly (1982) came to the finding that it is the availability of information that consistently determines the frequency of use. Also, later research has shown that computerization of information systems in SMEs is far from complete (Bragard et al., 1992; Donckels and Mok, 1990), while an effort in this domain contributes to smoother information processing (Poppel and Goldstein, 1987), and to better performance (McNally and Eng, 1980). Although studies with industrial SMEs (Raymond and Magnetat-Thalmann, 1982) have shown that the impact of MIS is operational rather than decisional, we hypothesize a positive relation between its presence and information use.

The last determinant that is taken into consideration is the financial condition. It has been argued repeatedly that the resources a firm must draw upon have a significant influence on the conduct of that firm (Hambrick and Finkelstein, 1987). It can be supposed that a SME owner/manager who has at his disposal the necessary financial resources also has more possibilities to realise his strategic preferences, or – in terms of this study – to build up the desired information system.

Finally, in terms of the characteristics peculiar to the firm itself, we investigate the maturity and the size of the firm, the intervention of family, the involvement of co-workers, the availability of information systems, and the financial condition as possible influences on the information use of the owner/manager. More specifically, the second hypothesis can be stated as:

*H3: The information use of the SME owner/manager will be greater, the larger the firm and the higher the emphasis on the first stage, the smaller the family intervention in ownership and management, the higher the delegation, including information gathering tasks, the more information systems are available and used, including for administration, and the less costs are a problem.*

## 2.2. Research methodology

Clearly the research is about the relation between information use, success and the person-specific and firm-specific influences on the extent of the information set. In fact, we can illustrate the process of information use as shown in Figure 1.

All the terms used in this figure are unobservable, unmeasurable constructs, called latent variables. They can be divided into endogenous (dependent) variables on the one hand (being information use and success), denoted by  $\eta$ , and into exogenous (independent) variables on the other hand (being the person-specific and firm-specific elements), denoted by  $\xi$ .

The question is posed by which statistical

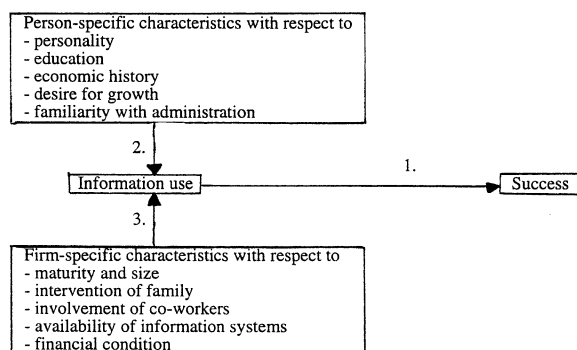


Fig. 1. The presumed research domain.

method the causality between these variables needs to be examined. The fact that we are confronted with connections between theoretical variables, indicated by a set of indicators, does not leave many alternatives for the empirical study. Thus, because the phenomenon under study can be specified in terms of cause-effect variables and diverse causal effects, we consider structural equation models (Bollen, 1989). These models allow the researcher to decompose relations among variables and to test causal models that involve both observable (manifest) and unobservable (latent) variables. There is an impressive body of literature on econometric structural equation modeling (for an overview see, for instance, Dillon and Goldstein, 1984).

One of the most relevant approaches is Karl Jöreskog's general 'Linear Structural RELations' (LISREL) model (1973), and other recent advances by him and Dag Sörbom (1988, 1989, 1993). Simply described the LISREL model is a regression methodology for empirical variables, and has a lot of advantages. Probably the most important one is that the LISREL model provides an integrated approach to data analysis and theory construction. This is accomplished by allowing the researcher to simultaneously evaluate both the measurement and causal (i.e., structural) components of a system. The model makes it possible to study the aspects of the model specification properly, since it provides a higher information content than its alternatives.<sup>1</sup> Other advantages are that the LISREL model can easily handle latent factors, measurement errors in both independent and dependent variables, reciprocal causation, simultaneity and interdependence. Although the model is broadly similar in spirit to the path-analytic model, it is far less restrictive. Another important distinction is that LISREL uses maximum likelihood estimation.

The general LISREL model consists of two parts, namely the measurement model and the structural equation model, and is defined by three structural equations. The first two concern the measurement model, the third concerns the structural equation model. We refer to the appendix for a short presentation of the method.

Here we can state that, whether there are significant relations between the theoretical constructs as formulated in the hypotheses is

examined in the second part of LISREL. Though before concentrating on this question, the latent variables need to be specified. Thus, we must collect observable measures. Since the filling in of these variables cannot occur exclusively on the basis of existing objective data, we opt for the use of a written survey. It is very important to question the SME owner/manager himself, since he plays a key role in the process of information gathering and processing. In total he was asked 157 questions.

The valid answers to these questions, that ultimately are taken into account, have to make it possible to measure and define the hypothetical constructs. Stated differently, the answers of the questionnaire fulfill the role of observable measures, called the manifest variables. They too can be divided into endogenous variables on the one hand, denoted by *y*, and into exogenous variables on the other hand, denoted by *x*. Thus, in the first part of LISREL we trace how well the selected observed variables measure the constructs, both individually and in the group.

### 2.3. *Gathering of the data*

From our sector study (cfr. II.1.), as well as from the literature (Holmes et al., 1991), it appears that not all sectors place an equal importance on information. Thus, for the empirical analysis we want the industrial environment as homogenous as possible and focus upon those sectors where the same information is important, and where the acquiring and processing of this information can contribute to success.

Using the results of our sector study, it concerns those sectors with the greatest spread of growth. As mentioned, this variability is positively related to the presence of various information-related strategic variables, so that the acquiring and processing of information can be considered to be more strategically important for these sectors than for others.

Given our definition of information use, it is also advisable to target industrial sectors which have high expenses for R&D and a low degree of concentration, besides the required high variability of growth. In accordance with these three characteristics, we selected firms of NACE 25 (chemical industry), NACE 31 (production of metal products, excl. machines and means of transport) and NACE 34 (electrical industry).

In these three sectors, there were 834 firms with a staff size of 20–100 which had submitted an annual report in 1991 (see Table I column a). After a pilot study, we contacted the Dutch speaking presidents of these firms by telephone. This call made it possible to explain the aims of the research to increase the motivation to participate. It also gave us the opportunity to get the first response of the president (or a co-worker). Another advantage was that the call made it possible to contact the right person on the right address.

All together, we succeeded in contacting the presidents of 387 firms (see Table I column b). Of these, 311 presidents were somewhat prepared to cooperate (see Table I column c), i.e., 80%. They received the questionnaire from May to June 1993. After another call and/or sending out a

TABLE I  
Completion of the sample

| Sector <sup>a</sup> | Potential target group (a) | Were telephoned (b) | Were sended questionnaire (c) | Sended usable response (d) |
|---------------------|----------------------------|---------------------|-------------------------------|----------------------------|
| 25AB                | 25                         | 12                  | 12                            | 8                          |
| 25CO                | 96                         | 44                  | 35                            | 25                         |
| 31AB                | 303                        | 144                 | 118                           | 75                         |
| 31CO                | 266                        | 129                 | 105                           | 73                         |
| 34AB                | 56                         | 25                  | 18                            | 10                         |
| 34CO                | 88                         | 33                  | 23                            | 17                         |
|                     | 834                        | 387                 | 311                           | 208                        |

<sup>a</sup> AB/CO: Submitted annual report according to abbreviated/complete schedule.

reminder, the survey was finalized in December 1993. The total usable number of questionnaires was 208 (see Table I column d). This is an average of 67%, when only the number of sent out questionnaires is taken into account. Of the potential target group, 25% was reached. Table II shows the composition of the sample according to the company size, namely, the number of employees and the turnover. And although we are inclined – on basis of the first criterium – to state that there is rather a preponderance of the small SMEs, this is contradicted somewhat by the turnover figures.

