# The Actual and Potential Use of Information Technology in Small and Medium Sized Enterprises

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ABSTRACT *This paper is based on a recent report from the Dutch Council for Small and Medium-Sized Enterprises, in which an indicator is deduced for the present state of the application rather than the development of technology in the business sectors. The application of information technology is the prime concern. We shall demonstrate that much of the literature in the field of indicators concentrates on larger companies. In our set-up, the indicator can be tuned to the branch level, but it can be applied to all companies, including the smaller ones. The indicator then is tested in an SME-rich sector—the car dealer branch. In the final part of this paper, we take a closer look at the problems surrounding the diffusion and implementation of information technology in SMEs and close with some policy recommendations.*

Keywords: information technology, SMEs, The Netherlands, automobile industry.

## Introduction

Diffusion and implementation of technological knowledge were the central concepts used in the 1995 report of the Dutch Council for Small and Medium-Sized Enterprises (RMK) on the technological consultancy structure and technological innovations in SMEs.[1] It was assessed that SMEs usually innovate by combining elements that are actually already known, resulting in innovations that merely consist of a new combination of products, markets and existing technology. Innovations that involve original research and the generation and application of new knowledge are far less common. This situation creates, in general, two major bottlenecks. First, there is the problem of the diffusion of knowledge. Secondly, the actual implementation of knowledge in the production process is usually rather difficult. At this level, it is after all not just a question of technological knowledge, but also of knowledge concerning market demand, market structure (what kind of cooperation and with whom?), the necessary changes in the organisation, and the tasks and duties of employees. In its report in 1996, RMK revealed that there is apparently much knowledge available in the field of information technology (IT), more than in other forms of technology, but also that the actual application thereof is lagging far behind.[2] The same report also proves that the implementation of IT is an important stimulus for technological innovation in combination with organisational and strategic innovation, also in small and medium sized enterprises (SMEs). The above-mentioned indicator will be tested in three branches of industry consisting largely of SMEs: the automotive, machine construction and clothing industries. Finally, a number of policy recommendations will be made.

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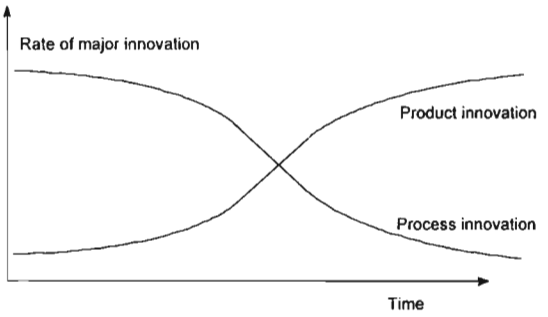


**Figure 1.** The rate of process and product innovation over time.

This paper is based on a 1997 report from RMK in which an indicator is deduced for the present state of the application rather than the development of technology in the business sectors.[3] The application of information technology is the prime concern. We shall demonstrate that much of the literature in the field of indicators concentrates on larger companies. In our set-up, the indicator can be tuned to the branch level, but it can be applied to all companies, including the smaller ones. The indicator is then tested in an SME-rich sector—the car dealer branch. In the final part of this paper, we take a closer look at the problems surrounding the diffusion and implementation of IT in SMEs and close with some policy recommendations.

## Indicator

RMK gives a description of a few development concepts that provide more room for changes in business processes.[4] Much emphasis is placed on process innovation as a focal point for the implementation of IT. Eventually this will lead to product innovation. The 'normal' industrial cycle that we had grown used to is that of product renewal, standardisation, and process renewal. Abernathy and Utterback have pointed out that mostly small companies fight for market share in the first phase of the cycle. [5] Radical new ideas for products are tested until a dominant design eventually arises. This is followed by product standardisation and further process renewal. This results in mechanisation and computerisation, so that advantage can be taken of large-scale production. Production on a large scale goes hand in hand with a concentration of production and integration of the branch.