TABLE II  
Composition of the sample

|                         |    |     |
|-------------------------|----|-----|
| The number of employees |    |     |
| < 20                    | 9  | 4%  |
| 20–39                   | 87 | 42% |
| 40–59                   | 59 | 29% |
| 60–79                   | 25 | 12% |
| 80–100                  | 25 | 12% |
| > 100                   | 3  | 1%  |
| The turnover            |    |     |
| < 50 mio                | 7  | 3%  |
| 50–99 mio               | 36 | 17% |
| 100–149 mio             | 51 | 25% |
| 150–199 mio             | 21 | 10% |
| 200 mio of >            | 92 | 45% |
| not given               | 1  |     |

### 3. Choosing the latent and manifest variables

#### 3.1. Measurement and choice of the endogenous manifest variables

As mentioned, a questionnaire was used to gather manifest variables. As to the measurement of information use, a generally accepted scale does not exist. Since the most comprehensive and theory-based method to measure ‘environmental scanning’ empirically is the typology of Hambrick (1979, 1981), we use it. We selected 20 questions concerning R&D and competition, which contained – according to our view – the most relevant kinds of internal and external information. We asked the respondents how frequently they learn of the stated events and trends (cfr. the ‘frequency’ method), and to rate the extent to which they make a point of staying abreast of these same domains (cfr. the ‘interest’ method).<sup>2</sup> For both, the Likert-scale is used.

As to the measurement of success, there have been a lot of attempts to define and measure the effectiveness of firms.<sup>3</sup> Although there is no unanimity about how success should be measured best, it is clear that it would be wrong to base our work on only one kind of variable of success. Therefore, we chose ten firm measures, taking into account the popularity with researchers as well as with SME owner/managers, and taking care of the possibility for manipulation and existing ideas in financial literature. Because of the unfamiliarity of many SME owner/managers with the precise internal ‘hard’ figures, as well as the inclination for secrecy, we asked for relative measures which showed an evolution over time, rather than to asking for concrete data. In addition, we asked the participants of the study to gauge their expectations for the future on the basis of these same ten selected measures. Because of the high level of identification between the SME owner/manager and his firm, we also asked for subjective information using four measures. Though the importance of these ‘soft’ measures may not be overstated. If a SME does not make any profit, it will eventually go bankrupt, and all other reasons for having a firm will be sacrificed.

In total the questionnaire included 64 questions for the measurement of information use and success. The valid answers on these 64 questions, that ultimately would be taken into account, had to make it possible to measure and define the endogenous hypothetical constructs. Though not all 64 answers were applied as manifest variables. In order to indicate those variables which would be used for the development of the endogenous latent variables, it was decided to apply an exploratory factor analysis, using the polychoric correlation matrix as input.<sup>4</sup>

Because of the two kinds of questions for each latent variable in the questionnaire (i.e., ‘what really happens’ versus ‘what would ideally have to happen’ and ‘what has been’ versus ‘what is expected’), we expect that two factors would result, and not one factor would explain the most of the variance. The results in Table III show that our expectations are more or less confirmed. With respect to success, two factors explain 69% of the variance, while the remaining factors are of little additional importance. The cumulative eigenvalue of the first two factors is only 45% for informa-

TABLE III  
Factors for the endogenous variables

|                                                | Factor Structure |          |          |          |     |
|------------------------------------------------|------------------|----------|----------|----------|-----|
|                                                | Factor 1         | Factor 2 | Factor 3 | Factor 4 | ... |
| – With respect to information use (N VAR = 40) |                  |          |          |          |     |
| Eigenvalue                                     | 11.1743          | 3.2622   | 3.0092   | 2.2525   |     |
| Proportion                                     | 0.3520           | 0.1028   | 0.0948   | 0.0709   |     |
| $y_0$                                          | 0.70             | 0.57     |          |          |     |
| $y_1$                                          | 0.68             | 0.33     |          |          |     |
| $y_2$                                          | 0.64             | 0.57     |          |          |     |
| $y_3$                                          | 0.63             | 0.34     |          |          |     |
| $y_5$                                          | 0.19             | 0.85     |          |          |     |
| $y_6$                                          | 0.22             | 0.82     |          |          |     |
| $y_7$                                          | 0.24             | 0.79     |          |          |     |
| $y_8$                                          | 0.18             | 0.77     |          |          |     |
| – With respect to success (N VAR = 24)         |                  |          |          |          |     |
| Eigenvalue                                     | 7.0271           | 4.8831   | 1.6547   | 1.2949   |     |
| Proportion                                     | 0.4090           | 0.2842   | 0.0963   | 0.0754   |     |
| $y_9$                                          | 0.93             | 0.16     |          |          |     |
| $y_{10}$                                       | 0.89             | 0.17     |          |          |     |
| $y_{11}$                                       | 0.89             | 0.19     |          |          |     |
| $y_{12}$                                       | 0.87             | 0.06     |          |          |     |
| $y_{13}$                                       | 0.22             | 0.88     |          |          |     |
| $y_{14}$                                       | 0.10             | 0.84     |          |          |     |
| $y_{15}$                                       | 0.13             | 0.82     |          |          |     |
| $y_{16}$                                       | 0.13             | 0.80     |          |          |     |

tion use. Although these results are not very convincing, both factors integrate both kinds of questions. Thus, we have four latent variables instead of two.

The variables with the highest loading are the best measures for a given factor. Therefore, in order to limit the number of endogenous manifest variables, we take only those four variables into account that show the highest loading after rotation (where the applied rotation is equal to promax). Table III only shows these results. For clarity the loadings are rounded off to two numbers.

### 3.2. The measurement model for the endogenous variables

As mentioned in the appendix, the measurement model for the endogenous variables can be defined as:

$$y = \Lambda_y \eta + \varepsilon$$

By rearranging this measurement model, it is possible to trace whether the chosen observed variables measure the latent constructs in a valid and reliable manner on basis of the significance of the elements of  $\Lambda_y$ . Namely, this matrix contains the regression coefficients, or loadings, of  $y$  on the unobservable dependent variables  $\eta$ . Since we have 16 manifest variables, the harmony between the endogenous latent concepts and their measurement is determined by the significance of  $\lambda_1$  to  $\lambda_{16}$ .

For the four latent variables a separate data matrix was set up, making use of the listwise deletion<sup>5</sup> of observations on which the measurement model can be tested. The results obtained show a very good fit with the selected empirical indicators. Thus, the models cannot be rejected on basis of our data. However, with respect to the first latent variable for information use, it can be stated that, in spite of the significance of the individual parameters, the indices for the fit of the model as

a whole are a little bit worse, but acceptable nonetheless. The output shows that this is largely due to the presence of the first variable, i.e., the one with the highest loading. The replacement of this manifest variable by the one with the fifth highest loading, namely 0.63, allows for a better fit, so we make this replacement.

The results of the four measurement models are presented in Table IV. We limit the results of the most commonly known measures, being NCP, RMR, GFI and AGFI, although several others are given in the LISREL output. It is very clear that the selected manifest variables can be applied as measurement instruments for the endogenous latent variables.