The gradual introduction of information technology in many companies and sectors and the (accompanying) move from industrial to more service-oriented activities seem to be leaving a different stamp on the innovation process. We are no longer involved with the familiar forms of capital goods renewal and the accompanying computerisation of labour. In various industrial sectors, information systems are being introduced (for example, the chemical industry) and/or easily adjusted computer-controlled machines are being installed (for example, in the automotive industry). As a result of process innovation, existing products can, in general, be marketed more quickly and more extensively and will be more user friendly and reliable. Moreover, an improvement in information flows brings about different relations among suppliers, processors, customers, etc. This could be interpreted as process innovation (enhanced efficiency), which in itself leads to a better, faster, and more reliable product. This concept has been called the 'reverse product cycle' by Barras (see Figure 1).[6]

Another development process stimulated by the implementation of IT has been

described by RMK using the concepts of standardisation, specialisation, differentiation and integration.[7] Standardisation of products and processes in companies enables individual companies to differentiate and specialise further on the basis of the standards set. In this way, companies can raise their profile in a more advanced stage of technological development. Standardisation, differentiation and specialisation will, however, be realised only if these concepts are increasingly integrated within the company or branch of industry. IT can play an important integrating role in this.

These development concepts, which allow for changes in business processes, are nevertheless too abstract to serve as a basis for the indicator to be developed. Porter's Information Hierarchy,[8] which has also been described by RMK,[9] may provide a better basis in this respect. The starting point here is the enterprise. The first steps on the lower level of the hierarchy relate to the automation of manual tasks in their usual form (for example, financial administration), their optimisation (more accurate) and subsequent improvement thereof (more flexible, more information). The last not only involves computer-aided machinery, but also such equipment as decision support systems in, for example, the management of an organisation. Gradually, the implementation of IT will create the opportunity to coordinate comparable activities at different locations (integrated logistic systems). The next step consists of linking various added-value activities so that they form an added-value system. This is, for example, the case when CAD and CAM systems are linked with each other. Corporations have reached a very high level in the hierarchy when these links cross the boundaries of the organisations and the activities in the value chains are shared. However, the highest level is attained when the value chain is given a different function and the whole configuration is changed: different sequence, different integration or different steps in the process.

A scale that is often used in this respect is Nolan's.[10] Nolan's Stages Theory is often applied to determine an organisation's stage of development in terms of automation and to formulate desired future developments. On the basis of an analysis, Nolan describes the stages in the application of IT which an organisation has to pass through. The assumption that IT cannot be forced is of central importance. An organisation has to pass through a number of growing stages in which each stage has its own characteristics in terms of goal and motivation with respect to automation.

Nolan's model does provide some insight into the dynamics of automation (Figure 2). However, the idea that this is a linear process that will eventually be completed is almost inconceivable. What Nolan describes is actually one long growth trajectory. This development in stages has become the standard: the implicit assumption is that an organisation first has to pass through the various stages in order to learn how to deal with automation before it can become an organisation with a mature information supply. Does this mean that the best course for development has been laid down for all organisations? And that organisations, each at its own speed, are obliged to pass through these stages? Is it impossible or foolish to skip certain stages? Does this mean that newly formed organisations do better to start at stage 1? Nolan does not provide an adequate answer to such questions. It seems unlikely that no stages can be missed out and that Nolan's Stages Theory is generally valid. The assumption underlying the model is that there is a beginning and an end (maturation). The beginning can probably be identified quite easily, but when does an organisation reach the point of maturation? Fast developments in the field of information technology and the application areas make it difficult to envisage such a final maturation stage.

Tan carries the development of an indicator a step further.[11] He extends the consistency model of information flow developed by the MIT School of Management,[12] and the development phase model of Venkatraman applied to information technology.[13]

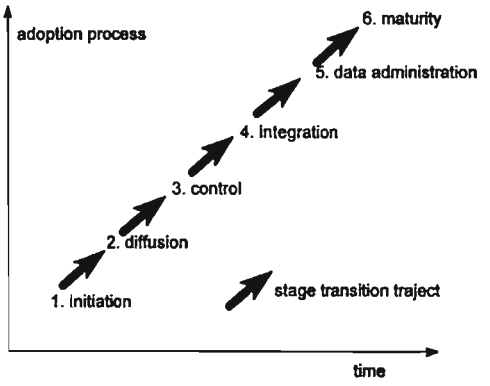


**Figure 2**. Nolan's transition trajectory.

This development phase model makes use of five information management levels or platforms. In ascending order these are:

1. functional integration: automation of existing workflow;
2. cross-functional integration: integration of workflow across several functional departments;
3. process integration: information systems enable the work of a complete business process to be carried out as a single entity;
4. business process redesign: existing business processes are not considered as definite, but are redesigned;
5. business scope redefinition: business objectives are redefined on the basis of IT.

In each successive phase the application of IT plays a more fundamental role in the organisation. The information systems are more complex, more knowledge is required to realise objectives, and implementation demands higher organisational levels. The point of departure is that a company must meet all characteristics/requirements of a platform before it can move on to a higher level. Something can be said about requirements before transition to another level can be achieved. Tan applied the consistency model of Scott Morton *et al.* to seven basic aspect systems of the IT domain and combined them with the five information management platforms mentioned (Table 1).[14]

Our starting point is that the development of a branch of industry provides the most important information for the development of SMEs in that branch of industry as well as for the potential use of IT in these SMEs. Eventually, in a certain way, the whole industry might be considered as one large enterprise. But that appears to be a real option only when the branch of industry is fully integrated. Before that time, a branch of industry is usually characterised by heterogeneity and mutual competition. In our set-up, the indicator can be tuned to the branch level, but it can be applied to all companies, including the smaller ones. The model presented in Table 2 is a further elaboration of Tan's model. Four main groups are distinguished: IT strategy, technical infrastructure, IT organisation and IT branch management. In the second column the main features per category are given. From these questions were designed for the empirical test.

The branch image is composed of the images from the individual companies. An indication is given of how many companies have reached a certain phase. A company is categorised as being in a particular phase if at minimum it meets all the conditions for that phase. The companies therefore have to be tested for all these conditions. Thus, all conditions can be represented and tested as variables. While operationalising these

**Table 1.** The basic aspect systems for each information management level

| | **Functional integration** | **Multifunctional integration** | **Process integration** | **Process redesign** | **Revision of aims** |
|---|---|---|---|---|---|
| Information strategy | Raising efficiency information plan based on inventory of user needs | Raising of effectiveness of information plan deduced from business plan | Strengthening competitive position in existing product–market combinations. Fine tuning of information plan and business plan | Competitive advantage in existing and new PMCs. Information plan integrated with a business plan | Innovative PMCs. Information plan integrated with a business plan |
| Information systems | Support for existing work within company functions | Support for work processes across some organisation units | Carrying out existing company processes | Carrying out existing and adapted company processes | Carrying out adapted and new company processes |
| Technical infrastructure | Platform per company function | Common standards | Integrated infrastructure | Integrated infrastructure | Integrated infrastructure |
| Organisation of the information flow | Dependent situation, central to decentral | Dependent situation, central to federation | Selectively decentralised | Selectively decentralised | Selectively decentralised |
| Users | Functional specifications | Functional specifications | Responsible for realisation of information systems | Redesign of processes and information systems | Design of new processes and information systems |
| Computer experts | Realisation of information systems | Realisation of information systems | Design/building information systems | Building of information systems | Building of information systems |
| Information management | IT manager decides within a budget | Control group line and IT managers | Control group under head management | Head management decides after advice from control group | Head management decides |

*Source*: D. S. Tan, *IT Management Plateaus: An Organizational Architecture for IS*, Information Systems Management, New York, 1995, pp. 44–53.

**Table 2.** IT platform model for industries

| Domain | Characteristic | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |
|---|---|---|---|---|---|---|
| IT strategy | What form has the IT plan? | Based on user demands | Derived from business plan | Geared to business plan | Integrated strategic plan | Integrated strategic plan |
| | Main characteristic of IT strategy | Increase efficiency (cost saving) | Improve effectiveness | Advantage in own product/market | New PMCs | New (innovative) PMCs |
| | What function has IT? | Supports existing functions | Integrates workflow across business functions | Enables complete business processes across departments | Enables complete business processes after redesign | Complete business processes possible after scope redefinition |
| Technical infrastructure | What does the IT technology look like? | Standalone Pcs, minis, no links other departments/ processes, own platforms (OS, software) | Links between departments, connections with other companies, joint standards | Integrated infrastructure, connections with other companies directly linked | Integrated infrastructure, connections with other companies directly linked | Integrated infrastructure, connections with other companies directly linked |
| | Business processes to be automated | Computer-assisted loose elements | Computer-assisted elements, indrectly controlled by IT of other departments and companies | Computer-assisted elements, directly controlled by IT of other departments and companies | Computer-assisted elements, to be directly controlled by IT of other departments and companies | Computer-assisted elements, to be directly controlled by IT of other departments and companies |
| IT organisation | Who is responsible for what? | Director, part-time manager not IT technician | IT technician external consultant, supplier | IT technician external consultant, supplier | IT technician external consultant, supplier | IT technician external consultant, supplier |
| | What is the role of the users? | Provide specifications themselves | Users follow | Much involvement of users in formulating IT system | Users redefine business process and form of IT | Users design new business |
| | IT training | No or little training | Specific training for specific groups of users | Specific training for specific groups of users, instruction of IT specialists on task | Specific training for specific groups of users, instruction of IT specialists on task | Specific training for specific groups of users, instruction of IT specialists on task |
| | Has the organisation been redesigned? | No | A little agreements between departments | Yes, business process-oriented organisation, agreements with other companies | Yes, organization adapted to new defined business processes, relations with other companies redefined | Yes, completely new organization structure, new role towards other companies |
| IT branch of industry management | Is there any steering or a coordinating body? | No | A little, branch organization, large company as IT carrier | Yes, branch organization, large company as IT carrier | Yes, branch organization, large company as IT carrier | Yes, branch organization, large company as IT carrier |