TABLE IV  
The measurement models for the endogenous variables

|                   | $\Lambda_y$ | $\Theta_\epsilon$ |                                  |
|-------------------|-------------|-------------------|----------------------------------|
| – for $\eta_{1a}$ |             |                   |                                  |
| y <sub>1</sub>    | 0.78**      | 0.39*             | NCP (2 df) = 4.64 ( $p = 0.10$ ) |
| y <sub>2</sub>    | 0.60**      | 0.64**            | RMR = 0.034                      |
| y <sub>3</sub>    | 0.50*       | 0.75**            | GFI = 0.99                       |
| y <sub>4</sub>    | 0.61**      | 0.63**            | AGFI = 0.93                      |
| – for $\eta_{1b}$ |             |                   |                                  |
| y <sub>5</sub>    | 0.83**      | 0.31**            | NCP (2 df) = 3.49 ( $p = 0.17$ ) |
| y <sub>6</sub>    | 0.89**      | 0.21*             | RMR = 0.020                      |
| y <sub>7</sub>    | 0.72**      | 0.49**            | GFI = 0.99                       |
| y <sub>8</sub>    | 0.80**      | 0.37**            | AGFI = 0.93                      |
| – for $\eta_{2a}$ |             |                   |                                  |
| y <sub>9</sub>    | 0.97**      | 0.05*             | NCP (2 df) = 0.21 ( $p = 0.90$ ) |
| y <sub>10</sub>   | 0.91**      | 0.18**            | RMR = 0.0071                     |
| y <sub>11</sub>   | 0.90**      | 0.19**            | GFI = 0.99                       |
| y <sub>12</sub>   | 0.80**      | 0.35**            | AGFI = 0.97                      |
| – for $\eta_{2b}$ |             |                   |                                  |
| y <sub>13</sub>   | 0.94**      | 0.11*             | NCP (2 df) = 0.0 ( $p \cong 1$ ) |
| y <sub>14</sub>   | 0.73**      | 0.46**            | RMR = 0.0073                     |
| y <sub>15</sub>   | 0.88**      | 0.22**            | GFI = 1.00                       |
| y <sub>16</sub>   | 0.84**      | 0.29**            | AGFI = 0.99                      |

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; °  $p < 0.10$ .

With:

NCP = (the ‘Estimated Non-Centrality Parameter’), i.e., the best estimate of  $\chi^2$  when the variables are not assumed to be normally distributed;

RMR = (the ‘Root Mean Square Residual’), i.e., a measure of the average of the fitted residuals;

GFI = (the ‘Goodness of Fit Index’), i.e., a measure of the relative amount of variance and covariance jointly accounted for by the model;

AGFI = (the ‘Adjusted Goodness of Fit Index’), i.e., the GFI index adjusted for d.f.

Now that the manifest variables are definitively selected, we must define more detailed names for the latent variables. The names which are opted for are shown in Table V. Here the variables that are selected as endogenous observable variables (y) are presented, as well as the obtained latent variables ( $\eta$ ).

### 3.3. Measurement and choice of the exogenous manifest variables

By integrating questions in the questionnaire, we also learn about the influences on the information use. Since scales and scenarios developed, evaluated and approved in literature are not applicable, we develop new ones.<sup>6</sup> In total, the respondents were asked to fill in 92 questions for the measurement of the ten person- and firm-specific characteristics. (The exact number of questions per characteristic can be found in Table VII, as N VAR.) Again, not all these 92 answers are applied as manifest variables.

In order to highlight those variables, needed for the development of the exogenous latent variables, we do not apply an exploratory factor analysis. Because of the more restricted size of the potential exogenous manifest variables per latent variable, we select those variables with a high correlation. This working method is based on the conviction that the variables with a high correlation are measures of the same concept. Thus, we depart from the polychoric correlation matrices here as well. More specifically, the matrices are reduced in such a way that no correlation smaller than 0.20 still appears. From the results obtained this way, we perform three operations. Two variables are deleted because of the high number of missing values, one because of the difficulty in interpreting the results, and we set a maximum of four manifest variables per latent variable. Ultimately 32 variables remain.

### 3.4. The measurement model for the exogenous variables

As mentioned in the appendix, the measurement model for the exogenous variables can be defined as:

$$x = \Lambda_x \xi + \delta$$

TABLE V  
The selected endogenous manifest and latent variables

---

– Variables with respect to information use (N VAR = 40)

To what degree do you keep up to date concerning:

$y_1$  = changes in needs and attitudes of customers concerning the products offered by your firm?

$y_2$  = the price level of products offered by your competitors?

$y_3$  = the possible consequences of the unified market for your firm?

$y_4$  = the knowledge and the capacities of the own personnel?

$\eta_{1a}$  = use of information about market and personnel

To what degree would you like to remain up to date concerning:

$y_5$  = the price level of products offered by your competitors?

$y_6$  = the new products and product assortments offered by the competitors?

$y_7$  = the research activities of the other firms in your sector?

$y_8$  = the management practices of your competitors?

$\eta_{1b}$  = desired use of external information about competitors

– Variables with respect to success (N VAR = 24)

What are your expectations for the coming years for:

$y_9$  = reserves?

$y_{10}$  = owners equity?

$y_{11}$  = accumulated profits?

$y_{12}$  = the bottom line of your business?

$\eta_{2a}$  = expected performance

What was the evolution during the last 3 financial years of:

$y_{13}$  = reserves?

$y_{14}$  = the bottom line of your business?

$y_{15}$  = owners equity?

$y_{16}$  = accumulated profits?

$\eta_{2b}$  = performance during the last 3 financial years

---

By rearranging this measurement model, it is possible to specify how well the latent variables are indicated by the observed variables on basis of the significance of the elements of  $\Lambda_x$ . Namely, this matrix contains the regression coefficients, or loadings, of  $x$  on the unobservable dependent variables  $\xi$ . Since we have 32 manifest variables, the harmony of these measurements with the exogenous theoretical variables is determined by the significance of  $\lambda_{17}$  to  $\lambda_{48}$ .

In addition, we apply a measurement model on the separate data matrix of each latent variable. However, this is not possible because of the negative number of degrees of freedom and the saturation of the model when there are two and three empirical indicators for a latent variable. Therefore, we unite the measurement models of personality and economic history, of education and familiarity with administration, and of desire for growth and maturity and size of the firm. For the

other four latent variables, we have enough manifest variables. The results of the seven measurement models are given in Table VI.

The results clearly illustrate that the selected observed indicators can be used as measurement instrument for the different latent variables. All models fit the data well: the NCP is almost always 0, while the minimum GFI is 0.99. Moreover, all  $\lambda$ -coefficients are, with exception of the loadings of  $x_4$  and  $x_5$ , statistically significant at the 5% level. Analogous to Table V, we present in Table VII those variables which are assigned the role of exogenous observable variables ( $x$ ), as well as the obtained latent variables ( $\xi$ ).