variables scientists face obstacles. A company can meet a condition in several different ways (for example,. both a mainframe and a Novell PC network are indicative of an extensive computer network, but separate tests are required), and the size of a company influences operationalisation. If such an operationalisation is converted into a question list it becomes extremely long. Such an extensive question list can have a profoundly negative influence on the response. The target group may have little affinity with the subject matter and may not feel that answering the question list is a major priority. Therefore, an attempt was made to create a compact question list and to opt for an alternative method of operationalisation.

We used a different set-up for the question list. It is quite simple to formulate a number of scenarios from the IT branch platform, one for each phase in each subsector (IT strategy, technical infrastructure, and IT organisation). These scenarios were included in the question lists. The people questioned were able to fill in the scenario that was the best match for their company in each subsector. Besides that, people were asked to determine which scenario fitted each subsector. In this way, one can quickly and easily determine what stage company thinking has reached for each subsector. If the scenario being pursued is from a higher phase, it is an indication of the strategic desires of the person questioned. However, the opinion of those questioned was insufficient in itself. We should not forget that one of the points of departure in the research is that entrepreneurs lack knowledge concerning IT. For this reason some key variables were determined to ascertain whether the statements of the people questioned are representative of the company reality. These control variables were operationalised differently for each phase too. This makes it possible to make corrections.

There are certain disadvantages to this method. Reading and assessing scenarios requires some concentration of those questioned and the ability to stand back and look at a company objectively. At present it is difficult to estimate the reliability of this scenario method. We screened the seriousness of the question lists returned on the basis of the probability of the answers given. Certain combinations of answers were not possible and someone who consistently ticked either the first or last boxes was not regarded as a serious respondent. Nearly all the question lists that were returned were filled in seriously. Considering the response, we can tentatively conclude that the researchers' ploy was successful. To obtain a reliable picture, a large number of control variables were used. As a result, many of the companies originally categorised in a higher phase have nevertheless been classified in a lower phase. This can mean two things: either entrepreneurs are not fully able to determine the position of their companies from the scenarios given to them (the question remains whether this has to do with them or with the way the scenarios are formulated), or the control variables are too strict. In further research, case studies in various companies could help to find the reason for this phenomenon. In addition, the usability of the scenario method could be investigated. For now we used the method described here without any further alterations and the figures presented are the results we found.

### Indicator Test in the Car Dealer Branch

The usefulness of the indicator was tested in the car dealer branch. So, as far as the automotive sector is concerned, we will mainly focus on the sales companies, repair shops or combinations of these. The products and services include the sale of new and used cars, tests or inspections, maintenance and repair. People in this sector work with standard products which have client-specific parts. Important products and functions that generate added value are: sales and marketing, service, and external communication (for

example, public relations and advertising). The characteristics of the process are a high level of expertise with a limited standard data exchange (partly marque-dependent). The market for car dealers who sell one make of car only is characterised by the supplies of new cars being provided by the importer or producer, and all dealers working together in a cooperative network. To some extent, their position is threatened by the multi-marque dealers, especially with regard to the maintenance of new and used cars. The threshold level with respect to gaining admission to this branch of the industry is generally low. The customers are reasonably loyal to their make of car, although there is a gradual decline in this respect. The following critical success factors apply to this sector: customer relations and customer-friendliness, reliability, service, expertise and professional skills. The multi-marque car dealers achieve the highest effectiveness primarily as a direct result of improving their efficiency (fewer mistakes, improved information supply, improved management information), and process innovation leads to product innovation.

A real future scenario is one in which the line from manufacturer to customer is shortened drastically. Via a global network (such as the Internet), customers will be able to obtain all necessary information for a purchase, to place an order for a car directly with the manufacturer, to express all their wishes, and even to change them at the last moment. The roles of the participants in the chain will change. Much more than they do now, importers will focus on information supply, marketing and dealer support. Dealers will become agents who issue motor vehicles and also take care of more formal matters, such as registration. In addition, their garages and showrooms will remain important as demonstration centres. Dealers will supply a greater number of marques. Garages will no longer be associated with one dealer or marque. IT will enable them to contact the suppliers of car parts more directly concerning orders, product information and especially the status of ordered goods. In addition, much information will be available on-line or by means of CD-ROM or standalone equipment.

A total of 75 answers could be given to the 27 questions asked. Some 700 questionnaires were distributed equally to single-marque and multi-marque car dealers. For this purpose, we used the address files of RDC Datacentre Amsterdam. Representativeness was aimed at through nationwide coverage and by expressing the size of a company in the number of employees. On the basis of this survey, certain statements can be made as to the phase of a company. These individual data were subsequently aggregated for the entire branch of industry. A total of 185 questionnaires were returned, a response of 26.4%. Given the complexity of the subject and the fact that it can have only indirect bearing on everyday business management, this is a very satisfying result.

Of the companies that returned the questionnaire, 40% were multi-marque dealers and 60% were single-marque dealers. The average business size of the multi-marque dealers was clearly smaller than that of the single-marque dealers. Questionnaires had been filled in by the entrepreneurs themselves (73%), the management (12.4%) or, in some cases, by data-processing employees (5.9%). Of the people who filled in the questionnaire, 80% had received either upper secondary vocational education (MBO) or a higher form of education. About 20% had received higher professional education (HBO), and 2.7% had received university education. No relationship was found between the respondents' level of education and their knowledge of IT.

### Classification into Finalisation Phase

For the definite classification of a company in a particular phase (the finalisation phase) all conditions for that phase had to be fulfilled by the company concerned. First, the

**Table 3.** Classification into the finalisation phase

| | Phase 0 | Phase 1 | Phase 2 | Total |
|---|---|---|---|---|
| Total | 5 | 143 | 3 | 151 |
| *n*% | 2.7 | 77.3 | 1.6 | 81.6 |

*Note:* Missing cases: 34 (18.4%).

classification into three main categories (technology, organisation and strategic knowledge) allows us to make some general statements. Subsequently, each of these categories allows us to make more specific statements. These strict conditions have the disadvantage that a questionnaire that has not been fully completed will make it practically impossible to classify a certain company. The results show that this is the case: 34 companies could not be classified.

Classification of the companies into a certain phase for which they had fulfilled all conditions gave the results shown in Table 3. This classification will hereafter be referred to as the 'finalisation phase'. Most of the car dealers (143) are in phase 1. This phase is characterised by the fact that the companies use IT to support their existing activities. They use standalone PCs without links, and the RDC link is also standalone. Their organisations needed hardly any adaptations or adjustments.

To be classified into a finalisation phase, a company has to fulfil all conditions of that phase for three different categories. These are, respectively, the conditions for organisation, strategy and technology. We will discuss them in this order. We will indicate in the tables in which phase a company fulfilling all conditions is classified, and where it would be if only the condition of the main category were to be valid.

### Classification into Organisation Phase

Table 4 shows classification by organisation phase based on the respondents' statements, and Table 5 the same classification after correction for the control conditions. Many companies are now classified in lower phases than might have been expected on the basis of their own statements. These figures show that the phase classification with additional conditions is quite different from the phase classification without additional conditions. No fewer than 103 respondents do not fulfil the conditions required and have therefore been classified into a lower phase. These conditions can be examined separately to see which of them has been fulfilled the least or the most:

- the way in which IT is supported: 24 companies do not fulfil this condition;
- IT training of employees: the training of the employees is adequate in all companies;
- available knowledge: 11 companies assess the knowledge available within their own organisation somewhat differently than would be expected from the data;
- the everyday responsibility for the IT system: 112 companies (about two-thirds of them) would fulfil this condition if they had organised the responsibilities for the IT system in a different way.

Of particular importance in the correction of classification of organisation is that, in many companies, the everyday responsibility for the IT system lies with the manager/owner and not with an (external) consultant. The classification into the finalisation phase corresponds largely with the classification into the organisation phase. On the basis of the conditions for the organisation phase, 32 (16.2%) of the 136 companies were classified too high.

**Table 4.** Classification into a organisation phase on the basis of the respondents' statements

| | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Total |
|---|---|---|---|---|---|---|---|
| Total | | 61 | 96 | 27 | 1 | | 185 |
| *n*% | | 33 | 51.9 | 14.6 | 0.5 | | 100 |

*Note:* Missing cases: 0.