### 3.5. Final scheme in LISREL notations

Now that the selection for all manifest and latent variables has been made, we can formulate the hypotheses in LISREL terms. Because we measure

TABLE VI  
The measurement models for the exogenous variables

|                          | $\Lambda_x$ |          | $\Theta_\delta$ |                                  |
|--------------------------|-------------|----------|-----------------|----------------------------------|
| – for $\xi_1$ en $\xi_3$ |             |          |                 |                                  |
| X <sub>1</sub>           | 0.82***     | –.       | 0.33*           |                                  |
| X <sub>2</sub>           | 0.54***     | –.       | 0.70***         |                                  |
| X <sub>3</sub>           | 0.45***     | –.       | 0.79***         | NCP (8 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>6</sub>           | –.          | 0.91***  | 0.17**          | RMR = 0.028                      |
| X <sub>7</sub>           | –.          | 0.93***  | 0.14*           | GFI = 0.99                       |
| X <sub>8</sub>           | –.          | –0.59*** | 0.66***         | AGFI = 0.97                      |
| – for $\xi_2$ en $\xi_5$ |             |          |                 |                                  |
| X <sub>4</sub>           | 0.56°       | –.       | 0.69*           |                                  |
| X <sub>5</sub>           | 0.77°       | –.       | 0.41            | NCP (4 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>12</sub>          | –.          | 0.50**   | 0.75***         | RMR = 0.022                      |
| X <sub>13</sub>          | –.          | 0.71***  | 0.50**          | GFI = 0.99                       |
| X <sub>14</sub>          | –.          | 0.74***  | 0.45**          | AGFI = 0.97                      |
| – for $\xi_4$ en $\xi_6$ |             |          |                 |                                  |
| X <sub>9</sub>           | 0.81***     | –.       | 0.34*           |                                  |
| X <sub>10</sub>          | 0.87***     | –.       | 0.24*           | NCP (4 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>11</sub>          | 0.41**      | –.       | 0.83***         | RMR = 0.013                      |
| X <sub>15</sub>          | –.          | 1.00*    | –0.06           | GFI = 1.00                       |
| X <sub>16</sub>          | –.          | 0.43*    | 0.82**          | AGFI = 0.98                      |
| – for $\xi_7$            |             |          |                 |                                  |
| X <sub>17</sub>          | 0.98**      |          | 0.05*           | NCP (2 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>18</sub>          | 1.00**      |          | 0.00            | RMR = 0.0068                     |
| X <sub>19</sub>          | 0.81**      |          | 0.34**          | GFI = 1.00                       |
| X <sub>20</sub>          | 0.65**      |          | 0.58**          | AGFI = 0.99                      |
| – for $\xi_8$            |             |          |                 |                                  |
| X <sub>21</sub>          | 0.52*       |          | 0.73**          | NCP (2 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>22</sub>          | 0.68**      |          | 0.53*           | RMR = 0.014                      |
| X <sub>23</sub>          | 0.60**      |          | 0.64**          | GFI = 1.00                       |
| X <sub>24</sub>          | 0.72**      |          | 0.49*           | AGFI = 0.99                      |
| – for $\xi_9$            |             |          |                 |                                  |
| X <sub>25</sub>          | 0.83**      |          | 0.31*           | NCP (2 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>26</sub>          | 0.43*       |          | 0.82**          | RMR = 0.0014                     |
| X <sub>27</sub>          | 0.77**      |          | 0.41**          | GFI = 1.00                       |
| X <sub>28</sub>          | 0.82**      |          | 0.32*           | AGFI = 1.00                      |
| – for $\xi_{10}$         |             |          |                 |                                  |
| X <sub>29</sub>          | 0.60**      |          | 0.64**          | NCP (2 df) = 0.0 ( $p \cong 1$ ) |
| X <sub>30</sub>          | 0.68**      |          | 0.54*           | RMR = 0.019                      |
| X <sub>31</sub>          | 0.61**      |          | 0.63**          | GFI = 1.00                       |
| X <sub>32</sub>          | 0.43*       |          | 0.82**          | AGFI = 0.98                      |

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; °  $p < 0.10$ .

With:

NCP = (the ‘Estimated Non-Centrality Parameter’), i.e., the best estimate of  $\chi^2$  when the variables are not assumed to be normally distributed;

RMR = (the ‘Root Mean Square Residual’), i.e., a measure of the average of the fitted residuals;

GFI = (the ‘Goodness of Fit Index’), i.e., a measure of the relative amount of variance and covariance jointly accounted for by the model;

AGFI = (the ‘Adjusted Goodness of Fit Index’), i.e., the GFI index adjusted for d.f.

TABLE VII  
The selected exogenous manifest and latent variables

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|                                                                                                  |                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| – Variables with respect to personality of the SME owner/manager (N VAR = 11)                    |                                                                                                                                                                           |
| $x_1$                                                                                            | = Statement: I have a broad interest for new information, and an urge for new insights.                                                                                   |
| $x_2$                                                                                            | = Statement: I always try to think about the future.                                                                                                                      |
| $x_3$                                                                                            | = Statement: I think of myself as having a strong sense of responsibility.                                                                                                |
| $\xi_1$ = strategic awareness                                                                    |                                                                                                                                                                           |
| – Variables with respect to education of the SME owner/manager (N VAR = 6)                       |                                                                                                                                                                           |
| $x_4$                                                                                            | = Since you have been a small business owner-manager, have you sought additional education or training?                                                                   |
| $x_5$                                                                                            | = Statement: I regularly consult a manual or a course.                                                                                                                    |
| $\xi_2$ = additional education in present position                                               |                                                                                                                                                                           |
| – Variables with respect to economic history of the SME owner/manager (N VAR = 6)                |                                                                                                                                                                           |
| $x_6$                                                                                            | = In how many other firms did you work before you became a small business owner/manager?                                                                                  |
| $x_7$                                                                                            | = How many years of experience did you gain in other firms?                                                                                                               |
| $x_8$                                                                                            | = How many years of experience did you gain in your own firm, before you became the small business owner/manager?                                                         |
| $\xi_3$ = firm experience prior to the present position                                          |                                                                                                                                                                           |
| – Variables with respect to desire for growth of the SME owner/manager (N VAR = 6)               |                                                                                                                                                                           |
| $x_9$                                                                                            | = Statement: Presently the size of my firm is too small: I want it to grow.                                                                                               |
| $x_{10}$                                                                                         | = Statement: The growth of my firm is not important to me. I prefer its present size.                                                                                     |
| $x_{11}$                                                                                         | = Statement: I feel the pressure to create something in the business world.                                                                                               |
| $\xi_4$ = desire for growth                                                                      |                                                                                                                                                                           |
| – Variables with respect to familiarity with administration of the SME owner/manager (N VAR = 7) |                                                                                                                                                                           |
| $x_{12}$                                                                                         | = Statement: I know how to use the data of my bookkeeping for optimal decision making concerning stocks, buying, production, etc.                                         |
| $x_{13}$                                                                                         | = Statement: I try to stay up to date with the changes in the accounting law as best as possible.                                                                         |
| $x_{14}$                                                                                         | = Statement: I always have the necessary up-to-date accounting information available whenever I need it.                                                                  |
| $\xi_5$ = understanding of administration                                                        |                                                                                                                                                                           |
| – Variables with respect to maturity and size of the SME (N VAR = 8)                             |                                                                                                                                                                           |
| $x_{15}$                                                                                         | = Below are 6 key areas of the firm: To which area do you attach the most importance at this moment?                                                                      |
| $x_{16}$                                                                                         | = Below are 6 key areas of the firm: What importance do you attach at developing systems of management (for instance, planning, organisation and control) at this moment? |
| $\xi_6$ = present importance of key areas                                                        |                                                                                                                                                                           |
| – Variables with respect to intervention of family in the SME (N VAR = 7)                        |                                                                                                                                                                           |
| $x_{17}$                                                                                         | = Is the majority of the shares of the firm in the hands of one family?                                                                                                   |
| $x_{18}$                                                                                         | = Which portion of the firm is in the aggregate in hands of one or more families?                                                                                         |
| $x_{19}$                                                                                         | = Are you a member of that family?                                                                                                                                        |
| $x_{20}$                                                                                         | = Yes: Does the family also intervene in the strategic management of the firm?                                                                                            |
| $\xi_7$ = family ownership and intervention in strategic management                              |                                                                                                                                                                           |
| – Variables with respect to involvement of co-workers in the SME (N VAR = 13)                    |                                                                                                                                                                           |
| $x_{21}$                                                                                         | = Do you sometimes delegate decision making to your personnel with respect to personnel?                                                                                  |
| $x_{22}$                                                                                         | = Do you sometimes delegate decision making to your personnel with respect to production?                                                                                 |
| $x_{23}$                                                                                         | = Do you sometimes delegate decision making to your personnel with respect to administration?                                                                             |
| $x_{24}$                                                                                         | = Do you sometimes delegate decision making to your personnel with respect to sales?                                                                                      |
| $\xi_8$ = delegation of decision making                                                          |                                                                                                                                                                           |