**Table 5.** Corrected classification organisation phase

| | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Total |
|---|---|---|---|---|---|---|---|
| Total | | 106 | 29 | 1 | | | 145 |
| *n*% | | 77.9 | 21.3 | 0.7 | | | 100 |

*Note:* Missing cases: 49 (26.4%).

### Classification into Strategy Phase

The second category is the strategy category: the strategic insights available within a company with respect to future use of IT and its effects on the organisation. This variable has also been derived from a classification on the basis of the entrepreneurs' statements, and has been corrected for one condition—the existence of an IT plan. At first we again made use of the scenarios. More specifically, the respondents were asked how they envisaged the future development of their company over the next ten years (Table 6).

Correction again takes place on the basis of the existence of the IT plan. Different demands are placed on the IT plan for the various phases. The demands are incremental: in the beginning *ad hoc* decisions are made (no plan), then there are investment plan and detailed IT plans, finishing with the business plan in which IT has been integrated but is an explicit component. The higher the phase is that an entrepreneur wishes to achieve in the future, the more fundamentally the company has to change. For phase 1, *ad hoc* decisions suffice, but for phase 5 where the entire structure has to change under the influence of IT, a sound business plan has to be made with strategic insight and an explicit role for IT. At present the fact that an IT plan exists seems to be a good way to determine whether entrepreneurs have or have not underestimated the future role of IT. The correction gives us the results in Table 7.

The outcome is rather dramatic: practically none of the companies has an IT plan, and they therefore also do not have a clear and well-defined idea about the future. The

**Table 6.** Classification into strategy phase on the basis of the respondents' statements

| | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Total |
|---|---|---|---|---|---|---|---|
| Total | | 64 | 32 | 31 | 23 | 6 | 156 |
| *n*% | | 41.0 | 20.5 | 19.9 | 14.7 | 3.8 | 100 |

*Note:* Missing cases: 29 (15.7%).

**Table 7.** Corrected classification strategy phase

| | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Total |
|---|---|---|---|---|---|---|---|
| Total | | 145 | 5 | 3 | 2 | | 155 |
| *n*% | | 93.5 | 3.2 | 1.9 | 1.3 | | 100 |

*Note:* Missing cases: 37 (20.0%).

**Table 8.** Classification into technology phase

| | Phase 0 | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 | Total |
|---|---|---|---|---|---|---|---|
| Total | | 14 | 58 | 59 | 41 | | 166 |
| *n*% | | 7.9 | 34.9 | 35.5 | 24.7 | | 100 |

*Note:* Missing cases: 19 (10.2%).

non-existence of an IT plan can be regarded as a major stumbling block that prevents companies reaching a higher phase. Such a plan is of paramount importance. The entrepreneurs' statements prove that they are open to ideas concerning the future, but they fail to incorporate that future into their business objectives in the form of a concrete plan.

### Classification into Technology Phase

The last main category is that of the actual technology and technical infrastructure. This phase was relatively easy to determine: the number of computers, networks and software links were counted and compared with the conditions set by the model. No additional conditions were therefore formulated for this phase. In this category, more than in the two other categories, a relatively large number of companies fulfil the conditions formulated for phase 3 (Table 8).

The results of this category were also compared with the classification in the finalisation phase. Without presenting the full table, the surprising outcome of this analysis is that most of the companies, 94 of the 145 to be classified (78.6%), have structured their technology and technical infrastructure in such a way that they actually belong in a higher phase, and many of them (39) even in two higher phases.[15] This shows that, contrary to all expectations and general (preconceived) ideas, technology and technical infrastructure do not prevent a company from reaching a higher phase. The demands of both RDC and importer, although they have not (yet) supplied any directly linkable systems, have forced the companies to start with computerisation. In addition, the companies were asked whether they were connected to the Internet. Despite the hype surrounding this medium and its important future role in information supply, few companies have an Internet connection.

### IT Implementation Problems

The entrepreneurs were also asked to state the problems they encountered implementing IT in their organisations. They were presented with eight possible bottlenecks, from which they could choose a maximum of three. In Table 9, the bottlenecks are represented in order of importance as indicated by the respondents. It is striking that three of the first four bottlenecks mentioned are actually knowledge issues more or less related to strategy and the strategic knowledge of IT. The somewhat platitudinous statement 'no time' is the one exception. Finances rank only fifth. The fact that the expected resistance to the implementation of IT scores low can probably be related to the lack of knowledge concerning the implementation of IT.