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TABLE VII (Continued)

– Variables with respect to availability of information systems in the SME (N VAR = 18)

- $x_{25}$  = Yes: Do you own or lease a computer system?  
 $x_{26}$  = Do you make use of the following computer application: the recordkeeping of wages and salaries?  
 $x_{27}$  = Do you make use of the following computer application: controlling stocks?  
 $x_{28}$  = Do you make use of the following computer application: following-up orders?  
 $\xi_9$  = use of computer system

– Variables with respect to financial condition of the SME (N VAR = 8)

- $x_{29}$  = Statement: I cannot afford to be connected to the available networks.  
 $x_{30}$  = Assertion: The cost of consultants is prohibitive.  
 $x_{31}$  = Assertion: More training programs would be used if they were less costly.  
 $x_{32}$  = Assertion: Due to high costs, the bookkeeping of many SMEs is kept to date but not analysed.  
 $\xi_{10}$  = cost restraints

information use and success by two different latent constructs, we have more than three hypotheses. More specifically, we have eight subhypotheses. For each, we expect a positive influence since all questions are recorded this way. All together we can state a priori:

- H1a:  $\eta_{1a}$  influences  $\eta_{2a}$  (+)  
 H1b:  $\eta_{1b}$  influences  $\eta_{2a}$  (+)  
 H1c:  $\eta_{1a}$  influences  $\eta_{2b}$  (+)  
 H1d:  $\eta_{1b}$  influences  $\eta_{2b}$  (+)  
 H2a:  $\xi_1, \xi_2, \xi_3, \xi_4$  en  $x_5$  influence  $\eta_{1a}$  (+)  
 H2b:  $\xi_1, \xi_2, \xi_3, \xi_4$  en  $\xi_5$  influence  $\eta_{1b}$  (+)  
 H3a:  $\xi_6, \xi_7, \xi_8, \xi_9$  en  $\xi_{10}$  influence  $\eta_{1a}$  (+)  
 H3b:  $\xi_6, \xi_7, \xi_8, \xi_9$  en  $\xi_{10}$  influence  $\eta_{1b}$  (+)

The latent constructs, their empirical indicators and the mutual relations are displayed graphically<sup>7</sup> in Figure 2. Consequently the question is posed by which method the whole model should be estimated. Since the observed variables are ordinal, it is advisable to analyse the matrix of polychoric correlations with the generally weighted least-squares method using the correct weight matrix. Though since our sample is too small to make an accurate estimate of the asymptotical covariance matrix (less than 200 observations using listwise deletion), we opt for the maximum likelihood method.

## 4. Testing the hypotheses

### 4.1. The latent variable model using partial models

As mentioned in the appendix, the latent variable model is defined as:

$$\eta = B\eta + \Gamma\xi + \zeta$$

In this study when these connections are written in matrix formulation, the result is:

$$\begin{bmatrix} \eta_{1a} \\ \eta_{1b} \\ \eta_{2a} \\ \eta_{2b} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ \beta_1 & \beta_2 & 0 & 0 \\ \beta_3 & \beta_4 & 0 & 0 \end{bmatrix} \begin{bmatrix} \eta_{1a} \\ \eta_{1b} \\ \eta_{2a} \\ \eta_{2b} \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \\ \zeta_5 \\ \zeta_6 \\ \zeta_7 \\ \zeta_8 \\ \zeta_9 \\ \zeta_{10} \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \end{bmatrix}$$

By rearranging this latent variable model, it is possible to trace whether the premised hypotheses have to be rejected on the basis of the significance of the elements of B and  $\Gamma$ . Namely, these matrices

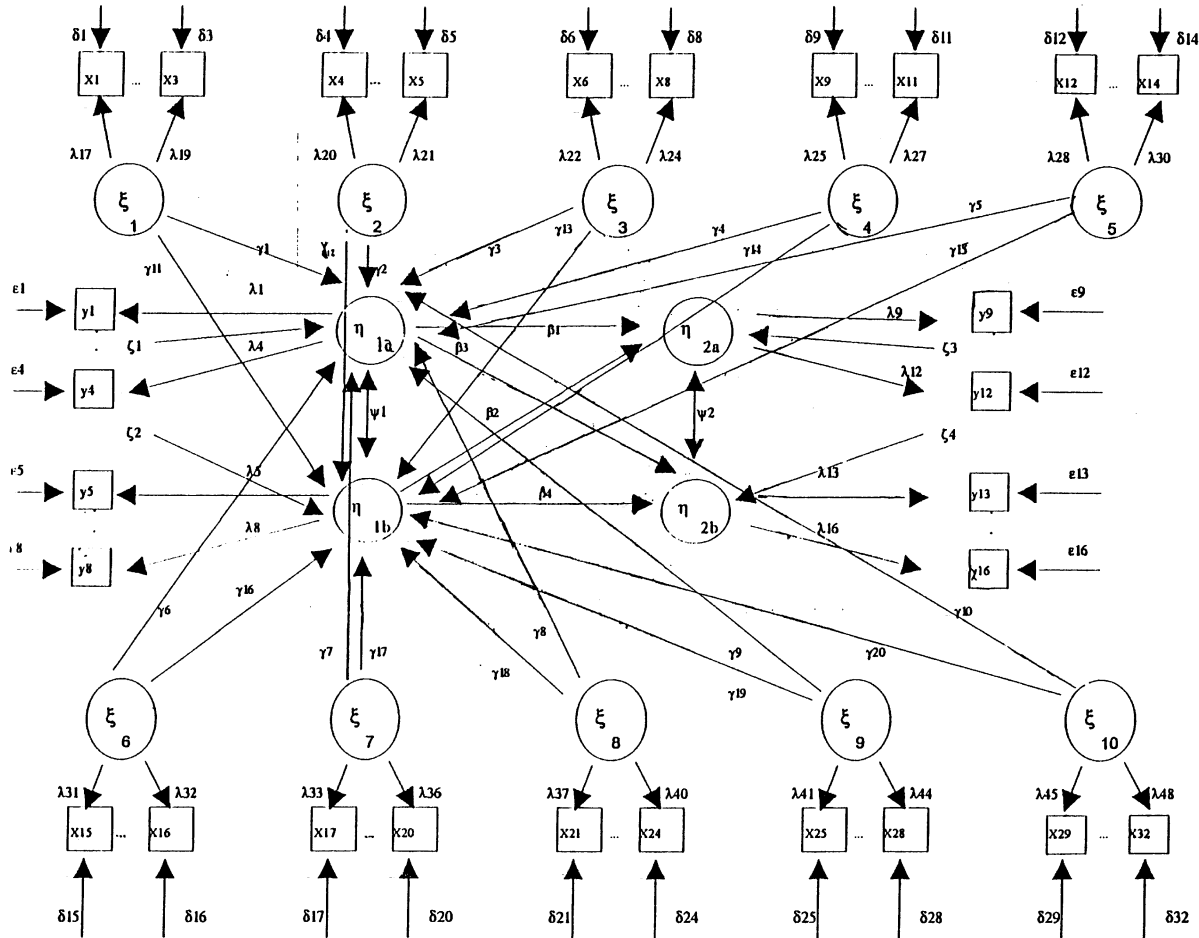


Fig. 2. The presumed research domain in LISREL terminology.

contain the regression coefficients of the effects of the latent endogenous variables  $\eta$ , and of the latent exogenous variables  $\xi$ , on the latent endogenous variables  $\eta$ . More specifically, we use the significance of  $\beta_1$  for testing H1a, of  $\beta_2$  for testing H1b, of  $\beta_3$  for testing H1c, of  $\beta_4$  for testing H1d, of  $\gamma_1$  to  $\gamma_5$  for testing H2a, of  $\gamma_{11}$  to  $\gamma_{15}$  for testing H2b, of  $\gamma_6$  to  $\gamma_{10}$  for testing H3a and of  $\gamma_{16}$  to  $\gamma_{20}$  for testing H3b.

For setting up the data matrix for this analysis, we use the listwise deletion of observations as well. As a result, the original sample size of 208 becomes only 149. Since this size is smaller than the number of parameters, the parameter estimates are unreliable. Thus, the structural equation model that we have assumed so far is no longer correct, and we have no choice but to split up the whole

model into different blocks. The most sensible division is on basis of the hypotheses to be tested. By working this way, the total sample size – without missing values<sup>8</sup> – is 181 for H1, 183 for H2 and 166 for H3.

Because of the split, we no longer define parameters for  $\Lambda_x$ ,  $\Lambda_y$ ,  $\Theta_\epsilon$  and  $\Theta_\delta$ .<sup>9</sup> We limit the model to those elements that allow us to accept or reject the hypotheses, namely, the elements of B and  $\Gamma$ . In addition to their value, we have a standard deviation and a t-value.

We begin with the results of the 'core' of this whole research, namely H1, the relation between the endogenous variables.<sup>10</sup> Of the obtained  $\beta$ -values,<sup>11</sup> as given in Table VIII, the use of information about market and personnel has a significant influence on both the expected perfor-

TABLE VIII  
The structural equation model for H1

| B           | $\eta_{1a}$              | $\eta_{1b}$                  |
|-------------|--------------------------|------------------------------|
| $\eta_{2a}$ | 0.22<br>(0.10)<br>2.17 * | -0.30<br>(0.09)<br>-3.21 *** |
| $\eta_{2b}$ | 0.22<br>(0.10)<br>2.16 * | 0.02<br>(0.09)<br>0.23       |

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; °  $p < 0.10$ .

mance and the performance during the last 3 financial years at the  $p = 0.05$  level. In addition, both influences are positive, as hypothesized. Thus, according to these results an efficient use of information is important for the attainment of a good measure of success.

Desired use of external information about competitors also has a significant influence on the expected performance at the  $p = 0.001$  level. Strikingly, this relation is negative, highlighting that entrepreneurs who wish to use less (more) external information about their competitors assume that they will perform well (poorly). In our view the logical explanation for it is to search in reversing the relation. More specifically, those SME owner/managers who have poorer (better) expectations for the future, also wish to acquire more (less) information about their competitors. The results are not analogous for the desired use of external information about competitors on the performance during the last 3 financial years. The value of  $\beta_4$  indicates that the relationship is not significant. Thus, of the four hypotheses, H1d is rejected.

Now that we proved a significant causal relation between the latent variables of information use and success, we can turn to the results for H2, the influence of personal characteristics on the information use. Output shows that  $x_{11}$ , that is, the statement: 'I feel the pressure to create something in the business world', does not contribute uniquely to the latent variable concerning the desire for growth, but also shows a loading for the measurement of the strategic awareness. Therefore, we modify our model by freeing this manifest variable on  $\xi_1$  as well as on  $\xi_4$ . Although this was not considered a priori, this modification is surely defensible a posteriori.

The  $\gamma$ -values, obtained from the model tuning,<sup>12</sup> are given in Table IX. They show that the most significant influence proceeds from the desire for growth both on the effective and the desired information use. Also, strategic awareness plays a significant role for both variables. Finally, the firm experience prior to the present position has some influence, although only on the desired use. Thus, we conclude that H2a and H2b can be rejected only partly.

The results do not affirm the positive correlation between education and information use. A possible reason is that we restrict ourselves to additional education in the present position for the measurement of this variable, instead of previous education. It is less surprising that we do not find any significant influence from the understanding of administration, since the measurement of information use does not encompass any administrative data.

Now, only H3 remains. It is the influence of firm characteristics on the information use. Although this model cannot be rejected on basis

TABLE IX  
The structural equation model for H2

| $\Gamma$    | $\xi_1$                  | $\xi_2$                  | $\xi_3$                  | $\xi_4$                    | $\xi_5$                  |
|-------------|--------------------------|--------------------------|--------------------------|----------------------------|--------------------------|
| $\eta_{1a}$ | 0.26<br>(0.13)<br>2.03 * | -0.04<br>(0.09)<br>-0.45 | -0.03<br>(0.10)<br>-0.26 | 0.23<br>(0.09)<br>2.47 **  | 0.10<br>(0.13)<br>0.77   |
| $\eta_{1b}$ | 0.20<br>(0.11)<br>1.79 * | -0.02<br>(0.08)<br>-0.22 | 0.18<br>(0.09)<br>2.08 * | 0.40<br>(0.09)<br>4.42 *** | -0.06<br>(0.11)<br>-0.49 |

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; °  $p < 0.10$ .

of the data,<sup>13</sup> the predictive validity of our hypothetical model is based on the significance of the  $\gamma$ -parameters, as given in Table X. They show that there is no significant influence from any of the investigated firm-specific characteristics. There is a notable influence at the 10% level. Thus, family ownership and intervention in strategic management is of modest importance for information use, while the desired information use is more or less determined by the delegation of decision making. Both influences allow us to conclude that H3a and H3b cannot be rejected completely.

It seems acceptable to assume that the present importance of key areas does not appear to play a significant role, since we state that the investigated strategic variables are important in every phase of the firm and may never be neglected. We find no support no more for the findings in literature, that state that the availability of a computer system determines the frequency of information use. A possible explanation may be found in the unclear link between the investigated domains of information and the selected computer applications. Finally, the cost restraints play an insignificant role. In fact, this finding is very positive, since it shows that the use of information by the manager is not influenced by cost considerations.