These answers, which prove that the entrepreneurs clearly lack the necessary knowledge of IT, give added weight to the questions about available knowledge and the respondents' training needs. To the question whether the available knowledge in the company will suffice to make optimum use of IT, most respondents answered 'no'.

**Table 9.** Bottlenecks in the implementation of IT

| | Number | % |
|---|---|---|
| Lack of technical IT knowledge in the company | 59 | 31.8 |
| Lack of knowledge concerning the implementation of IT in the organisation | 47 | 25.4 |
| No time | 45 | 24.3 |
| Uncertainty about the consequences that the implementation of IT will have for the organisation | 39 | 21.0 |
| No financial means | 26 | 14.0 |
| The company has little use for IT | 21 | 11.3 |
| No suitable products on the market | 11 | 5.9 |
| Expected resistance to the implementation of IT in the company | 6 | 3.2 |

Consequently, knowledge might be expanded. Most training needs referred to concrete applications. When asked about their training budgets, 53 companies proved to have training budgets, of which 21 allow for IT courses. As many as 53 companies have laid down in a plan what courses their employees may take, and 22 of them have even laid this down in a separate plan. There is, however, no relation between the budgets that are available and the plans that are drawn up. In other words, if there is a plan, there is not always a budget for it and vice versa. The companies clearly wish to expand their knowledge, but mainly with respect to software and applications. Yet bottlenecks are in general and strategic knowledge.

## General Conclusions

The empirical findings with respect to the speed with which IT is being implemented showed most of the companies to be in phase 1. The companies use IT to support their existing activities. Standalone PCs are used without links. The organisational structure has hardly been adapted or adjusted to the IT installed, and a real strategic role for IT has not been planned. With regard to the other results of the empirical research, the picture differs by main category. For the technology phase, for example, most of the companies are classified into a high phase. Technology and technical infrastructure do not, therefore, hinder companies when they wish to reach a higher phase, not even if low participation in the Internet is taken into account. Utilisation of the IT systems to process the results of motor vehicle inspections electronically for internal applications still causes problems. For classification into an organisation phase, the allocation of responsibility for the IT system remains a stumbling block. If the managers/entrepreneurs would pass this responsibility on to IT specialists, most companies would be in a higher phase than phase 1, where they are found now. In strategy classification, many companies are still in phase 1. Here, the main cause is the lack of an IT plan. It is not so much the non-existence of the plan as the resulting implication that counts. After all, the existence of an IT plan indicates that the role of IT in a company has been taken into consideration in the long term. This explains why the companies were also classified low in this phase.

The major bottlenecks that occur in the branches of industry are caused by the lack of knowledge of IT or, more specifically, of strategic knowledge, and not so much by the lack of, for example, capital for investment. This knowledge is essential for drawing up an IT plan in which both short-term and long-term views on the role of IT are laid down, as well as how the technological options are adapted to the changes that have to

be introduced into the organisation. It has been established that the execution of this test provided important information for the branch associations of industries as well as for the participating companies. Nonetheless, the general conclusion is that industries still make little use of the opportunities that IT has to offer. Much remains to be done with respect to the implementation of IT, particularly in the field of organisational and strategic imbedding. This conclusion is confirmed by the other two sectors in which this test was carried out—machine construction and the textile industry. The empirical results related to the speed with which information technology is being introduced and the obstacles faced appear to be practically identical.