#### 4.2. The latent variable model using an integrated model

So far, we have had to rely on partial models when testing the hypotheses. Only a more limited selection of the latent variables would make it possible to integrate all the presumed influences into one model. Using the above results, we find a solution to this problem. Specifically, we limit ourselves to

the most empirically relevant – or rather: the most empirically significant (i.e., once  $p < 0.10$ ) – variables. The relations of the latent variable model with respect to this limited research model can be written in matrix formulation as:<sup>14</sup>

$$\begin{bmatrix} \eta_{1a} \\ \eta_{1b} \\ \eta_{2a} \\ \eta_{2b} \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ \beta_1 & \beta_2 & 0 & 0 \\ \beta_3 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \eta_{1a} \\ \eta_{1b} \\ \eta_{2a} \\ \eta_{2b} \end{bmatrix} + \begin{bmatrix} \gamma_1 & 0 & 0 & \gamma_4 & \gamma_7 & 0 & 0 \\ \gamma_{11} & 0 & \gamma_{13} & \gamma_{14} & 0 & \gamma_{18} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \\ \zeta_7 \\ \zeta_8 \\ \zeta_{10} \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \end{bmatrix}$$

We do not show in detail how the results were obtained. Rather, it is our main objective to show how the global model confirms the evidence of the partial models.

All together we can state that – in spite of the modified levels of significance – the former conclusions concerning H1a, H1b and H1c are consistent with the limited global model (see Table XI). In other words, we reject none of these hypotheses. An analogous conclusion can be made for H2. The results of Table XII allow us to conclude that the presumed influences stay significant, although not always at the same level. Thus, once again, we do not have to reject H2a and H2b completely.

The results for H3 are less consistent. Working out the partial models allowed us not to reject the two subhypotheses completely, although at the minimum acceptance level. From Table XIII, it is

TABLE X  
The structural equation model for H3

| $\Gamma$    | $\xi_6$                  | $\xi_6$                  | $\xi_8$                 | $\xi_9$                | $\xi_{10}$               |
|-------------|--------------------------|--------------------------|-------------------------|------------------------|--------------------------|
| $\eta_{1a}$ | -0.01<br>(0.11)<br>-0.06 | 0.26<br>(0.16)<br>1.59°  | 0.10<br>(0.21)<br>0.47  | 0.09<br>(0.22)<br>0.40 | -0.09<br>(0.18)<br>-0.50 |
| $\eta_{1b}$ | 0.10<br>(0.17)<br>0.61   | -0.03<br>(0.13)<br>-0.25 | 0.26<br>(0.18)<br>1.43° | 0.08<br>(0.19)<br>0.44 | 0.07<br>(0.16)<br>0.45   |

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ ; °  $p < 0.10$ .

TABLE XI  
Comparison of the results – obtained by the partial and the global model – concerning H1

|                                                       | PARTIAL              |                                          | GLOBAL               |                                          |
|-------------------------------------------------------|----------------------|------------------------------------------|----------------------|------------------------------------------|
|                                                       | Expected performance | Performance during the last 3 fin. years | Expected performance | Performance during the last 3 fin. years |
| Use of information about market and personnel         | +: $p = 0.05$        | +: $p = 0.05$                            | +: $p = 0.10$        | +: $p = 0.01$                            |
| Desired use of external information about competitors | –: $p = 0.001$       |                                          | –: $p = 0.01$        |                                          |

TABLE XII  
Comparison of the results – obtained by the partial and the global model – concerning H2

|                                          | PARTIAL                                       |                                                       | GLOBAL                                        |                                                       |
|------------------------------------------|-----------------------------------------------|-------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------|
|                                          | Use of information about market and personnel | Desired use of external information about competitors | Use of information about market and personnel | Desired use of external information about competitors |
| Strategic awareness                      | +: $p = 0.05$                                 | +: $p = 0.05$                                         | +: $p = 0.05$                                 | +: $p = 0.10$                                         |
| Additional education in present position |                                               |                                                       |                                               |                                                       |
| Firm experience before present position  |                                               | +: $p = 0.05$                                         |                                               | +: $p = 0.01$                                         |
| Desire for growth                        | +: $p = 0.01$                                 | +: $p = 0.001$                                        | +: $p = 0.05$                                 | +: $p = 0.001$                                        |
| Understanding of administration          |                                               |                                                       |                                               |                                                       |

TABLE XIII  
Comparison of the results – obtained by the partial and the global model – concerning H3

|                                                      | PARTIAL                                       |                                                       | GLOBAL                                        |                                                       |
|------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------|-----------------------------------------------|-------------------------------------------------------|
|                                                      | Use of information about market and personnel | Desired use of external information about competitors | Use of information about market and personnel | Desired use of external information about competitors |
| Present importance of key areas                      |                                               |                                                       |                                               |                                                       |
| Family ownership and intervention in strategic mngt. | +: $p = 0.10$                                 |                                                       | +: $p = 0.05$                                 |                                                       |
| Delegation of decision making                        |                                               | +: $p = 0.10$                                         |                                               |                                                       |
| Use of computer system                               |                                               |                                                       |                                               |                                                       |
| Cost restraints                                      |                                               |                                                       |                                               |                                                       |

clear that working out the limited global model cannot affirm the modest influence coming from the delegation of decision making. This means that, although the conclusion concerning H3a can be maintained, we reject H3b completely.

## 5. Summary and conclusions

The central question in this paper is whether information use is important for obtaining good measures of success. The empirical test, done by questioning the presidents of 208 SMEs, confirmed this question. More specifically, we show that the firms of those SME owner/managers who use more information, achieved better results in the past, and were more optimistic about the future. Thus, there is a relationship between success and the use of information concerning competitors and R&D in this study, as shown by the importance of both to the selected research group, and we are convinced that the findings are generalizable.

We also find that owner/managers who are pessimistic about the future are more interested in information. Once again, this finding emphasizes the importance of information for the obtainment of success. Entrepreneurs value information to arm themselves for the future.

This insight is important: SMEs must contend with the same problems and decisions as the big enterprises, but without the advantage of expert personnel and with fewer resources. Managers of big companies have competent co-workers, who can search, analyse and handle information. They influence the strategic decisions of the topmanagers with rational arguments. This influence, based on correct information, is decisive for the efficient organization (Schilit and Paine, 1987). On the contrary, the process of 'scanning-interpretation-action-performance' (Thomas et al., 1993) in a SME is the work of the owner/manager, and possibly with the co-operation of an external consultant (rather than personnel). Thus, they are much more responsible for both vertical and horizontal decision making. In short, their strategic position serves as a 'focal' point, around which all business activities are centralized, including those of information search and assimilation.

Consequently we examine in the other – more exploratory – question of this paper which char-

acteristics of the owner/manager and his firm determine the extent of information use. For three person-specific and two firm-specific elements significant influences are found, each in the presumed direction. We find that SME owner/managers with a greater strategic awareness, with less firm experience prior to their present position and with a greater desire for growth use more information. With smaller family ownership and intervention in strategic management, as well as with a stronger delegation of decision making, a higher information use can be observed as well in terms of firm-specific characteristics.

In many industrial countries, empirical studies show that the SME sector plays an important role in the economic and social life. Because of high failure rates, a number of measures should be implemented by organizations which work – directly or indirectly – with or for SMEs. One of the measures that should be taken, is convincing the owner/managers of SMEs of the importance of information, and to help them in their search for information and the development of sound information systems. By referring to the results concerning the influences on information use, it cannot be denied that certain entrepreneurs and enterprises will be more open to these measures, meaning that although all SMEs should be selected as target group, different approaches will be needed when addressing to them.

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## Appendix: The LISREL-method

The structural equation model specifies the causal relationship among the latent exogenous and endogenous variables. More specifically the parameters  $B$ ,  $\Gamma$  en  $\Psi$  are used to describe the causal effects and the extent of the unexplained variance. Thus, this structural equation component of LISREL refers to the hypothesized exogenous and latent endogenous variables that characterize the causal system under study, and can be written as:

$$\eta = B\eta + \Gamma\xi + \zeta$$

where  $\eta$  is an  $m \times 1$  vector of latent endogenous variables,  $\xi$  is an  $n \times 1$  vector of latent exogenous variables,  $B$  is an  $m \times m$  matrix of regression coefficients of the effects of endogenous on endogenous variables,  $\Gamma$  is an  $m \times n$  matrix

of regression coefficients of the effects of exogenous on endogenous variables, and  $\zeta$  is an  $m \times 1$  vector of residuals, or errors in equations. It is assumed that  $\zeta$  and  $\xi$  are uncorrelated, and that I-B is nonsingular.

The measurement model specifies how latent variables or hypothetical constructs depend upon or are indicated by the observed variables. More specifically the parameters  $\Lambda_x$ ,  $\Lambda_y$ ,  $\Theta_\epsilon$  and  $\Theta_\delta$  are used to describe the measurement properties (reliabilities and validities) of the observed variables. Thus, the measurement model can be described by two equations, which specify the relations between endogenous latent and manifest variables, and between exogenous latent and manifest variables:

$$y = \Lambda_y \eta + \epsilon$$

$$x = \Lambda_x \xi + \delta$$

where  $y$  is a  $p \times 1$  vector of observed measures of dependent variables,  $\Lambda_y$  is a  $p \times m$  matrix of regression coefficients, or loadings, of  $y$  on the unobservable dependent variable  $\eta$ , and  $\epsilon$  is a  $p \times 1$  vector of errors of measurement of  $y$ . Similarly,  $x$  is a  $q \times 1$  vector of observed measures of independent variables,  $\Lambda_x$  is a  $q \times n$  matrix of regression coefficients, or loadings, of  $x$  on the unobservable independent variable  $\xi$ , and  $\delta$  is a  $q \times 1$  vector of errors of measurement of  $x$ . The measurement errors are assumed to be uncorrelated with  $\eta$ ,  $\xi$  and  $\zeta$ , but are allowed to correlate mutually.

In summary, the LISREL model involves the specification of the following eight matrices:  $\Lambda_y$  and  $\Lambda_x$  (the regression coefficients of manifest on latent variables),  $B$  and  $\Gamma$  (the causal links between the latent variables), and  $\Phi$ ,  $\Psi$ ,  $\Theta_\epsilon$  and  $\Theta_\delta$  (the variance-covariance matrices of  $\xi$ ,  $\zeta$ ,  $\epsilon$  and  $\delta$  respectively).

## Notes

<sup>1</sup> Stated differently, LISREL is an integrative approach that distinguishes between empirical (measurement) and the theoretical specific error. One cannot gain as much information from drawing from other methods as regression or path analysis which only determine the combined error term.

<sup>2</sup> Hambrick makes use of three methods. Thirdly, there is the 'hours' method, in which the owner/managers are asked what percent of their scanning time is directed at each of the environmental sectors and, in turn, how many total hours they spent scanning in an average week. Though Hambrick, as well as others (Fahr et al., 1984), point out that this third method has some limitations, and because the other two methods are valid and trustworthy, we restrict our study to this limited model.

<sup>3</sup> A good survey of many of these attempts is, for instance, in Lewin and Minton (1986).

<sup>4</sup> Since all questions are ordinal variables, the polychoric correlation matrix and not the raw data is used as input. Here, for each two ordinal variables a contingency table is obtained, from which the maximum likelihood estimate of the correlation is computed, whereby an underlying bivariate normal distribution is assumed. For the calculation of this matrix, we use PRELIS, a preprocessor of LISREL.

<sup>5</sup> With listwise deletion, all observations with missing values are deleted, such that the data matrix is effectively reduced to a matrix without missing values. This procedure is preferable to the pairwise deletion, though the difference is the – sometimes drastic – loss of observations.

<sup>6</sup> There are no accepted rules for the measurement of the selected characteristics. However, it would be unfortunate to have to remove them from the study because of this shortcoming. Therefore, we try to better understand the presumed latent variables by way of self-developed questions, naturally from a thorough review of literature. Hereby, we mainly appeal to the 1 to 5 category. This choice is based on the experience of the 'optimal number of response alternatives for a scale' (Haahti, 1989). Irrelevant or obscure questions were not allowed to appear anymore after the pilot study. According to our view this creative approach is permissible, since it concerns more 'observable' characteristics such as education, experience, family share, and computer literacy. In fact, these data to be selected seem more or less comparable with objective or 'relative' objective data.

<sup>7</sup> Several conventions are followed in drawing this path diagram. The observed  $x$ - and  $y$ -variables are enclosed in boxes, the latent variables  $\xi$  and  $\eta$  in circles. The error variables  $\epsilon$ ,  $\delta$  and  $\zeta$  appear in the diagram but are not enclosed. A one-way arrow between 2 variables indicates a postulated direct influence of one variable on another. A two-way arrow indicates that these variables may be correlated without any assumed direct relationship. It is also customary in LISREL to give each coefficient two subscripts: the first is the subscript of the variable to which the arrow is pointing, and the second is the subscript of the variable from which the arrow is coming. Though because of the great number of manifest and latent variables in our study, we deviate from this rule. For clarity we number the subscripts of these coefficients consecutively:  $\lambda y_{11}$  becomes  $\lambda_{11}$ ,  $\gamma_{1c1}$  becomes  $\gamma_{11}$ ,  $\beta_{2a1a}$  becomes  $\beta_{11}$ , and so on.

<sup>8</sup> The indication 'missing value' not only refers to blank answers, it also refers to invalid (i.e., indicating more than one answer when only one is possible) and inconsistent answers. Another category of questions is one where more than one answer was possible, though where this happened so sporadically that it was not worth the trouble to set up separate variables.

<sup>9</sup> Here all selected manifest variables are brought in together in one measurement model, instead of applying the measurement model on each latent variable separately. Of these results, it also appears that the observed indicators can be used without a problem as a measurement instrument for the various hypothetical constructs. More specifically, all elements of  $\Lambda_x$  and  $\Lambda_y$  are statistically significant at the 0.001 level.

<sup>10</sup> The fit of this model is: NCP = 133 with 98 d.f. ( $p = 0.01$ ), RMR = 0.065, GFI = 0.87 and AGFI = 0.82. They indicate an acceptable fit with the data.

<sup>11</sup> Since both latent variables of information use are not being influenced in this submodel, they could be represented as exogenous variables. Though for practical reasons – for instance,  $\beta$ -values would become  $\gamma$ -values – we continue to work with four endogenous variables, in order to obtain results which conform with the whole model.

<sup>12</sup> After the model tuning the indices of fit are: NCP = 234 with 187 d.f. ( $p = 0.11$ ), RMR = 0.071, GFI = 0.84 and AGFI = 0.78. Although these values are not impressive, the fit is rather satisfactory, in view of the exploratory nature of the hypothetical model.

<sup>13</sup> While testing this structural equation, the model seems to be very consistent with the data. The value of  $\chi^2$  is 129 with 278 d.f., and results in  $p = 1$ . In other words, the fit is perfect.

<sup>14</sup> In order to ease the references to and comparisons with the former results, we have retained the original indices.

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