## IT and SMEs: Policy Recommendations

As regards the technological renewal of SMEs, it is generally agreed that the key terms are 'diffusion' and 'implementation'.[16] In this paper we are more specifically interested in the application of existing information technology in SMEs. Information technology mainly provides a focus on process innovation and basically is essential to every SME, large or small, manufacturer or service industry, traditional trade or high-tech. A part of the existing research concerning problems of diffusion and implementation in SMEs therefore is less relevant. Part of the research, for example, focuses on small, innovative high-tech companies just starting out. The policy recommendations are especially aimed at starters and financial problems.[17] Sometimes attention is paid to all SMEs, but product innovation is emphasised.[18] In the meantime, the body of literature supporting the diffusion and implementation of IT is growing. Often a start is made by criticising the linear stepwise model of Rogers, running from the first introduction, via conviction, decision making and implementation up to and including confirmation.[19] Iivari takes an entirely different route by attempting to explain the adoption of information systems.[20] Unlike Rogers, he concentrates on the micro level. However, he hardly touches upon links, but presents an extensive framework with the most important factors that determine the adoption process of information systems. The endeavours of Voss and of Chen and Small appear more fruitful.[21] They also looked for explanations at the micro level for the success or failure of manufacturing technologies based on information technology. Voss designed a life-cycle model for the implementation process leaving room for many explanatory factors. This model consists of three phases. In the pre-installation phase all the success and failure factors of the new technology are determined. This phase is rounded off with a go/no-go decision. In the installation phase the technology is installed, to be improved and adjusted in the following phase with an eye to the highest possible yield. Chen and Small extended this model by placing an emphasis on the pre-installation phase. The Integrated Planning (IPL) model they finally present is therefore mainly based on the supposition that the success of implementation of new technology depends on a proper strategic base. They recommend that all companies develop an integrated business plan with a vision, direction of development, and method for achieving strategic goals for each organisational unit. This is the foundation for the design of a production and computerisation plan. The conclusion drawn by Chen and Small is in agreement with the most important finding in our own empirical research: smaller entrepreneurs often lack strategic insight. It is our recommendation that the entrepreneur have an IT plan drawn up. Such a plan will address issues such as the strategic role of IT in a company and the choices involved, the integration of the chosen technology into the technical infrastructure, and the structure of the

organisation. To enable entrepreneurs to draw up such a plan, it is advisable to instruct them about the various issues that will be addressed in the plan. This does not concern technical instruction, but instruction whereby entrepreneurs are given the necessary tools for a high-quality discussion on IT matters.

Bessant and Rush emphasise the interactive nature of innovation processes in which many parties participate in complex chains and networks.[22] The unilateral, linear transfer of knowledge, certainly to larger parts of SMEs, is extremely ineffective as a result. The main point is the interactive process of knowledge transfer. They emphasise the important role of consultants and intermediary organisations in the guidance of this process. They also found an increase in the number of innovation policy programmes that included a guiding role for consultancy organisations. Our second series of recommendations ties in with this and is particularly focused on branch associations. It is beyond doubt that encouraging IT applications specifically geared to the branches of industry is beneficial. The branch associations can furthermore play an important role in the necessary standardisation processes, as there are no other powerful parties in most branches of industry. In addition, the further implementation of IT in individual companies has to be encouraged. In terms of information provision, the test of the indicator as presented in this paper is an important step. It is furthermore also important that individual companies are given the necessary support to enable them to draw up their IT plans.

Our final series of recommendations is for the government. In the technology policy of the Dutch Ministry of Economic Affairs a relatively large sum has been reserved for knowledge development. Considerable amounts of money are spent on wages for R&D activities within companies and technological development budgets. Only about 15% of the national budget for technology policy is being spent on the diffusion and implementation of technology, with not a single programme specifically aimed at the application of information technology. The government is advised to continue to subsidise business-oriented technological cooperation. The stimulation of IT demands a collective approach instead of an individual approach. The government is, however, primarily advised to invest in the reinforcement of the intermediate knowledge infrastructure. Organisations such as the Innovation Centres and Industrial Technology Centres, initiatives to subsidise feasibility studies, the KIM scheme (for knowledge transfer and innovation in SMEs) and various training schemes can help SMEs gain more strategic insight into the application of IT and the necessary organisational changes involved.

We propose that the Dutch government spends an extra amount of 1.5 billion guilders in the coming three to five years. Approximately 200,000 of the 500,000 SMEs in The Netherlands are so-called 0-companies. It is desirable to help 300,000 companies to reach the next phase in the coming three to five years by assisting them with their IT plans. The idea is that 50% of the costs is subsidised by government and the other 50% is covered by the branch centres or the companies themselves. For reasons of collectivity, the subsidy should be managed by innovation centres and branch (technology) centres. Scale effects could be achieved during execution, so that the average costs for (collective) information and the drawing up of an IT plan would come to an estimated 10,000 guilders per company. For 300,000 companies and 50% subsidy for a period of three to five years this amounts to 1.5 billion guilders (300 million to 500 million guilders per annum). This sum is comparable to the labour costs subsidy for R&D staff. The result of this increase in funding for diffusion and implementation within technology policy would be a concomitant increase in the number of SMEs able to realise the potential use of their IT.

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15. These figures need some further explanation. On earlier occasions, we found that the direct link between the software of the importer/RDC and the software of the companies was still inadequate. A classification in phase 3, for which a direct link is required, is therefore not really possible on these grounds. However, the internal infrastructure is so well organised that a classification in phase 3 is nevertheless justified.
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